

UNIVERSITY OF MINNESOTA  
Graduate School

Minutes, Graduate School Executive Committee  
Meeting of Thursday, November 20, 1986  
9:15 a.m., 303 Johnston Hall

Present: Faculty representatives--Professors Ellis S. Benson, Kendall W. Corbin, Michael Hancher, Stephen Prager, Clark Starr; administrative representatives--Deans Robert T. Holt (Chair), Kenneth Zimmerman; Duluth representative--Professor Stephen C. Hedman; student representatives--Alan Anderson, Michael Kahlow, Mary Strand, Michael Toups; Graduate School Fellowship Committee representative--Professor Mark Snyder; Civil Service representative--Paul Altmann; guests--Professors Duane E. Anderson, George H. Copa, Harlan G. Copeland, Barton W. Galle Jr.; staff--John T. Hatten, Andrew J. Hein, Myrna Smith; secretary--Vicki Field

I. FOR ACTION

A. Approval of the Minutes of the May 20, 1986 Meeting

The minutes were approved as submitted.

B. Proposal for a Master of Science (M.S.) Degree Program in Applied and Computational Mathematics at Duluth

Professor Prager reported that the proposal had the unanimous support of the Physical Sciences Policy and Review Council. The Executive Committee also voted without dissent to approve the proposal for an M.S. degree program in Applied and Computational Mathematics at Duluth. The proposal will be forwarded to the Board of Regents for consideration. (Copy of proposal

C. Proposal for a Graduate Minor in Gerontology for the M.A./M.S. and Ph.D. Degrees <sup>appended with these minutes.)</sup>

Dean Holt reported that the proposal had been discussed by three Policy and Review Councils (Education and Psychology, Health Sciences, and Social Sciences), all of which had approved it. In response to a comment by Professor Corbin regarding the proposal's emanation from a group in the Hubert H. Humphrey Institute of Public Affairs (rather than from a body in the health sciences such as the Medical School), Professor Galle distinguished between geriatrics, which is medically-oriented, and gerontology, which examines broad aspects of aging and is largely concerned with social issues. Professor Corbin observed that there appears to be sufficient interest in Gerontology at the University of Minnesota to offer a doctoral degree in this field. Professor Copeland stated that the faculty may at some future point wish to pursue this possibility, however a minor is preferred initially. Dean Holt inquired about the likely demand for a Ph.D. degree in Gerontology. Professor Copeland said this would be difficult to estimate, although on the basis of enrollment in the "Multidisciplinary Perspectives on Aging" course (which draws approximately 100 students per year), he thought a doctoral program might attract as many as 50 students annually. He emphasized the minor's potential to affect a large number of programs and faculty across the University. In response to a query about employment prospects in gerontology, Professor Galle explained that students will receive primary

training in another discipline such as sociology or social work, which the minor is intended to complement. The long-term care field is growing he said, and he noted that the number of teaching positions in this area is also increasing.

A motion to approved the proposed graduate minor in Gerontology for the M.A./M.S. and Ph.D. degrees passed on a unanimous vote and will be forwarded to the Board of Regents for consideration. (Copy of proposal attached with these minutes.)

D. Proposal for a Ph.D. Degree Program in Education with an Emphasis in Vocational Education (to Replace the Existing Ph.D. Degree Programs in Vocational Education and in Education with an Emphasis in General Education Aspects of the Vocational Fields)

Professor Starr reported that the Education and Psychology Council had approved the proposal on a unanimous vote. Dean Zimmerman clarified the dual nature of the proposal: first, a modification and renaming of the existing emphasis in General Education Aspects of the Vocational Fields for the Ph.D. degree in Education, and second, the discontinuance of the Ph.D. degree in Vocational Education. The Executive Committee passed the following two motions without dissent:

1.) to approve the revised emphasis in General Education Aspects of the Vocational Fields for the Ph.D. degree in Education and a change in name of the emphasis to simply Vocational Education, and

2.) to approve the disestablishment of the Ph.D. degree program in Vocational Education, which will be incorporated in the revised emphasis for the Ph.D. degree in Education.

It was noted that the first item is a matter internal to the Graduate School while the second requires review and approval by the Board of Regents. (Copy of proposals attached with these minutes.)

E. Request to Change the Name of the Graduate Degree Program in Communicative Disorders at Duluth to Communication Disorders

Professor Starr reported that the Education and Psychology Council recommended the name change. The Executive Committee voted unanimously to approve a change in the name of the graduate degree program in Communicative Disorders at Duluth to Communication Disorders. This action will be forwarded to the Board of Regents for review. (Copy of request and related correspondence attached with these minutes.)

II. FOR DISCUSSION

A. Commitment to Focus

Dean Holt reported that he had discussed Graduate School perspectives on the new planning process, called A Strategy for Focus, with the Policy and Review Councils at their fall quarter meetings. He proposed using the Graduate School staff to draft a document setting forth the relevant issues for presentation to the Committee in mid-January, prior

to the winter quarter Policy and Review Council meetings. The document could then be presented to the Councils in late January and further discussed by the Executive Committee in early February.

Dean Holt described the elements he felt are important to include in the Graduate School's response to A Strategy for Focus:

1. a description of the external setting in which planning occurs. The major items to be addressed are:

- o demographics affecting higher education
- o the disjunction between traditional departmental organization and emerging research interests and interdisciplinary fields
- o the significant increase in the number of foreign students applying to and enrolling in U.S. graduate schools
- o minority students and women in graduate programs

(Regarding the last item, Dean Holt observed that all minority populations are significantly underrepresented in graduate education; this has the potential to affect the composition of the faculty at U.S. universities in coming years, he pointed out.)

2. a description of the University setting in which planning occurs. Items to be addressed are:

- o the quality of graduate programs and the relationship of program quality here to that at other institutions (mentioned in this regard was the general decline in the national rankings of many University of Minnesota programs in the arts and humanities)
- o the problem of multi-departmental programs versus multi-disciplinary programs that do not coincide with budgeted departments
- o the relationship of graduate to undergraduate education

3. a description of the Graduate School. Items to be included are:

- o fellowship programs
- o the Research Advisory Committee
- o program support and development (e.g., program reviews, the Fesler-Lampert University Professorships, the McKnight-Land Grant Professorships)
- o Graduate School governance

- o administration of the Graduate School (e.g., admissions, student records)
- o specific administrative functions of the Graduate School, such as the Minnesota Sea Grant Institute and the Hormel Institute
- o the Duluth campus

A lengthy discussion ensued. With respect to program quality, Dean Holt emphasized the difficulties associated with comparing program quality between graduate institutions as well as between programs at the same institution. One likely measure of quality across programs are GRE scores; Dean Holt said he is trying to assess the quality of the applicant pool for University of Minnesota graduate programs by looking at applicant scores on the combined verbal and quantitative sections of the Graduate Record Exam (GRE). (For Committee members' information, he distributed samples of bar graphs that are being prepared for about 70 graduate programs here. The graphs illustrate score frequencies on the combined GRE for all applicants to a program for the years 1980-81 through 1984-85 for whom the scores are available, and for students admitted during the same period.) Combined scores on the GRE will be examined in relation to the national ranking of a graduate program and in terms of the program's record in the competition for Graduate School Fellowships. Dean Holt said he would also like to compare applicant GRE scores with the scores of students who actually matriculated here, however this information is stored in a different database and is difficult to merge with the applicant information. He stressed that he would like to look at inter-correlations between several measures of program quality, rather than just a single measure, and said he hopes to build comprehensive program profiles indicative of quality. Another index he would like to examine is the total number of outside offers received by faculty in a department in relation to the number and percent of faculty who received offers and remained in the department, Dean Holt said. These data would provide a sense of how University of Minnesota faculty are perceived by those outside the University and an indication of departments' ability to retain faculty. The data would need to be standardized for market demand according to information published by the Bureau of Labor Statistics, for example, Dean Holt added.

Dean Holt pointed to a difference in the way the University's Management Planning and Information Services Office (MPIS) calculates the ratio of graduate students to undergraduate students and the way in which other AAU institutions determine this ratio. MPIS includes in its calculation students registering for graduate credit in Continuing Education and Extension (CEE) courses to yield an undergraduate to graduate student ratio of 4.5:1, while other AAU institutions exclude CEE registrations. If CEE registrations here were excluded, Minnesota's ratio would be about 5.5:1, the highest in the Big Ten.

Concerning the emergence of multidisciplinary graduate programs, Dean Holt expressed concern that institutional barriers (such as organization of disciplines along departmental lines) impede interdisciplinary

collaboration and research. In this regard he referred to a recent report prepared for the State of Minnesota by Professor Michael Flickinger, chair of the State's Educational Task Force of the Biotechnology Council. Professor Corbin reported that Sigma Xi had just begun a survey on the national level to determine which factors aid, and which thwart, this kind of interaction. He suggested that the results of the survey might be useful in devising mechanisms to foster interdisciplinary efforts here.

With respect to the relationship of graduate to undergraduate education, Dean Holt expressed his personal view that in a large urban university it is very difficult to have quality undergraduate education in the absence of strong graduate programs, and he pointed to the importance of good graduate and research programs in attracting the best faculty to the institution.

Professor Starr inquired if the Graduate School, in drafting its planning document, would have available to it the plans of each department/program. Dean Holt said this had not yet been determined. He stressed, however, that the Graduate School plan would be University-wide in a context (Commitment to Focus) that already emphasizes the importance of graduate education and research.

B. Policy and Review Council Representation of Biology-Based Graduate Programs

Dean Holt observed that biology-based graduate programs are represented on both the Health Sciences and the Plant and Animal Sciences Policy and Review Councils. No forum exists, however, that is oriented just to the interests of basic biology. Some mechanism is needed that will permit faculty in the basic biological sciences to meet together to discuss common concerns, Dean Holt stated. With the consent of the Health Sciences and the Plant and Animal Sciences Councils, he would like to establish a subcouncil with representation from the biological/life sciences, he said. This committee would not have constitutional status within the Graduate School, but might have future implications for the Graduate School's governance structure, depending on its success.

III. FOR INFORMATION

A. Dean's Report

1. Update on the Graduate School's Capital Fund Drive

Dean Holt called attention to the Graduate School brochure for the Minnesota Campaign and highlighted the three major objectives of the Graduate School's fund drive: (1) creation of six to ten endowed chairs for multidisciplinary University professorships; (2) establishment of a center for research and graduate education in ecosystem ecology; and (3) creation of a new program of three-year, nationally competitive graduate student fellowships. Dean Holt spoke briefly about each of these objectives, as described in the campaign brochure. He reported that the

3M Foundation's recent contribution of \$1 million to the University for the establishment of two interdisciplinary chairs will be announced shortly. Discussions with two other potential donors are underway, Dean Holt added.

## 2. Centennial of the Award of the First Ph.D. at the University of Minnesota

Dean Zimmerman commented on the 100th anniversary of the University's first Ph.D., awarded to Charles B. Elliott in spring 1888. He called attention to excerpts from Elliott's diary reprinted in the current Graduate School Bulletin and briefly reported on activities planned in conjunction with the centennial. These include a series of about nine interdisciplinary symposia funded through the Fesler-Lampert endowment, and a monograph by former Graduate School Dean Bryce Crawford on the history of the Graduate School and graduate education (mid-summer publication is expected, and the monograph will be distributed to faculty, students and friends of the University). Tentatively planned is an early issue next year of the Alumni magazine that would be devoted to graduate education, and special activities in connection with the fall 1987 and spring 1988 commencement ceremonies. Professor Benson suggested inviting area colleges whose undergraduate students enroll in University graduate programs to participate in centennial activities; this would heighten visibility of Graduate School programs, he said. Dean Zimmerman stated that area colleges have been encouraged to take part in the symposia, which will be widely advertised, for example. Dean Holt reported that he is also working with the state's private colleges to create a program that would enable approximately ten University teaching assistants per year to develop a course during the fall term and teach it at a private college the following spring. In addition, he is trying to form a group similar to the Midwest Faculty Forum sponsored by the University of Chicago that would involve faculty from around the state and thus help cement the University's relationships with other state colleges and universities. Professor Starr reported that when a student graduates in Communication Disorders, the program sends a letter of thanks to faculty members who wrote letters of recommendation as part of the student's admission application. Professor Hedman stated that this is also done by some Duluth programs and has proven to be a very effective recruiting device.

## 3. Effects of the 1986 Tax Reform Act on Graduate Students

Dean Holt reported that while tuition waivers will be taxed at most universities, Minnesota's tuition fellowships for graduate assistants will not. Graduate School Fellowships will be considered to be taxable income, however, except for that portion used to pay tuition and related educational expenses such as books. Dean Holt indicated that a memorandum is likely to be sent from the academic vice president's office to deans, directors and department heads explaining a broad range of tax-related issues. In addition, he would like to send a letter in collaboration with the Council of Graduate Students that clarifies the law with respect to graduate students, Dean Holt stated. To compensate

for fellowship dollars lost to taxes, the Graduate School will try to increase the amount of the stipend, he said.

#### 4. Administrative Review of the Graduate School Dean

Dean Holt stated that it is the University's practice to review administrators during their fifth year in office. His review will begin this December 16, which marks the beginning of his fifth year as Graduate School Dean, he said. Dean Zimmerman indicated that the academic vice president would likely meet with the Executive Committee during the winter quarter to discuss the review.

#### B. Report from the Graduate School Fellowship Committee

Professor Snyder called attention to a handout entitled "Report on Departmental Grants for Graduate Student Support from the Graduate School, 1986-87" and briefly summarized this document. He emphasized the considerable flexibility that departmental grants provide and stated that the program has been enthusiastically received. The Fellowship Committee has just met to review requests for funds for 1987-88 and the results will be announced in early December, Professor Snyder reported. Professor Hedman asked why the size of individual student awards varies so greatly. Professor Snyder explained that this difference is indicative of the wide diversity in how the funds are used. Ms. Smith stated that this year slightly over \$1.4 million will be spent on departmental allocations.

#### C. Report from the General Research Advisory Committee

The report from the General Research Advisory Committee was postponed until the Committee's next meeting.

#### D. Report from the Council of Graduate Students

Mr. Kahlow reported that the Council of Graduate Students (COGS) will focus on the following issues during 1986-87:

- o re-definition of full-time graduate student status
- o definition and clarification of the responsibilities of both graduate students and their advisers
- o effects of Commitment to Focus on graduate students
- o the TA training program now being developed
- o improvements in health care coverage for graduate students, including expanded coverage
- o effects of tax reform legislation on graduate students

- o extension of tuition benefits to fellowship holders and part-time students

In response to Dean Zimmerman's question about the morale of graduate students generally, Mr. Kahlow said students are enthusiastic, as evidenced by the high degree of interest in Commitment to Focus.

E. Board of Regents Actions Regarding Degree Program Additions, Deletions, and Modifications

Dean Zimmerman reported that the following degree program proposals were approved by the Board of Regents subsequent to the Executive Committee's May 20 meeting:

(Copies of all seven of these proposals are appended to these minutes.)

- Biometry and Health Information Systems name change to **Biometry** (meeting of June 13, 1986)
- free-standing graduate minor in Feminist Studies (meeting of June 13, 1986)
- M.S. degree program in Technical Communication (meeting of August 8, 1986)
- discontinuance of M.S./Ph.D. degree program in Physiological Hygiene (meeting of August 8, 1986)
- Metallurgy and Materials Science name change to **Materials Science and Engineering** (meeting of August 8, 1986)
- Ph.D. degree program in Neuroscience (meeting of September 12, 1986)
- M.S. degree program in Computer Science at Duluth (meeting of October 10, 1986)

In addition, the following degree programs are under consideration by the Higher Education Coordinating Board and final Regents' approval is expected in December, Dean Zimmerman said:

- M.A./Ph.D. degree program in Comparative Studies in Discourse and Society
- M.S./Ph.D. degree program in Health Informatics
- M.S. degree program in Chemical Physics

F. Tentative Date of Next Meeting

Members agreed that the Committee would not need to meet again during the fall quarter.

IV. OLD BUSINESS

No old business was reported.

V. NEW BUSINESS

No new business was reported.

The meeting was adjourned.

Respectfully submitted,

Vicki Field, Assistant to the Dean

OCT 16 1986

College of Science and Engineering



UNIVERSITY OF MINNESOTA  
DULUTH

Department of Mathematics and Statistics  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

October 13, 1986

TO: Kenneth C. Zimmerman, Associate Dean  
University of Minnesota Graduate School

FROM: Duane E. Anderson, Head  
Department of Mathematics and Statistics

A handwritten signature in cursive script that reads "Duane E. Anderson".

RE: Errata for Master of Science in Applied and Computational Mathematics  
Proposal

- (1) Page II-4, line 18, delete "the three" and replace with "any."
- (2) Page II-9, line 18, delete "90" and replace with "99."
- (3) Page III-21, line 26, delete "8887" and replace with "8777."
- (4) Page III-45, lines 9-10, insert a period after "thesis" and delete "or Plan B electives."

jal



UNIVERSITY OF MINNESOTA  
DULUTH

*Office of the Dean*

College of Science and Engineering  
108 Mathematics-Geology Building  
Duluth, Minnesota 55812-9989

(218) 726-7201

MEMO: 30 September 86  
TO: President Keller  
Board of Regents  
FROM: George Rapp, Jr., Dean *George Rapp Jr*  
RE: Proposal For Master Of Science In Applied  
And Computational Mathematics

With this memo I want to indicate my very strong support for this proposal and to indicate the budgetary considerations. This proposal has taken two years to prepare. An intensive study was made of the state and regional needs and of trends in graduate studies in mathematics. We believe this new degree responds to the educational needs of the UMD service area and is consistent with UMD's mission.

You will note that the major part of the projected costs will come from reassigning current resources. The department currently has regular or temporary faculty teaching all components of all classes. Under this proposal lower division mathematics courses would be restructured to have regular faculty teach all lecture sections but graduate student teaching assistants would teach recitation and tutoring sections as well as doing a large share of the grading. The reassignment takes funds currently allocated to temporary faculty and reinvests in graduate students. The small one-time costs and the \$8,000 new annual costs will come from reallocation within the College of Science and Engineering.

GRRjr:ah



UNIVERSITY OF MINNESOTA  
DULUTH

Graduate School  
431 Darland Administration Building  
10 University Drive  
Duluth, Minnesota 55812-2496

September 30, 1986

Dean Robert T. Holt  
University of Minnesota  
Graduate School  
333 Johnston Hall  
101 Pleasant Street SE  
Minneapolis, MN 55455

Dear Dean Holt:

The completed proposal for the Master of Science in Applied and Computational Mathematics is attached. The Graduate Faculty Committee from the Duluth campus has reviewed the proposal and passed a motion to support the proposal at its April 2, 1986, meeting.

I believe that this is a well developed proposal. The program will take advantage of the unique strengths of the department and will be an excellent compliment to the developing engineering programs on campus.

I urge your support of this proposal and request that you forward it through the review process.

Sincerely,

A handwritten signature in cursive script that reads "John T. Hatten".

John T. Hatten  
Assistant Dean

JTH/mj  
attachment



UNIVERSITY OF MINNESOTA  
DULUTH

*Office of Vice Chancellor*

Academic Administration  
420 Darland Administration Building  
10 University Drive  
Duluth, Minnesota 55812-2496

September 30, 1986

Robert T. Holt, Dean  
Graduate School  
University of Minnesota  
333 Johnston Hall  
101 Pleasant St., S.E.  
Minneapolis, MN 55455

Dear Dean Holt:

Please find enclosed the proposal for the Master of Science in Applied and Computational Mathematics.

This proposal has my personal endorsement and the support of this office. I see the strengths of our Mathematics and Statistics Department accurately reflected in this program emphasis. I also recognize many opportunities for increased interaction between Departments using this program as a vehicle.

Thank you for your continued interest in this positive development of our campus.

Sincerely,

Robert M. Carlson  
Acting Vice Chancellor for  
Academic Administration

RMC:ekh

Enclosure

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College University of Minnesota, Duluth. Code No. 2

I. General Information

A. Program Title MASTER OF SCIENCE IN APPLIED AND COMPUTATIONAL MATHEMATICS

B. Program Review Category:  Regular  
(check one)  Experimental (If Experimental, give Reporting Date:      /      /     )

C. Proposed Implementation Date: 9 / 1 / 87

D. Program Length: Total Cr/hr 49 Classroom      Laboratory     

E. Administrative Unit Immediately Responsible for Program: Department of Mathematics and Statistics

F. Describe the Program (in 50 words or less):

2 The ~~Master of Science degree in Applied and Computational Mathematics is a two-year~~  
3 ~~program of advanced study designed to provide fundamental graduate training in the~~  
4 ~~academic discipline and to prepare individuals in the application of mathematical~~  
5 ~~and statistical principles to areas in engineering, medical, material, or social~~  
6 ~~sciences. Studies include advanced lecture or seminar material in the foundations~~  
7 ~~of the discipline, with applications for analysis and solution of current inter-~~  
8 ~~disciplinary problems.~~

5 G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	First Year: <u>8</u> (Yr.)		Full Operation: <u>40</u> (Yr.)	
	Number (Headcount) Expected	Student Credit or Contact Hours	Headcount Capacity	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	<u>7</u>	<u>168</u>	<u>18</u>	<u>414</u>
Other Students	<u>7</u>	<u>84</u>	<u>6</u>	<u>72</u>
Total	<u>14</u>	<u>252</u>	<u>24</u>	<u>486</u>
b. Program Graduates/Completers	<u>0</u>		<u>9</u>	

A. Projected Costs of the Program: II. Budget Data

	First Year 1987				Full Operation 1989			
	New		Re-assigned		New		Re-assigned	
	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost
a. Faculty		\$	3.	\$ 42,000		\$	4.	\$ 56,000
b. Civil Service	25	\$ 4,000		\$	25	\$ 4,000		\$
c. Equipment, Supplies, etc.		\$ 4,000		\$		\$ 4,000		\$
Total Direct Costs (a+b+c)		\$ 8,000		\$ 42,000		\$ 8,000		\$
d. One-time Costs		\$ 20,000		\$		\$		\$
e. Space Rental		\$		\$		\$		\$
f. Indirect Costs		\$		\$		\$		\$
g. Total Program Costs (a+b+c+d+e+f)		\$ 28,000		\$ 42,000		\$ 8,000		\$ 56,000

B. Expected Sources of Funds for Program:

	First Year: 1987			Full Operation: 1989		
	Dollar Amount	% of Annual Expend.	One Time Input	Dollar Amount	% of Annual Expend.	One Time Input
a. Local	\$		\$	\$		\$
b. State	\$ 37,500	75.	\$ 10,000	\$ 48,000	75.	\$
c. Tuition	\$ 12,500	25.	\$	\$ 16,000	25.	\$
d. Federal	\$		\$	\$		\$
e. Private	\$		\$ 10,000	\$		\$
f. Dedicated Fees	\$		\$	\$		\$
g. Other (Specify)	\$		\$	\$		\$
h. Total	\$ 50,000	100%	\$ 20,000	\$ 64,000	100%	\$

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions:

D. System Verification:

Authorized Institution or System Signature

Title

Date

29 39

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42 47

SECTION II. - SUMMARY

## II. A.1. SUMMARY DESCRIPTION OF PROGRAM

This document proposes a Master of Science degree in Applied and Computational Mathematics, to be offered by the Department of Mathematics and Statistics, College of Science and Engineering, at the University of Minnesota, Duluth.

The program is designed for students seeking careers in industry, business, or government at the M.S. level. It emphasizes mathematical modeling and such areas of the mathematical sciences as differential equations, computational techniques, mathematical programming, and applied statistics. The program features interaction with local governmental research institutes and agencies such as the Natural Resources Research Institute and the Environmental Protection Agency, and with industry through visiting lecturers and industrially sponsored student research projects. Research level interaction will also take place with the three new UMD engineering programs as well as the long established programs in physics, chemistry, biology, geology, computer science, economics, and management sciences.

The two-year program is intended to provide a sound academic basis for fundamental research in Applied and Computational Mathematics and Statistics, and to provide knowledge and training for applications to natural, engineering, environmental, biomedical, managerial, or social sciences, as well as to research and development related to technology. The research activities of present faculty members in the department, both within the two disciplines and in a variety of their applications, indicate the

breadth intended for the program. Current ongoing research areas include computational group theory, statistical linguistics, theoretical and computational bifurcation theory, Fredholm theory, analytic/numerical modeling and simulation, probabilistic methods in behavioral biology, population biology, functional differential equations, operator expansions and computations, several complex variables, heat transfer studies in building materials, neuron firing, operators in Banach spaces, graph theory, generalized root searching algorithms, statistical computation, nonclassical orthogonal polynomials, combinatorics, and large-scale computing. Much of the day-to-day research activity by faculty members continues to involve close interaction with theoretical and applied computer science.

The proposed graduate program builds upon the undergraduate baccalaureate programs in mathematics and statistics offered at UMD since 1947.

## II. A.2. ORGANIZATION AND CONTENT OF THE CURRICULUM

The proposed program is intended to provide a firm foundation for both theoretical aspects and applications of the mathematical sciences. A solid master's level grounding will prepare students for positions in government, business, and industry that demand application of mathematical and statistical principles to areas in engineering, medical, material, or social sciences. The program can also prepare students for doctoral programs, provide an opportunity for advanced teacher academic certification (particularly in northern Minnesota), or prepare men and women for consulting/research

activities important in environmental and technological areas for the 1980s and 1990s.

A student will receive traditional graduate level training through lectures and seminars in the discipline, and will also acquire hands-on experience with analytical, statistical, and numerical modeling and simulation techniques for applications of fundamental principles in a variety of areas.

The curriculum of the master of science degree in applied and computational mathematics has been designed to conform with those in practice in established programs throughout the nation, but also to permit wide flexibility in applications options. The program will also be governed by the standard periodic processes of internal and external review by the University.

#### II. A.3. NUMBER OF EXPECTED ENROLLEES

During its initial year of operation (1987-88), approximately 7 graduate students would be enrolled in the program. When the program reaches full operation in 1989, approximately 18 graduate students will be enrolled, with 9 students per year expected to complete their M.S. degree.

#### II. B. PROPOSED PROGRAM'S COMPLIANCE WITH HECB GUIDELINES

##### II. B.1. MISSION

The introduction of a Master of Science program in Applied and Computational Mathematics is compatible with UMD's mission to offer a comprehensive selection of undergraduate instructional programs and to provide graduate, professional, and continuing education programs. The establishment of such a program would better enable UMD to

fulfill its broad teaching, research, and service responsibilities. The program would also advance UMD's unique regional mission as the only institution in northern Minnesota that offers applied and computational mathematics and statistics.

## II. B.2. EVIDENCE OF INSTITUTIONAL READINESS

The graduate program in Mathematics and Statistics will be able to build upon existing resources. The Department of Mathematics and Statistics has maintained active undergraduate programs for almost four decades, while establishing and expanding a modern program in computer science. Now that the discipline of computer science has evolved to full stature for an undergraduate and graduate program, corresponding development for a modern mathematics and statistics master's program is also timely. The department currently has 11 mathematicians and statisticians in professorial ranks with 1 new tenure track Ph.D. in mathematics and statistics to be hired in 1987. In addition to these 12, there are 8 professional FTEs to provide a good foundation for the proposed graduate program. A major criterion in the selection of the three new individuals will be their potential to contribute to the graduate program.

The graduate program in applied and computational mathematics and statistics will interact substantially with that in computer science, through sharing of faculty expertise and much combined research activity by both faculty and students. Classroom and laboratory space already exists, and more will become available when the new engineering building is completed in November 1986. The graduate program will make extensive use of existing facilities through the

Computer Center, including an 8-processor ENCORE, VAX VMS, Cyber NOS, microcomputers at UMD, and supercomputers (Cray-2, Cyber-205) and other special purpose equipment on the University network.

It should be emphasized that the proposed Master's degree represents a logical extension of the baccalaureate mathematics program established at UMD since 1947. Throughout its evolution, faculty members have maintained an undergraduate research program with the kind of one-to-one student/faculty advisor relationship necessary for high quality research. The proposed master's program is a natural extension of this type of academic interaction. Moreover, the longstanding existence of viable undergraduate research means that qualified applicants are readily available for the graduate program.

## II. B.3. COST OF THE PROGRAM (Does not include fringe benefits on salaries)

Costs are designated as new (\*) or from reassignment of temporary instructorships to teaching assistantships (\*\*).

## 1. Implementation: 1987-88

## a) Faculty:

3 FTE Teaching Assistants	\$42,000 (**)
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## b) Civil Service:

0.25 FTE Secretary	4,000 (*)
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c) Equipment Supplies, etc.	4,000 (*)
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Total Direct Costs	\$50,000
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## d) One-time Costs:

Initial Equipment Purchase or donation	10,000 (*)
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Office and lab space conversion	10,000 (*)
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Total Program Costs	\$70,000
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## 2. Full Operation: 1989-90 (COL not included)

## a) Faculty:

4 FTE Teaching Assistants	\$56,000 (**)
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## b) Civil Service

0.25 FTE Secretary	4,000 (*)
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c) Equipment, Supplies, etc.	4,000 (*)
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Total Direct Costs	\$64,000
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Total Program Costs	\$64,000
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## Remarks on program cost:

Initially, the 12 full-time permanent members (in professorial ranks) of the Mathematics and Statistics Faculty will staff the program. We anticipate the need to hire one additional tenure-track faculty member by 1989.

Three FTE teaching assistant positions will be funded by conversion of departmental funds for teaching specialists, instructors, and graders and by college funds to a limited extent. This will be accomplished by reorganization of the lower division mathematics courses (currently being taught substantially by non-tenure-track faculty) into a lecture-recitation format with faculty lecturing and being assisted by graduate students. This will also free up faculty time for the graduate program. The total support for teaching assistants is:

- 1 new FTE from College of Science and Engineering funds;
- 3 FTE by conversion of existing departmental funds.

It is anticipated that support for several additional graduate students will be available through 1) fellowships and tuition scholarships from the Graduate School, 2) research assistantships funded by external grants, and 3) fellowships funded externally.

We expect that several additional costs will be funded by other University sources in programs now being planned:

- Library book and journal acquisitions, funded by anticipated legislative appropriation.
- Ethernet connections to all faculty and TA offices, now being planned by the Computer Center.
- Acquisition of space for faculty and TA offices by addition of 4th floor on the Math-Geology building (part of the University's 6-year capital request) and completion of the new engineering building.

## II. B.4. GEOGRAPHIC AREA TO BE SERVED

Two other institutions in Minnesota - UM and Mankato State U. - offer viable master's programs in mathematics and statistics. (The third program, at Bemidji, is aimed at teacher education and graduates only about 2 students per year.) However, they are located in the southern half of the state. There are no master's level applied and computational mathematics or statistics degree programs currently offered in northern Minnesota.

One important function of the proposed program would be to offer access to students and professionals in the northeastern sector of the state. Furthermore, the program would offer a unique opportunity for cooperation with northeastern Minnesota's five community colleges: Mesabi (Virginia), Itasca (Grand Rapids), Hibbing (Hibbing), Rainy River (International Falls), and Vermilion (Ely). Faculty members at these institutions who require formal training to upgrade their credentials for teaching mathematics and statistics courses, or for a wide variety of applications, could make use of the proposed program at UMD. The program's location will also make possible research interaction with the Natural Resources Research Institute, the Environmental Protection Agency of Duluth, and the three new engineering programs at UMD.

Although the program at UMD would provide a unique regional service, the program is expected to draw students from a much wider geographic area given the increasing demand for experienced personnel, the shortfall in supply (see Section III.C.3), and the full breadth of theory and application planned for the program.

## II. B.5. JUSTIFICATION FOR IMPLEMENTATION OF THE PROGRAM

## II. B.5.a. STUDENT DEMAND

Employment opportunities in applied and computational mathematics and statistics are good: trained personnel with expert backgrounds and experience in applications are in increasing demand in educational, business, and industrial environments. Moreover, the undergraduate program in Mathematics and Statistics at UMD is strong, versatile, and well established, having operated almost 40 years. This combination tends to increase accrued student demand for a graduate program.

The Department of Mathematics and Statistics at UMD surveyed students enrolled in undergraduate mathematics and computer science courses to determine student interest in graduate studies. One hundred seventy-eight students answered the questionnaire between April 10-12, 1985. Of these, 134 indicated interest in pursuing a graduate degree at some point in their careers; 72 indicated interest in a mathematics or statistics graduate degree; 74 indicated interest in graduate study at UMD; and 90 indicated highest interest in a graduate degree in theoretical or applied mathematics or statistics. These responses indicate a high degree of potential student interest in a master's level program at UMD.

Aside from undergraduates interested in graduate work, a number of workers currently employed in mathematical areas at UMD or in businesses in northeastern Minnesota would like to upgrade their skills and obtain an advanced degree. Additional support for the program has been documented in letters from Minnesota Power, Honeywell, the Natural Resources and Research Institute, the

Environmental Protection Agency, and others (see pp. 48-49 and Appendix A), and is an aspect of the program particularly appropriate to the service mission of UMD as a land-grant institution.

## II. B.5.b. EMPLOYMENT OPPORTUNITIES

One compelling reason for the introduction of a Master's program in applied and computational mathematics and statistics at UMD is the increasing demand for qualified professionals in Minnesota (and national) business, education, and industry. Combined with the growing awareness at the federal level of the emerging crisis in mathematical and other sciences throughout the nation, this need emphasizes the timeliness of establishing a modern graduate program in northeastern Minnesota.

R.D. Anderson, past President of the Mathematical Association of America, writes in Notices of the American Mathematical Society that the College Placement Council Salary Survey for 1983-84 reports starting salaries in mathematics are up 8.4% from 1982-83. For students with a master's degree, the increase between 1982-83 and 1983-84 amounted to 12.9%.

According to Renewing U.S. Mathematics: Critical Resource for the Future, the Report of the Ad Hoc Committee on Resources for the Mathematical Sciences, National Research Council, 1984, demands for undergraduate mathematics instruction have increased 60% in the last eight years, yet Ph.D.s awarded to U.S. citizens declined by half

over the last decade, creating a gap between supply and demand for faculty. According to Focus, the newsletter of the Mathematical Association of America, May-June 1985, fewer than 700 U.S. citizens received a Ph.D. degree in 1984 in all mathematical sciences combined. This gap may well widen as retirements increase in the 1990s. There is the prospect of a further 12% increase in demand for graduate mathematical scientists needed for sophisticated utilization of supercomputers in academia, business, industry, and government.

Renewing U.S. Mathematics (sometimes called the "David Report" after its panel chairman, Edward E. David, Jr., President, Exxon Research) points out that the research community in the mathematical sciences is concentrated heavily at academic institutions. Over 90% of productive research mathematicians--some 9,000-10,000--serve on the faculties of the nation's universities and colleges. One of the crucial elements that enables these mathematical scientists to pursue research effectively is the presence of graduate students, postdoctorals, and young investigators of high quality.

However, industry also needs mathematicians at the graduate level. Peterson's Guide to Engineering, Science, and Computer Jobs 1985 lists 345 major companies, organizations, and institutions with opportunities at the bachelor's and master's levels in mathematics or statistics. Of these, 163 specifically identified a need for research and development.

On a state level, Jobs in Technology: Minnesota's Critical Human Resource Needs for the Coming Decade, published in 1983 by the Minnesota High Technology Council (MHTC) lists mathematics as one of its high-demand employment categories, projected to 1991, and predicts a solid demand (10%) of all hires to 1991 to be master's level mathematicians, scientists, and engineers.

## II. B.5.c. DUPLICATION

Given the demand for master's level mathematics and statistics graduates, and the projected shortage of such graduates, limited duplication of graduate programs within the state would not be wasteful.

In Minnesota, there are three viable Master's level programs in mathematics and statistics. (A fourth program at Bemidji has a different focus, offering a degree for teachers, directed towards math education; it produces only 2 or 3 graduates per year.) In any event, there is no duplication in terms of geographic area to be served. The proposed program at UMD would provide a unique opportunity for students in northeastern Minnesota. It would complement, rather than compete with, the existing programs at Minneapolis and Mankato.

The program offered at UMD would encourage breadth within the discipline and would include a strong emphasis towards applied research. It would also include training in applications to areas in engineering, medical, material, and social sciences, providing a master's degree that is either pre-doctoral or terminal.

The program at Mankato State is similar in focus and objective to the proposed program at UMD, but does not emphasize the modeling, simulation and computational features of the UMD program. The programs in mathematics and statistics at UM (Twin Cities campus) offer master's degrees that emphasize theoretical aspects and prepare the student for doctoral studies. The thrust of the UM programs is quite different from the proposed program at UMD.

Section III

\_\_\_\_\_  
(Date)

Proposal for: Master of Science Degree in Applied and Computational Mathematics  
Submitted by the: Department of Mathematics and Statistics  
of the: College of Science and Engineering, University of Minnesota,  
Duluth

The proposal has been reviewed and approved by:

\*\*\*\*\*

APPROVAL CERTIFICATION

ADDITIONAL APPROVALS (as appropriate)

\_\_\_\_\_  
(Department Chairperson) (Date)

\_\_\_\_\_  
(Vice Chancellor for Academic Administration) (Date)

\_\_\_\_\_  
(Dean) (Date)

\_\_\_\_\_  
(Vice President, Academic Affairs) (Date)

\_\_\_\_\_  
(Dean, Graduate School) (Date)

\_\_\_\_\_  
(Vice President, Institutional Relations) (Date)

Approval by Regents:

\_\_\_\_\_  
(Date)

First Reading by PAC:

\_\_\_\_\_  
(Date)

Second Reading by PAC:

\_\_\_\_\_  
(Date)

Recommendation by the MHECB:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(Date)

Confirmation by Regents:

\_\_\_\_\_  
(Date)

## III. THE PROPOSAL

## III. A. INTRODUCTION - (A description of the intellectual, social, and educational context of the proposed program and of the planning and development activities from which the proposal was generated.)

This document proposes the establishment of a Master of Science degree in Applied and Computational Mathematics at the University of Minnesota, Duluth.

The proposed program is appropriate at this time for reasons including the maturation and expansion of the discipline; the crucial unmet demand for applied and computational mathematics professionals in both the business world and academia; the educational, research, and service missions of UMD and the College of Science and Engineering; and for demographic reasons.

The undergraduate programs in the Department of Mathematics and Statistics have evolved in orderly steps over the past four decades at UMD. The department has maintained a sound academic environment for pure and applied mathematics and statistics, and nurtured the development of a program in computer science to independence. Some major milestones in the department's evolution are summarized chronologically below:

1947 - First B.A. and B.S. programs offered.

1965 - An IBM 1620 computer system is installed at UMD, and a three-quarter computing sequence is offered.

1972 - All mathematics majors in the department are required to complete a common "core" curriculum that includes introductory FORTRAN.

- 1975 - Requirements for the B.S. in Mathematical Sciences are split into 3 options: applied mathematics, statistics, and computer science.
- 1979 - A separate four-year baccalaureate degree is established for computer science.
- 1982 - An honors program is initiated to promote undergraduate research.
- 1985 - Two separate departments are proposed: a Department of Mathematics and Statistics, and a Department of Computer Science, both within the College of Science and Engineering.
- 1985-1986 - Two complementary master's programs are proposed: one for the prospective Department of Mathematics and Statistics, and one for the prospective Department of Computer Science.
- 1986 - Two separate departments became official July 1, 1986.

Since 1947, the mathematics programs have been an integral part of both education and research in many disciplines at UMD. Several introductory level courses are required of numerous majors and pre-professional programs. Students (primarily from mathematics and the physical sciences) who have completed advanced courses in the programs now form an important segment of the UMD and the Duluth-area scientific communities. Many graduates now hold positions in northeastern Minnesota scientific and computing installations.

Planning activities for the UMD mathematics and computer science curricula had been centered in the Department of Mathematical Sciences. All proposals were introduced at the departmental level, and were subsequently approved by College and University governing bodies. Planning has been facilitated by the varied areas of research expertise represented within the department. The main objective of mathematical sciences curriculum development at UMD has

been to provide a high quality, integrated curriculum of mathematics, starting appropriately with statistics and computer science courses identified as most fundamental, and gradually expanding to full recommended programs.

### III. B. THE PROPOSED PROGRAM

#### III. B.1. PROGRAM OBJECTIVES

The basic intention of the master's program in applied and computational mathematics and statistics is to develop the student's critical professional thinking and intuition. The program primarily emphasizes the concepts, theory, and practice within the discipline. Students will acquire a broad understanding of their field.

The proposed program is designed to prepare graduates to enter positions in business, industry, and government at a relatively high level of responsibility and expertise, or to pursue doctoral research. It is also designed to upgrade the skills and knowledge of persons with a bachelor's degree who are already engaged in positions in business, industry, and academia (see Appendix A: Letters of Support).

The National Science Foundation (NSF) is the only federal agency responsible for support across the entire spectrum of mathematical sciences. In 1977, NSF funded the development of two new programs in mathematical science at Clemson University (S. Carolina) and Washington State University. These programs, like the proposed program at UMD, emphasized a problem solving or modeling simulation orientation rather than a subject discipline orientation.

In terms of more specific goals, the proposed master of science degree in applied and computational mathematics and statistics will teach and require a mature grasp of the concepts, nature, and techniques associated with:

- 1) analysis of large or complex problems and the efficient design of solutions;
- 2) practical problems in the implementation of such designs;
- 3) organization and coordination in interdisciplinary teamwork;
- 4) written and oral communication skills;
- 5) research and scholarship in the technical literature; and
- 6) broad understanding of the present physical, theoretical, and algorithmic limits of mathematics, statistics, or computing, and their effects on potential applications.

The proposed program is intended to upgrade skills of persons already employed in positions in applied and computational mathematics or statistics or related fields, in addition to the traditional student. Potential students would include:

- 1) future and present professionals and managers in regional industry or government;
- 2) university, community college, and vocational technical institution faculty from a variety of disciplines;
- 3) public and private secondary school teachers; and
- 4) students planning to pursue doctoral programs at other institutions.

## III. B.2. ADMISSION REQUIREMENTS

A bachelor's degree in mathematics or statistics or its foreign equivalent in mathematics or statistics (or a parallel field such as computer science, etc.) will be a normal prerequisite to admission. Other admission requirements for the master's degree program will be consistent with the general admission stipulations of the Graduate School of the University of Minnesota.

A student with a degree in any other major but with a substantial background in mathematics or statistics may qualify; however, an applicant who lacks certain 3000-level prerequisites for graduate level courses in his or her program must make up these deficiencies without receiving graduate credit.

Special Application Requirements--Scores from the General (Aptitude) and Subject (Advanced) Tests of the Graduate Record Examination are recommended, but will be required for students whose undergraduate degree is not from the United States or Canada. The advanced test should be in mathematics or statistics. These scores will be used in admissions decisions as well as for advisement.

Students whose native language is not English and who have not completed one year in residence as a full time student at a recognized institution of higher learning in the United States must submit their score on the Test of English as a Foreign Language (TOEFL). (The Graduate School requires a minimum TOEFL score of 450 for admission. The Department reserves the right to require a higher score, initially 500, for teaching assistants. An applicant with a TOEFL score of less than 500 but at least 450 could be accepted, but would not receive a teaching assistantship.)

## III. B.3. DESCRIPTION OF THE CURRICULUM

The Master of Science degree in Applied and Computational Mathematics is a two-year program of advanced study intended to provide fundamental graduate training in the academic discipline and to prepare individuals in the use of its principles for problem solving in other fields or applications. Studies include advanced lecture and laboratory materials, with hands-on experience in both academic and industrial research environments. Interaction in the form of joint or exchange seminars and colloquia is planned with research mathematicians and statisticians from industry, the Natural Resources Research Institute, and the Environmental Protection Agency.

The thrust of the program is nontraditional. It is project or modeling oriented; unlike traditional applied mathematics, which concentrated on engineering and the physical sciences, new directions for applied mathematics include an emphasis on modeling and simulation with respect to the life, managerial, and behavioral sciences.

Ongoing research in the department is varied: activities include investigations into theoretical aspects (e.g., Fredholm theory or structures in probability spaces), applied areas (e.g., graph theory or nonclassical orthogonal polynomials and harmonic oscillators), and interdisciplinary applications (e.g., statistical linguistics, or epidemiology). A substantial professional breadth is intended for the program. In addition, students will have hands-on experience with state-of-the-art software systems and computer hardware,

including an 8-processor ENCORE on the UMD campus and the Cray-2 and Cyber-205 systems of the Minnesota Supercomputer Institute.

a. DEGREE REQUIREMENTS

Total required credit hours: [49]

12 cr from required courses prefixed Math

- 5326

- 3 courses chosen from two of the categories

a., b., c., below, not all from category a.

a. 5671, 5672, 5555

b. 5701, 5702

c. 5591, 5595

Students who enter the program with sufficiently strong backgrounds will be allowed to make 5000 level math substitutions for one or more courses in these categories.

8 cr from related areas (9 credits of one prefix area constitutes a minor - Plan A only)

3 cr from Math 8980 - a graduate seminar

4 cr from a 5000-level mathematics or statistics seminar:  
Math 5985, 5986, and/or 5987

6 cr from one of the following clusters:

Scientific Computation: 5381, 5532, 5533, 5534

Applied Analysis: 5370, 5380, 5385, 5395, 5982

Stochastic Modeling: 5561, 5562, 5563, 5568, 5598

Continuous Modeling: 5380, 5381, 5385, 5386, 5387

Discrete Modeling: 5555, 5558, 5765, 5984

16 cr for thesis (Grad ~~8987~~<sup>8777</sup>) under Plan A; or a project plus 16 other 5000 level (other prefixes allowed) cr under Plan B, including at least 6 credits from a different cluster listed above.

No foreign language requirement.

Students must demonstrate an intermediate level competency in a modern scientific computer programming language (such as FORTRAN,

Pascal, or C). Record of such a course on the undergraduate transcript or satisfactory completion of CS 3102, 3510, or 3520 or an equivalent course will constitute an acceptable demonstration of this competency. Students will formally present their theses or project results to the department in a departmental colloquium.

b. COURSE DESCRIPTIONS

Listed below are 5000-level and 8000-level mathematics and statistics courses acceptable for the master's program. All but six (5395, 5568, 5982, 5985, 5986, 5987) of these are currently available within the UMD curriculum; 8000-level courses are currently under development.

Several "sample" programs are displayed at the end of the course listing, to indicate the flexibility intended for students who may wish to obtain more of a concentration in, for example:

A) applied mathematics for the natural sciences (including engineering); B) applied statistics and operations research (including simulation); and C) computational mathematics (including numerical computing and modeling). The flexibility has been carefully designed to take advantage of already existing courses in mathematics, computer science, engineering physics, and business at UMD and of the teaching and research interests of the Mathematics and Statistics faculty.

MATH 5326 - LINEAR ALGEBRA. (3 cr; prereq 3320)

A study of linear transformations and vector spaces including topics from orthogonality, canonical forms, bilinear forms, characteristic values and inner product spaces.

- MATH 5370 - OPERATIONAL MATHEMATICS. (3 cr; prereq 3380 or 3381)  
Laplace Transforms, Fourier Transforms, difference operators, numerical methods and the use of these techniques in solving difference, differential, and integral equations.
- MATH 5380 - PARTIAL DIFFERENTIAL EQUATIONS. (3 cr; prereq 3380 or 3381)  
An introduction to the study of partial differential equations stressing the use of Fourier series, Green's functions, and other classical techniques.
- MATH 5381 - PARTIAL DIFFERENTIAL EQUATIONS COMPUTATIONAL TECHNIQUES. (4 cr; prereq 5380)  
Continuation of Math 5380, with advanced topics on generalized Fourier series, boundary value problems, computational difference techniques, and adaptive mesh techniques. Numerical applications, using computer facilities.
- MATH 5385 - DIFFERENTIAL EQUATIONS II. (3 cr; prereq 3699)  
Uniqueness, comparison, separation, and existence theorems. Selected readings from the current literature, particularly in Sturmian theory and in modeling.
- MATH 5386-5387 - MATHEMATICAL MODELING IN DIFFERENTIAL EQUATIONS I-II. (3 cr each; prereq 3381 and 3699)  
Theory and applications of ordinary differential equations, emphasizing mathematical modeling.
- MATH 5390 - SPECIAL FUNCTIONS. (3 cr; prereq 3380 or 3381)  
A study of Bessel's, Legendre's, and other special functions which arise in Sturm-Liouville problems and the use of such functions in solving differential equations.
- MATH 5395 - ANALYSIS IN ENGINEERING AND SCIENCE. (4 cr)  
Complex variables, series and product expansions, complex potentials, conformal mapping, the Fast Fourier Transform and applications.
- MATH 5532 - NUMERICAL METHODS IN PHYSICS. (4 cr; prereq 3381, CS 3510 or CS 3520, Phys 3010)  
Numerical solutions to differential equations in physics with emphasis on hydrodynamics, heat, and mass transport problems.

- MATH 5533 - NUMERICAL ANALYSIS. (4 cr; prereq 3381, and 3699 and CS 3510 or CS 3520)  
Computer representation of numbers, unit roundoff, solution of nonlinear equations, polynomial interpolation, numerical integration and solution of differential equations.
- MATH 5534 - NUMERICAL LINEAR ALGEBRA. (4 cr; prereq 3670 and 5326, and CS 3510 or CS 3520)  
Solution of systems of linear equations. Pivoting and scaling. Error propagation. Iterative refinement of solutions. Orthogonal functions and least squares approximation.
- MATH 5551 - WORKSHOP. (1-5 cr)  
Opportunities for teachers and other special interest groups to concentrate on some topic of common interest and concern.
- MATH 5555 - DISCRETE MATHEMATICS II. (3 cr; prereq 3555)  
Graph algorithms, networks; generating functions, languages and grammars, circuits, finite-state machines, analysis of algorithms; complexity.
- MATH 5558 - COMBINATORIAL ALGORITHMS AND OPTIMIZATION. (3 cr; prereq 3555 and CS 3520 or equiv)  
Basic algorithmic methods in combinatorics with emphasis on optimization.
- MATH 5561 - APPLIED STATISTICAL ANALYSIS. (4 cr; prereq 3320, 3562 or equiv)  
Analysis of variance techniques as applied to scientific experiments and studies. Randomized block designs, factorial designs, nesting. Checking model assumptions. Using statistical computer software.
- MATH 5562 - REGRESSION ANALYSIS. (3 cr; prereq 3320 and 3562 or 5591)  
Simple, multiple, and polynomial regression. Estimation, testing, and prediction. Analysis of residuals. Computer analysis.
- MATH 5563 - MULTIVARIATE STATISTICS. (3 cr; prereq 5561 or 5562 or equiv)  
Matrix algebraic treatment of multivariate normal distribution theory and testing. Topics chosen from multivariate analysis of variance, canonical correlation, principal components, analysis, discrimination, classification. Computer software.

- MATH 5568 - LINEAR MODELS AND EXPERIMENTAL DESIGN. (3 cr; prereq 5326, 5591, 5560, 5562)  
Statistical theory and applications of general linear models including analysis of variance and regression.
- MATH 5591 - STATISTICAL INFERENCE. (3 cr; prereq 3350 and 3591)  
Sampling distributions, central limit theorem, principle of maximum likelihood, interval estimation and tests of hypotheses.
- MATH 5595 - PROBABILITY. (4 cr; prereq 3350 and 3562)  
Combinatorial methods, axioms of probability. Discrete and continuous random variables and their probability distributions. Joint and conditional distributions. Moments, generating functions, and limit theorems.
- MATH 5598 - STOCHASTIC PROCESSES. (3 cr; prereq 3320, 3591 or 5591)  
Topics in stochastic processes. May include such topics as finite Markov chains, random walks, birth-and-death process, Poisson process.
- MATH 5671-5672 - ABSTRACT ALGEBRA II AND III. (3 cr each; prereq 3670)  
Theory of groups, rings, and fields, including symmetry groups, coding theory, and Boolean algebras.
- MATH 5680 - FINITE GROUPS. (3 cr; prereq 3670)  
A survey of the achievements in finite simple group theory from C. Jordan (1870) to J. Thompson (present). Topics discussed will include the Sylow theorems, permutation groups, classical linear groups, Burnside's theorem, the Feit-Thompson theorem, Thompson's N-theorem and 3° theorem and sporadic simple groups.
- MATH 5701-5702 - ADVANCED CALCULUS I AND II. (3 cr each; prereq 3699)  
Sequences and series; limit superior, limit inferior, and an introduction to summability. Metric spaces; continuous functions on metric spaces, connectedness, completeness, and compactness. Sets of measure zero and the Riemann integral. Sequences and series of functions. Functions of several variables, partial differentiation, implicit functions, and integrals depending on a parameter.

- MATH 5760 - GENERAL TOPOLOGY. (3 cr; prereq 3699)  
Introduction to fundamentals of general topology basic to modern analysis. Set theory, Euclidean spaces, metric spaces, topological spaces, continuity, connectedness, compactness, product spaces, axiom of choice, generalized convergence.
- MATH 5765 - GRAPH THEORY. (3 cr; prereq 3320)  
A study of finite graphs and networks, directed and undirected, including such topics as connectivity, traversability, planarity, colorability, and matrix representations.
- MATH 5820 - COMPLEX VARIABLES. (3 cr; prereq 3699)  
Complex numbers, derivatives, and integrals of analytic functions, elementary functions and their geometry. Cauchy's integral theorem and formula. Laurent expansions, evaluation of contour integrals by residues, fundamental theorem of algebra.
- MATH 5830 - THEORY OF NUMBERS. (3 cr; prereq 3298)  
Elementary properties of integers; prime and composite numbers, Euclid's algorithm; congruences; the theorems of Fermat and Wilson; primitive roots; indices, Diophantine equations.
- MATH 5840 - SET THEORY. (3 cr; prereq 3670)  
Logic, sets and set operations on a nonaxiomatic level, Cartesian products, relations, functions, ordinal and cardinal numbers, lattices and axiomatizations of set theory including axiom of choice and several axiom systems.
- MATH 5950 - INDEPENDENT STUDY. (1-4 cr)  
Special projects not available in the standard curriculum.
- MATH 5970 - SPECIAL TOPICS. (1-3 cr)  
Directed reading and/or research in mathematics.
- MATH 5982 - APPLIED FUNCTIONAL ANALYSIS. (3 cr)  
Structure of normed linear spaces and inner product spaces together with linear operators and functionals. Topics related to differential equations, control systems, approximation and optimization are considered. Foundation for the mathematical analysis of models occurring in engineering operations research, and other sciences.

- MATH 5983 - APPLIED ABSTRACT ALGEBRA. (3 cr; prereq 3670)  
Applications of various algebraic structures to other areas, such as data communication, computer science, chemistry, and physics. Topics chosen from lattice theory, Boolean algebra, switching theory, and electronic gating networks; finite-state sequential machines, applications of finite group theory to network complexity; Polya-Burnside theory of enumeration; symmetry groups.
- MATH 5984 - ALGEBRAIC CODING THEORY. (3 cr; prereq 3670)  
A survey of error-correcting codes, including Hamming codes, Golay codes, BCH codes, and cyclic codes.
- MATH 5985 - SEMINAR: STOCHASTIC MODELING. (4 cr)  
Review of Markov processes and detailed treatment of renewal theory, Markov decision processes and queueing theory. Additional topics chosen from inventory theory, digital simulation, reliability, and continuous-time models. Each topic usually includes basic development, computational issues, and applications that may include case studies.
- MATH 5986 - SEMINAR: CONTINUOUS MODELING. (4 cr)  
Mathematical and computational structure of problem solving by means of a spectrum of problem types. Definitions and structural models of simulations. Operator equations with elementary search solutions; problems in several dimensions. Variety of discrete and continuous systems.
- MATH 5987 - SEMINAR: DISCRETE MODELING. (4 cr)  
Applications of techniques from combinatorics, graph theory and networks to other areas, such as political science, sociology, economics, computer science, or environmental studies. Topics taken from nonlinear programming, sparse matrix storage, path-following algorithms, computational procedures.
- MATH 8970 - SPECIAL TOPICS IN MATHEMATICS. (1-3 cr, may be repeated for a max. of 6 cr; applicable to M.S. program).

NOTE: Special topics may be repeated for credit when topics change. Possible special topics:

Advanced Computational Techniques  
Deterministic-Stochastic Modeling  
Advanced Combinatorial Mathematics  
Statistical Decision Theory  
Computer Algebra  
Mathematics of Patterns Recognition  
Discrete and Continuous Simulation

MATH 8980 - GRADUATE SEMINAR. (3 cr)  
 The graduate seminar is taken the first quarter the student is in residence (usually Fall Quarter). Modeling, simulation and computational topics from the three principal areas of concentration are introduced that illustrate the general thrust of the M.S. degree in Applied and Computational Mathematics.

MATH 8990 - GRADUATE RESEARCH. (Cr to be arranged)

COURSES FROM RELATED AREAS:

COMPUTER SCIENCE:

CS 5510 - COMPUTER ARCHITECTURE I (4 cr)  
 CS 5511 - COMPUTER ARCHITECTURE II (4 cr)  
 CS 5730 - COMPUTATIONAL GEOMETRY (4 cr)  
 CS 5737 - COMPUTER GRAPHICS II (4 cr)  
 CS 5726 - ALGORITHMS (4 cr)  
 CS 5736 - COMPUTER GRAPHICS I (4 cr)  
 CS 5746 - DATA BASE MANAGEMENT SYSTEMS (4 cr)  
 CS 5766 - AUTOMATA, COMPUTABILITY, AND FORMAL LANGUAGES (4 cr)  
 CS 5776 - ARTIFICIAL INTELLIGENCE I (4 cr)  
 CS 5777 - ARTIFICIAL INTELLIGENCE II (4 cr)  
 CS 5970 - SPECIAL TOPICS (1-3 cr)

PHYSICS:

PHYS 5107 - THERMAL PHYSICS (4 cr)  
 PHYS 5109 - STATISTICAL PHYSICS (4 cr)  
 PHYS 5123 - THEORETICAL MECHANICS (4 cr)  
 PHYS 5124 - MATHEMATICAL METHODS (4 cr)  
 PHYS 5135-5136 - APPLIED PHYSICS (3 cr each)  
 PHYS 5141-5142-5143 - COMPUTATIONAL PHYSICS AND MODELING (4 cr each)  
 PHYS 5166 - HYDRODYNAMICS (3 cr)

CHEMISTRY:

CHEM 5610-5611 - PHYSICAL CHEMISTRY (3/4 cr)  
 CHEM 5620-5621-5622 - PHYSICAL CHEMISTRY (3 cr each)  
 CHEM 5720 - THEORETICAL CHEMISTRY (4 cr)  
 CHEM 5740 - THERMODYNAMICS (4 cr)  
 CHEM 5750 - KINETICS AND MECHANISMS (4 cr)

GEOLOGY:

- GEOL 5320 - INTRODUCTION TO THEORETICAL PETROLOGY (3 cr)
- GEOL 5405 - PHYSICS AND CHEMISTRY OF THE EARTH (4 cr)
- GEOL 5505 - ADVANCED STRUCTURAL GEOLOGY (3 cr)
- GEOL 5640-5641 - MINING GEOLOGY I-II (3 cr each)
- GEOL 5802 - APPLIED GEOPHYSICS (4 cr)

BIOLOGY:

- BIOL 5155 - ORGANIC EVOLUTION (3 cr)
- BIOL 5222 - GENETICS OF EUCARYOTES (5 cr)
- BIOL 5770 - ADVANCED ECOLOGY (4 cr)
- BIOL 5773 - LIMNOLOGY (4 cr)
- BIOL 5778 - ECOLOGY OF ANIMAL POPULATIONS (5 cr)
- BIOL 5871 - WATER POLLUTION BIOLOGY (3 cr)

PHYSIOLOGY:

- PHSL 5461-5462 - COMPUTER APPLICATIONS TO PHYSIOLOGY I, II  
(2 cr each)
- PHSL 5541 - ANIMAL PHYSIOLOGY: INTERNAL COMMUNICATION (5 cr)
- PHSL 5807-5808 - HUMAN PHYSIOLOGY (7 cr each)

FINANCE AND MANAGEMENT INFORMATION SCIENCES:

- FMIS 5201 - QUANTITATIVE ANALYSIS (4 cr)
- FMIS 5206 - MATHEMATICAL PROGRAMMING FOR MANAGEMENT (3 cr)
- FMIS 5207 - SIMULATION METHODS FOR MANAGEMENT (3 cr)

ECONOMICS:

- ECON 5140 - INTRODUCTION TO MATHEMATICAL ECONOMICS (4 cr)
- ECON 5361 - REGIONAL ECONOMICS, LOCATION THEORY (5 cr)
- ECON 5401 - BUSINESS ECONOMICS (5 cr)
- ECON 5776 - NATURAL RESOURCE AND ENERGY ECONOMICS (4 cr)
- ECON 5777 - ENVIRONMENTAL ECONOMICS (4 cr)

In "Graduate Study for Employment: Academic and Nonacademic," Calvin T. Long of Washington State University suggests four concentrations for an applied mathematics curriculum. All are derived from the NSF-supported development of new graduate programs in applied mathematics at Washington State University and Clemson University (as listed in that document):

1. Concentration in computational mathematics: numerical analysis, ordinary and partial differential equations, combinatorial analysis; electives in statistics, engineering, continuum mechanics, etc.
2. Concentration in natural science: probability theory, stochastic processes, numerical analysis, continuum mechanics; electives in such areas as thermodynamics, biological science, and physics.
3. Concentration in operations research: mathematical programming and game theory, simulation, numerical analysis, probability theory, stochastic processes, and mathematical modeling in operations research.
4. Concentration in statistics: mathematical statistics, data analysis, numerical analysis; electives from among time series analysis, decision theory, sampling theory, experimental design, stochastic models, econometrics, demography, etc.

The proposed curriculum in applied and computational mathematics at UMD is designed to take advantage of the teaching and research interests and expertise of the faculty, and incorporates many of these suggested areas in the three concentrations offered: A)

applied mathematics for the natural sciences; B) applied statistics and operations research; and C) computational mathematics.

Based upon the teaching and research interests and qualifications of the Mathematics and Statistics faculty, numerous possible sample programs and projects for the Master of Science degree in Applied and Computational Mathematics are given on the following pages.

A) For a student with area of concentration in applied mathematics for the natural sciences.

This area emphasizes mathematical methods for dealing with natural phenomena, both physical and biological. Graduates from this area could work with natural scientists in the modeling of a wide range of problems in the sciences, agriculture, and engineering. A good undergraduate background in one or more of the natural sciences (physics, chemistry, geology, biology, etc.) is highly desirable.

Sample program in applied mathematics for physical phenomena  
(deterministic)

Required Courses (12 cr)

Math 5326 Linear Algebra (3 cr)  
 Math 5701 Advanced Calculus I (3 cr)  
 Math 5702 Advanced Calculus II (3 cr)  
 Math 5555 Discrete Mathematics II (3 cr)

Related Area (8 cr)

Physics 5123 Theoretical Mechanics (4 cr)  
 Physics 5124 Mathematical Methods of Physics (4 cr)

Graduate Seminar (3 cr)

Math 8980 Graduate Seminar

Seminar (4 cr)

Math 5986 Seminar: Continuous Modeling (4 cr)

Math Elective Credits (6 cr)

Math 5370 Operational Mathematics (3 cr)  
 Math 5380 Partial Differential Equations (3 cr)

Research - Thesis (16 cr) - Plan A

or

Plan B Project plus at least 16 credits from:

Math 5381 Partial Differential Equations Computational  
 Techniques (4 cr)  
 Math 5385 Differential Equations II (3 cr)  
 Math 5386-5387 Mathematical Modeling in Differential Equations  
 I-II (3 cr each)  
 Math 5390 Special Functions (3 cr)  
 Math 5532 Numerical Methods in Physics (4 cr)  
 Math 5533 Numerical Analysis (4 cr)  
 Math 5534 Numerical Linear Algebra (4 cr)  
 Math 5820 Complex Variables (3 cr)  
 Math 5984 Algebraic Coding Theory (3 cr)  
 Physics 5166 Hydrodynamics (3 cr)

Total (49 credits) (Assumes Physics 1109 and 3010, Math 3381  
 background)

Sample program in applied mathematics for physical phenomena  
(stochastic)

Required Courses (12 cr)

Math 5326 Linear Algebra (3 cr)  
Math 5555 Discrete Mathematics II (3 cr)  
Math 5591 Statistical Inference (3 cr)  
Math 5595 Probability (3 cr)

Related Area (8 cr)

Physics 5101 Modern Physics I (4 cr)  
Physics 5107 Thermal Physics (4 cr)

Graduate Seminar (3 cr)

Math 8980 Graduate Seminar

Seminar (4 cr)

Math 5985 Seminar: Stochastic Modeling (4 cr)

Math Elective Credits (6 cr)

Math 5568 Linear Models and Experimental Design (3 cr)  
Math 5598 Stochastic Processes (3 cr)

Research - Thesis (16 cr) - Plan A

or

Plan B Project plus at least 16 credits from:

Math 5533 Numerical Analysis (4 cr)  
Math 5534 Numerical Linear Algebra (4 cr)  
Math 5561 Applied Statistical Analysis (4 cr)  
Math 5562 Regression Analysis (3 cr)  
Math 5563 Multivariate Statistics (3 cr)  
Physics 5109 Statistical Physics (4 cr)

Total (49 credits) (Assumes Physics 3500, Math 3562 background)

Sample programs in applied mathematics for physical phenomena also could be designed by using courses from chemistry or geology that involve considerable mathematical modeling. These courses might include:

Chemistry 5610-5611 Physical Chemistry (3/4 cr)  
 Chemistry 5620-5621-5622 Physical Chemistry (3 cr each)  
 Chemistry 5720 Theoretical Chemistry (4 cr)  
 Chemistry 5740 Thermodynamics (4 cr)  
 Chemistry 5750 Kinetics and Mechanisms (4 cr)

or

Geology 5320 Introduction to Theoretical Petrology (3 cr)  
 Geology 5405 Physics and Chemistry of the Earth (4 cr)  
 Geology 5505 Advanced Structural Geology (3 cr)  
 Geology 5640-5641 Mining Geology I-II (3 cr each)  
 Geology 5802 Applied Geophysics (4 cr)

Similarly, sample programs in applied mathematics for biological phenomena could be planned by using courses such as

Biology 5155 Organic Evolution (3 cr)  
 Biology 5222 Genetics of Eucaryotes (5 cr)  
 Biology 5770 Advanced Ecology (4 cr)  
 Biology 5773 Limnology (4 cr)  
 Biology 5778 Ecology of Animal Populations (5 cr)  
 Biology 5871 Water Pollution Biology (3 cr)

or courses from Physiology (Phs1 5441 - Animal Physiology: Internal Communication, Phs1 5807 - Human Physiology, etc.).

- B) For a student with area of concentration in applied statistics and operations research.

This area is designed to prepare students for careers in applying statistical/operations research ideas and techniques to a wide range of topics, including (among many others) actuarial science, agriculture and forestry, social and behavioral sciences, biology, environmental science, engineering, health and medicine, technology, energy, transportation, quality control, and reliability. Students ideally should have studied probability and statistics as undergraduates, one or more areas of application, and computing.

Sample program - applied statistics involving biology, medicine (physiology), or computer science.

Required courses (12 cr)

Math 5326 Linear Algebra (3 cr)  
 Math 5555 Discrete Math (3 cr)  
 Math 5591 Statistical Inference (3 cr)  
 Math 5595 Probability (3 cr)

Related area (8 cr)

Depending on the student's interest, the related area would be an area in which the student plans to apply statistical methods (e.g., biology or medicine) or an area of complementary skills (e.g., computer science). Examples of related area course work are:

Biology

Biology 5773 Limnology (4 cr)  
 Biology 5871 Water Pollution Biology (3 cr)  
 Biology 8960 Graduate Seminar (1 cr)

Medicine (Physiology)

Physiology 5441 Animal Physiology: Internal Communication (5 cr)  
 Physiology 5807 Human Physiology (7 cr)

Computer Science

CS 5726 Algorithms (4 cr)  
 CS 5746 Database Management Systems (4 cr)  
 CS 5776 Artificial Intelligence I (4 cr)  
 CS 5777 Artificial Intelligence II (4 cr)

Graduate Seminar (3 cr)

Math 8980 Graduate Seminar

Seminar (4 cr)

Math 5985 Seminar: Stochastic Modeling (4 cr)

Math Elective Credits (6 cr)

Math 5562 Regression Analysis (3 cr)  
 Math 5563 Multivariate Statistics (3 cr)

Research - Thesis (16 cr) - Plan A

or

Plan B Project plus at least 16 credits from:

Math 5533 Numerical Analysis (4 cr)

Math 5534 Numerical Linear Algebra (4 cr)

Math 5561 Applied Statistical Analysis (4 cr)

Math 5568 Linear Models and Experimental Design (3 cr)

Math 5598 Stochastic Processes (3 cr)

Math 5986 Seminar - Continuous Modeling (4 cr)

The sequence Math 5561-62 would usually be taken by all students interested in applied statistics.

Total (49 credits)

Similarly, sample programs in operations research could be planned by using courses from finance and management information sciences (FMIS 5201 - Quantitative Analysis; FMIS 5206 - Mathematical Programming for Management; FMIS 5207 - Simulation Methods for Management, etc.) and economics (Econ 5140 - Introduction to Mathematical Economics; Econ 5361 - Regional Economics, Location Theory; Econ 5776 - Natural Resource and Energy Economics; Econ 5777 - Environmental Economics, etc.).

C) For a student with area of concentration in computational mathematics.

This area emphasizes numerical computational techniques and the numerical solution of ordinary and partial differential equations, especially as they arise in the natural sciences and technology. Students selecting this area should have undergraduate experience in engineering or one or more of the natural sciences and a good background in computer science. (FORTRAN or some other scientific programming language is essential; knowledge of data structures, assembly language, other programming languages, and computer graphics is highly desirable).

For a student with an interest in mathematical physics, and in scientific computing.

Required Courses (12 cr)

Math 5326 Linear Algebra (3 cr)  
Math 5555 Discrete Mathematics II (3 cr)  
Math 5701 Advanced Calculus I (3 cr)  
Math 5702 Advanced Calculus II (3 cr)

Related Area (9 cr)

Physics 5135-5136 Applied Physics (3 cr each)  
Physics 5123 Theoretical Mechanics (3 cr)

Graduate Seminar (3 cr)

Math 8980 Graduate Seminar

Seminar (4 cr)

Math 5986 Seminar - Continuous Modeling (4 cr)

Math Elective Credits (6 cr)

Math 5370 Operational Mathematics (3 cr)  
Math 5380 Partial Differential Equations (3 cr)

Research - Thesis (16 cr) - Plan A

or Plan B Project plus at least 16 credits from:

Math 5381 Partial Differential Equations Computational  
Techniques (4 cr)  
Math 5390 Special Functions (3 cr)  
Math 5395 Analysis in Engineering and Science (4 cr)  
Math 5532 Numerical Methods in Physics (4 cr)  
Math 5533 Numerical Analysis (4 cr)  
Math 5534 Numerical Linear Algebra (4 cr)  
Physics 5141-5142-5143 Computational Physics and Modeling  
(4 cr each)  
CS 5510-5511 Computer Architecture I, II (4 cr each)

Total (49 credits)

For a student with an interest in computing, with applications in social/management sciences.

Required Courses (12 cr)

Math 5326 Linear Algebra (3 cr)  
Math 5555 Discrete Mathematics II (3 cr)  
Math 5595 Probability (3 cr)  
Math 5591 Statistical Inference (3 cr)

Related Areas (8 cr)

CS 5746 Data Base Management Systems (4 cr)  
Econ 5401 Business Economics (5 cr)

Graduate Seminar (3 cr)

Math 8980 Graduate Seminar

Seminar (4 cr)

Math 5985 Seminar - Stochastic Modeling (4 cr)  
or  
Math 5987 Seminar - Discrete Modeling (4 cr)

Math Elective Credits (6 cr)

Math 5558 Combinatorial Algorithms and Optimization (3 cr)  
Math 5765 Graph Theory (3 cr)

Research - Thesis (16 cr) - Plan A

or Plan B Project plus at least 16 credits from:

Math 5533 Numerical Analysis (4 cr)  
Math 5534 Numerical Linear Algebra (4 cr)  
Math 5561 Applied Statistical Analysis (4 cr)  
Math 5562 Regression Analysis (3 cr)  
Math 5598 Stochastic Processes (3 cr)  
FMIS 5207 Simulation Methods for Management (4 cr)

Total (49 credits)

Plan A - Master's Degree with Thesis differs from Plan B - Master's Degree without Thesis in that a heavier course requirement is substituted for the thesis in the latter plan. The program aims to produce graduates who are mathematical scientists with the background and perspective necessary for productive collaboration with nonmathematicians in dealing with "real world" problems amenable to mathematical approaches. Hence, we will urge most students to pursue plan A. We believe that work on a thesis will help a student:

1. To acquire skills in problem identification, communication, integrating multiple methodologies, and dealing with co-workers in the presence of fuzziness;
2. To develop a motivation, a questioning attitude, and an understanding of limitations of data, tools, and the institutional framework within which problems must be solved;
3. To learn to appreciate one's own qualifications and their limits, and to know where and how to get help when it is needed.

The following Plan A suggested thesis research topics involve considerable time and effort to solve and could lead to publishable results in refereed journals. The Plan B suggested project topics typically might cover course material in greater depth or material not usually developed in existing courses.

Sample M.S. Thesis Areas - Plan A (16 cr)

Fuzzy sets theory and pattern recognition.

Statistical techniques for evaluation of computer performance.

Parallel processing in numerical linear algebra.

Nonlinear difference equations: analytic/numerical problems and solutions.

Computational algorithms for global minimization.

Analytic/numerical modeling of solute transfer in porous media.

Spline functions in digital imaging.

Numerical linear algebra for large, sparse, nonsymmetric matrices.

Orthogonal polynomials: preservation of non-classicality under non-linear transformations.

Implementing adaptive mesh refinement techniques for partial differential equations.

Countable chains of harmonic oscillators.

Signal processing.

Hamiltonian paths and circuits in graphs of groups.

Fixed point theory in mathematical economics.

Counting problems in algebra.

Graceful Cayley graphs.

Harmonious Cayley graphs.

Cycle sequencing of group elements.

Numerical treatment of non-standard boundary conditions with wave equation, heat equation, and Laplace's equation.

Extension and numerical application of difference operator series.

Statistical inference in molecular evolution.

A comparison of strategies in stochastic models of optimal foraging.

Confidence intervals for Type I censored normal data.

Numerical Hopf Bifurcation

Neuron Firing Models

Statistical models for neuron spike trains.

Correspondence analysis for regional linguistics data.

Effects of misclassification on multiple census estimates of genetic defects.

Nonparametric tests of independence of components in serially connected systems.

A computer system for multiple census estimation with log-linear models.

Finding chemical analogs using graph-theoretic structural indices.

Quantifying chemical shape and form.

Risk analysis of a chemical delivery system.

Resolution of a spectrum into a convex combination of known spectra.

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Sample M.S. Project Areas - Plan B.

Rational approximations.

Numerical application of cubic splines.

The Fast Fourier Transform.

Evaluation of pseudorandom number generators.

Evolution of the Moment Problem.

Computer implementation of irreducibility tests for polynomials.

Mathematical analysis of games.

Error correcting codes.

Evaluation of statistical software for personal computers.

Classification and regression trees: examples and evaluation of the technique.

Applications of correspondence analysis.

The implementation of a Tausworthe random number generator.

Dynamic statistical graphics: A review of current technology.

## III. B.4. GRADUATION REQUIREMENTS

Graduation requirements for a Master of Science degree in Applied and Computational Mathematics will follow those of the Graduate School of the University of Minnesota.

The master's degree is offered under two plans: Plan A (involving a thesis) and Plan B (involving additional course work and special projects in place of a thesis). The completion of a master's program ordinarily requires six quarters in residence, or its equivalent in summer terms. (The Graduate School has a minimum four quarter residency requirement.) Students who are planning to earn the degree under either Plan A or Plan B should, therefore, take into account this customary rate of progress as well as the minimum completion time of one academic year.

The maximum time allowed by the Graduate School for completion of the master's degree is seven years. The seven-year period begins with the oldest work included on the official degree program, including any transfer work applied.

In addition to general Graduate School requirements, students must show proficiency in technical writing and professional presentations, and in the use of a computer system. This can be done in connection with a thesis, Plan B project, graduate seminar, or independent study under supervision of a faculty adviser. All master's students must demonstrate competence in the basic material through a written final examination. Each student must present his or her thesis or project at a departmental colloquium. Plan A students must also take a final oral examination on the thesis after

they have successfully completed the written examination and made their presentation.

PLAN A: MASTER'S DEGREE WITH THESIS

In choosing a major and related field(s) or minor field of work, the student must present the minimum undergraduate preparation prescribed under Department Statements. (See Section III.B.2. Admission Requirements.) The student must complete, with a minimum GPA of 2.80, at least 25 quarter credits in Math-prefixed courses, 8 credits in the related field(s), and 16 credits thesis or Plan B electives. (See Section III.B.3.a. Degree Requirements for specific required courses.) The thesis will account for 16 credit hours; thesis specifications are detailed in the UMD General Bulletin. In addition to the usual course examinations, the candidate for the master's degree under Plan A must pass a final written examination on the basic material and a final oral examination on the thesis.

## PLAN B: MASTER'S DEGREE WITHOUT THESIS

The requirements for this plan follow Plan A in matters of admission, residence, and language requirements. Under Plan B, the student must pass both a final written examination and a final oral examination in the major field. The oral examination will normally be an hour long. Plan B differs from Plan A in substituting for the thesis a heavier course requirement. For professional purposes, the master's degree program under Plan B is less focused on a single research topic and more appropriate for individuals who will profit by a broader range of knowledge in their fields. Whether taken for professional or personal purposes, the requirements for Plan B are meant to test interests and intellectual abilities for a different purpose, but not on a different level, from that of Plan A.

Under Plan B, candidates for the master's degree must complete, with a minimum GPA of 2.80, at least 46 quarter credits in graduate courses and three credits in a graduate seminar. At least 25 of the 49 credits must be in the major field, and at least 8 credits must be in a related field(s) outside the major. The remaining credits may be in either the major or related field(s).

## III. C. EDUCATIONAL AND SOCIAL NEED FOR THE PROGRAM

## III. C.1. PROPOSED NUMBER OF STUDENTS TO BE SERVED BY THE PROGRAM

The proposed program is designed to admit 7 students the first year, and 9 students each successive year.

## III. C.2. STUDENT INTEREST DATA

Petersen's Graduate Programs in the Physical Sciences and Mathematics 1985, lists nearly 2000 research and applied/professional programs in the U.S. and Canada. Of these, only 97 institutions advertise graduate programs in applied mathematics, and only 47 offer just a master's program in applied mathematics.

Yet the demand for programs is growing. The University of Colorado, Denver, began a graduate program in applied mathematics in 1981 with six students. By 1984-85, the enrollment had climbed to 50-60, with 100% job placement of graduates.

The University of Delaware and Bowling Green University also showed 100% employment of graduates with an applied mathematics master's degree.

Clemson University (South Carolina) receives far more qualified applicants than they can admit to their applied mathematics graduate programs.

In Minnesota, Mankato enrolled 110 master's students during the 1984-85 year, a number indicating high student interest in the field.

At UMD, as demonstrated by results of a survey of 178 computer science and mathematics students taken during April 1985, 72 students indicated specific interest in pursuing a graduate degree in mathematics or statistics at UMD and 99 indicated highest interest in a graduate degree in theoretical or applied mathematics or statistics. Since employment opportunities are good, with shortfalls predicted in numbers of trained personnel, high student demand may be expected to continue.

The letters in Appendix A indicate strong interest in the program from other sectors:

From the U.S. Environmental Protection Agency:

Gilman D. Veith, Ph.D., Associate Director for Research Operations: "The request from our staff of 94 scientists for additional support and outside assistance in computational mathematics appears to be increasing by 50 percent each year. I anticipate that we will require in excess of \$300,000 each year of extramural assistance in applied and computational mathematics by 1987. Moreover, the need for mathematicians is growing steadily throughout the government as greater emphasis is placed on chemical safety and risk assessment. I think the program that you have outlined at UMD will provide graduates with attractive job opportunities in many areas of government and industrial research....we sought to nurture a strong relationship with your department both for consulting services in statistics and basic research. I would regard your establishment of a formal graduate program as a major advance in this cooperative agreement...It is my view that graduate students in mathematics in Duluth would find added excitement and research experience in their graduate training through collaborative studies with our staff."

From the Natural Resources Research Institute:

Michael J. Lalich, Director: "In particular, I see that the NRRI is going to require the capability to mathematically model processes and expertise in the area of statistical analysis. Your program would be very supportive of this need at NRRI and within the industries that we serve."

Thys B. Johnson, Associate Director for Minerals: "I am submitting this letter in strong support of the program. I feel your proposed program will contribute greatly to many areas of interest to the Minerals Division of NRRI. The proposed graduate program in Applied Mathematics...will also provide graduates with the training required by Minnesota's growing high technology industries. Interaction with such a program as you propose is a must for such industries."

Eugene Shull, Associate Director for Energy: "Countless potential projects in the new Institute might benefit from the contributions of UMD faculty and well-equipped graduate students. Simulation modeling of combustion and gasification systems, and statistical design and analysis of fermentation processes are two typical applications of computational mathematics and statistics immediately expected. Of particular value to the Energy Division would be students pursuing the emphases in deterministic applications to physical phenomena, and in computational mathematics."

From Air Force ROTC:

Douglas B. Robison, Lt. Col., USAF, Commander AFROTC, UMD: "Recently, the Air Force has shifted its emphasis from recruiting undergraduate engineers to other needed areas in anticipation of future specialty requirements. Applied Mathematics is one such area that is receiving increased Air Force support. Future Air Force needs in this area are projected to increase."

From Honeywell:

Mel Geokezas, Ph.D., Director of Research: "The MS degree programs in applied mathematics and computer science... would produce graduates of value to our research programs. It is essential to our research efforts that we have access to graduate degree holders who have been trained and have experience with the tools, methods, and topics that are used in today's research programs."

Thomas B. Cunningham, Manager, Systems and Control Sciences: "Control Sciences deal with analysis of dynamical systems and synthesis of controllers for such systems. The technologies involved require a significant background in Applied Mathematics, particularly in the areas of analysis, optimization, approximation, and problem formulation. The proposed MS program in Applied Mathematics at UMD could provide the necessary background for potential workers in this area."

Nelson Marquina, Ph.D., Research Section Chief, Artificial Intelligence Technology: "I strongly support your proposed Master of Science program in Applied Mathematics. The needs of high technology companies such as Honeywell far surpass the availability of appropriately-trained individuals in the Midwest region."

From Minnesota Power:

Daniel J. Beddow, Engineer Programmer: "...a Masters Degree geared toward applications would be very beneficial to the area ... there is a need for more education in mathematical applications."

## III. C.3. GEOGRAPHIC AREA THE PROGRAM IS DESIGNED TO SERVE

In Minnesota, mathematics and statistics master's degrees are granted at the University of Minnesota (Twin Cities campus) and at Mankato State University. Bemidji State University offers a master's degree in mathematics that is essentially a teacher's program, directed towards mathematics education. There are no other viable masters programs in mathematics/statistics in Minnesota. Mankato awarded 24 master's degrees in 1983-84; UM awarded 8 M.S. degrees and 8 Ph.D. degrees in mathematics between July 1983 and July 1984 and awarded 7 M.S. degrees and 3 Ph.D. degrees in statistics during the same period.

There are no advanced degree mathematics or statistics programs in northeastern Minnesota. Therefore, the proposed program would afford a unique opportunity to residents of this geographic area.

## III. C.4. A QUANTITATIVE DISCUSSION OF EMPLOYMENT PROSPECTS FOR GRADUATES

In the late 1960s and early 1970s, Ph.D.s in mathematics glutted the field. The academic marketplace in mathematics became oversaturated and stayed that way for a number of years. Today, the employment situation in the mathematical sciences is considerably brighter. Virtually all Ph.D.s in 1982-83 are working in areas related to their training. Additional retirements in the early 1990s should create greater demand for mathematics faculty. Table 1 shows the rapid growth of mathematics and statistics enrollments in four-year institutions over the last eight years.

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Table 1. Enrollment in Mathematics and Statistics Courses in Universities and Four-Year Colleges -- Fall Semester

<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>1979</u>	<u>1983</u>
744,000	1,068,000	1,386,000	1,497,000	1,999,000	2,390,000

Source: Conference Board of the Mathematical Sciences

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The David report summarizes its findings:

There is an excess of demand for [mathematics] Ph.D.s over supply, created by increasing undergraduate enrollments; Ph.D. production and hiring rates at doctorate-granting departments have been stable for several years; the percentage of U.S. citizens among new Ph.D.s is decreasing; increased retirement rates in the 1990s will create somewhat greater demand for faculty; overall demand could increase sharply because of growth in the mathematics of computation. We conclude that the current Ph.D. production level of 800 per year is unlikely to be adequate to meet demand over the next decade.

The master's degree, even more than the Ph.D. degree, may be emerging as the leading professional degree in mathematical science. According to New Opportunities in Mathematics (1979), there appear to be many more professional opportunities for holders of a Master's degree than for Ph.D.s or B.S./B.A.s in mathematics.

The report of the 1982 Minnesota High Technology Council Survey, Jobs in Technology: Minnesota's Critical Human Resources Needs for the Coming Decade, published in 1983, lists mathematics as one of its high demand categories for all technical hires in 1980-1981, and for anticipated hiring needs to 1991.

On a national level, Peterson's Guide to Engineering, Science, and Computer Jobs in 1985 lists 345 major companies, organizations, and institutions with opportunities in mathematics for graduates with bachelor's and master's degrees. Of these, 163 specifically targeted a need for research and development.

Furthermore, it is reasonable to expect that employment opportunities for mathematics and statistics graduates will proliferate simply due to the expanded use of mathematics in fields that were already mathematically based, the rapid entry of mathematics into other fields, and the mathematical foundations of the newly formed sciences.

Starting salaries provide an indication of relative demand. Notices of the American Mathematical Society (AMS) (Vol. 31, No. 7, November 1984) includes an article by R.D. Anderson, Past President of MAA, entitled "Mathematics Salaries: Up and Competitive." Anderson presents data from the July 1984 report of the College

Placement Council Salary Survey, which uses data from 187 placement offices at 162 colleges and universities in the U.S. Salary offers in 1983-84 to bachelor's candidates in mathematics increased 8.4% over 1982-83; offers to master's candidates increased 12.9%.

### III. C.5. EDUCATIONAL, RESEARCH, CULTURAL AND SOCIAL BENEFITS

A master's degree program in applied and computational mathematics and statistics would be consonant with UMD's mission to provide graduate, professional, and continuing education programs as well as promote significant research and service activities. A master's level program at UMD would not only provide access to residents of northeastern Minnesota, but would also afford an educational opportunity to other qualified Minnesotans who cannot be accommodated in other programs within the state.

Furthermore, such a program would have far-reaching and beneficial social, economic, and research ramifications.

The centrality of mathematics and its link to all aspects of technology is detailed in Renewing U.S. Mathematics: Critical Resource for the Future, the Report of the Ad Hoc Committee on Resources for the Mathematical Sciences, National Research Council, 1984. In the words of the Committee Chairman, Frank Press:

It is well understood that several U.S. national objectives--primary examples are national security, economic strength, and the quality of life--are increasingly linked to our success in introducing new technologies that have been made possible by recent scientific advances. It is less fully appreciated that, in many diverse fields, scientific progress is stimulated by advances in mathematics, which defines the foundations of many of the sciences.

It cannot be overemphasized that the role of mathematics is increasingly vital to science, technology, and society itself. The period since World War II has been one of dazzling accomplishments in mathematics. The flourishing of the discipline has run hand-in-hand with burgeoning applications, which today permeate the theoretical fabrics of other disciplines and constitute important parts of the intellectual tool kits of working scientists, engineers, social scientists, and managers. The emergence of "high technology" brought our society into an era of mathematical technology, in which mathematics and engineering interact in new ways. Fifty years ago, mathematics made some tools directly for engineering but basically promoted the development of other sciences, which, in turn, provided the foundation for engineering principles and design. Today, however, mathematics and engineering interact directly, on a broader, deeper scale in the areas of communication, control, management, design, computer, and alternatives to experimentation. This new interaction has greatly benefited mathematics, engineering, and technology.

Research and development that arises from mathematics programs can be of enormous benefit to Minnesota based industries. In the 1980 IT Advisory Council Survey, 70% of Minnesota manufacturing company presidents and chief executives reported their belief that the vitality and growth of Minnesota's major industries are directly related to the availability of scientists and engineers.

A shortfall in available technical personnel in Minnesota is occurring in a state that is among the six major technology - oriented states in the U.S. Collectively, Minnesota's technology - based companies employ more than 30% of its workforce.

There is a strong relationship between gross state product and technology. In 1979, 39% of the GSP was generated by technology - intensive companies, according to the Minnesota Department of Economic Development.

Moreover, Minnesota has a tradition of nurturing successful technology-based ventures. Four out of five such new companies or units succeed each year, whereas nationally four out of five fail. Their success is often dependent on the availability of trained personnel.

The presence of a major research university has proven to be a necessary (though probably not sufficient) condition for attracting high tech industries and for supporting research and development. The 1977 Census of Manufacturers lists Minnesota as one of the top four state producers of electronic computing equipment, but warns that Minnesota's ability to retain its 11% share of the U.S. market will depend upon its ability to target research, development, and production effectively.

Education cannot be divorced from economic growth. Professor Arthur Jaffe in his paper, "Ordering the Universe: The Role of Mathematics" states:

In the past quarter century, mathematics and mathematical techniques have become an integral, pervasive, and essential component of science, technology, and business. In our technically oriented society, "innumeracy" has replaced illiteracy as our principal educational gap... We could say that we live in the age of mathematics--that our culture has been "mathematicized."

However, the technical workforce in America is shrinking compared with those in Japan and Germany, countries which have three to four times more technical graduates on a per capita basis than does the

U.S. (Technology Review 85:49-57, October, 1982). The pressing need for expanded technical programs and for trained personnel that led to the establishment of UMD's College of Science and Engineering and to the three new engineering degree programs at UMD now applies with equal force to applied and computational mathematics and statistics graduates at the bachelor's and master's levels.

### III. D. COMPARISON WITH SIMILAR PROGRAMS

There are four viable graduate programs in mathematics and statistics within Minnesota:

**Bemidji:** This program has an essentially different focus. It is aimed primarily at teachers, and concentrates on applications for math education. In recent years, only about two students per year entered this program.

**Mankato:** The program is labeled "Mathematics, Astronomy and Statistics." The proposed program at UMD will not include an astronomy option.

**U. of Minnesota (Twin Cities campus):** These programs (one in mathematics and one in statistics) have a different thrust from the proposed program at UMD, since they are designed to prepare the student for doctoral level studies in mathematics and statistics.

It should be pointed out that UMD's program would be the only graduate program in applied and computational mathematics and statistics in northern Minnesota. Current and projected market demand for trained personnel is high enough so that limited duplication of programs would be beneficial rather than harmful to the state and region.

III. E. QUALITY CONTROL

III. E.1. FACULTY QUALIFICATIONS

Summary of graduate level activities for nine fulltime faculty members with Graduate School Appointments:

- a. Professor Sabra S. Anderson  
Courses taught: Math 5326, 5671, 5672, 5760, 5765, 5830, 5840; plus a course in Mathematical Logic at Eastern Michigan University.
- b. Professor Sylvan D. Burgstahler  
Courses taught: Math 5370, 5380, 5390, 5950.
- c. Professor Joseph A. Gallian  
Courses taught: Math 5326, 5671, 5672, 5680, 5830, 5840, 5950, 5980.

Graduate examining committees: 1 student in Biology and 3 in Physics at UMD.

- d. Associate Professor Duane E. Anderson  
Courses taught: Math 5326, 5370, 5380, 5390, 5760, 5820, 5840, 5950, 5970; CS 5531, 5950.

Graduate examining committees: 6 students in physics, 2 in math education, and 1 in history at UMD.

- e. Associate Professor Richard F. Green  
Courses taught: Math 5590, 5591, 5598; plus courses in Statistical Ecology and Demography at University of California, Riverside.

Graduate Examining Committees: 7 students in biology at UMD; 1 master's level and 1 Ph.D. level in biology, 7 Ph.D.s in anthropology (1), entomology (2), psychology (2), and statistics (2) all at University of California, Riverside.

- f. Associate Professor Clinton J. Kolaski  
Courses taught: Math 5390, 5701, 5702.

Graduate examining committee: 1 student in Physics at UMD.

- g. Associate Professor Robert L. McFarland  
Graduate level courses taught: Abstract Algebra, Algebraic Coding Theory, Switching Theory and Logical Design, Seminar on Difference Sets.

Graduate examining committees: one master's level in mathematics, one master's level in computer science, both at Wright State University, Dayton, Ohio.

- h. Associate Professor James L. Nelson  
Courses taught: Math 5370, 5380, 5385, 5390, 5701, 5702, 5760, 5820, 5840, 5950.
- i. Associate Professor Ronald R. Regal  
Courses taught: Math 5562, 5598; plus courses in Statistics Lab, Linear Models I and II, Mathematical Statistics I and II at SUNY, Albany, N.Y.; plus courses in Statistical Analysis I and II, Theory of Statistics, and Theory of Sampling Surveys all at Univ. of Minnesota, Twin Cities.

Graduate level committees: full membership on graduate faculty in statistics at the Univ. of Minnesota, Twin Cities.

- j. Associate Professor Harlan W. Stech  
Courses taught: 5326. At Virginia Polytechnic Institute, University of Iowa and Iowa State University taught courses equivalent to 5370, 5380, 5385, 5386-7, 5395, 5530, 5531, as well as graduate courses in ordinary differential equations, integral equations, bifurcation theory, stability and systems of ordinary differential equations, and mathematical epidemiology.

Graduate thesis direction: 1 M.S. (A. Sathage, VPI, 1986).

Graduate thesis committees: University of Iowa: 1 PhD (math), 1 MS (mech. eng.).

Graduate examining committees: University of Iowa: 4 MS (civil eng.), 3 MS (mech. eng.), 1 MS (C.A.D.); Virginia Tech: 3 PhD (math), 1 MS (math).

Graduate Applied Mathematics Advisor: Virginia Polytechnic Institute, 1984-6, approx. 40 MS level, 6 PhD level.

- k. Assistant Professor James W. Rowell  
Courses taught: Math 5326, 5820.
- l. One new tenure track Ph.D. in mathematics and statistics is to be hired in 1987.
- m. Seven computer science faculty (formerly of the UMD Department of Mathematical Sciences) have graduate examining appointments in Mathematics (4 assistant, 2 associate, and 1 full professor all with Ph.D.s in Mathematics) and an eighth faculty member of that new department, with a Ph.D. in computer science.

Resumes for the eleven fulltime Mathematics and Statistics

faculty members are here appended:

(Curriculum vitae are attached to original proposal on file in Dean's office.)

## III. E.2. PROCEDURES BY WHICH THE PROGRAM WILL BE GOVERNED

The program will be governed according to the usual procedures for a graduate program in the College of Science and Engineering and the Graduate School. Accordingly, all significant program changes are to be developed and approved in the Department of Mathematics and Statistics, and must then be approved by the College Curriculum Committee, the deans of the College, the Graduate Faculty Committee, the Physical Sciences Policy and Review Council, and the Graduate School.

## III. E.3. EXTERNAL ACCREDITING AND CERTIFICATION AGENCIES

Since mathematics is an ancient discipline, and since mathematical sciences departments have such a long history in academic institutions, no external accrediting or certification agencies exist to regulate them as they do for new disciplines such as computer science. The accreditation granted to the College of Science and Engineering and to the University of Minnesota, Duluth as a whole will also govern the proposed program. (See the next section for review procedures.)

III. E.4. PLAN FOR SYSTEMATIC REVIEW AND EVALUATION OF THE PROGRAM

The program will be reviewed periodically as part of the standard internal and external review of the Department of Mathematics and Statistics, UMD, and the Graduate School of the University of Minnesota.

III. F. IMPLEMENTATION

III. F.1. TIME SCHEDULE

The program will be initiated September 1, 1987 (subject to approval by the University of Minnesota Board of Regents and the Minnesota Higher Education Coordinating Board). By 1989, the program is expected to be in full operation.

III. F.2. UNIVERSITY RESOURCES REQUIRED FOR IMPLEMENTATION AND FOR FULL OPERATION

Costs are designated as new (\*) or from reassignment of temporary instructorships to teaching assistantships (\*\*).

1. Implementation: 1987-88	
a) Faculty:	
3 FTE Teaching Assistants	\$42,000 (**)
b) Civil Service:	
0.25 FTE Secretary	4,000 (*)
c) Equipment Supplies, etc.	4,000 (*)
Total Direct Costs	\$50,000
d) One-time Costs:	
Initial Equipment Purchase or donation	10,000 (*)
Office and lab space conversion	10,000 (*)
Total Program Costs	\$70,000
2. Full Operation: 1989-90 (COL not included)	
a) Faculty:	
4 FTE Teaching Assistants	\$56,000 (**)
b) Civil Service	
0.25 FTE Secretary	4,000 (*)
c) Equipment, Supplies, etc.	4,000 (*)
Total Direct Costs	\$64,000
Total Program Costs	\$64,000



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL RESEARCH LABORATORY - DULUTH  
6201 CONGDON BOULEVARD  
DULUTH, MINNESOTA 55804

October 1, 1985

Dr. Duane E. Anderson  
Associate Head  
Dept. of Mathematics/  
Statistics  
University of Minnesota-Duluth  
10 University Drive  
Duluth, MN 55812

Dear Dr. Anderson:

Thank you for the opportunity to review the Draft #2 of your proposal for a Master of Science Degree in Applied and Computational Mathematics. It is without hesitation that I offer my support of the proposed program. You are to be congratulated for the unique staff already attracted to Duluth and for the proposed plans to formalize graduate training in this critical area of scientific research.

As you know, we are supporting research in the existing Mathematics Department for basic research in mathematics as well as the development of applied statistical methods needed for our work. The request from our staff of 94 scientists for additional support and outside assistance in computational mathematics appears to be increasing by 50 percent each year. I anticipate that we will require in excess of \$300,000 each year of extramural assistance in applied and computational mathematics by 1987. Moreover, the need for mathematicians is growing steadily throughout the government as greater emphasis is placed on chemical safety and risk assessment. I think the program that you have outlined at UMD will provide graduates with attractive job opportunities in many areas of government and industrial research.

As the largest environmental research lab in EPA, and one of the larger research institutions in northern Minnesota, we have often discussed the merits of hiring staff in statistics, systems, modeling and basic mathematics. Because of our relatively remote location, we have chosen not to duplicate the expertise of UMD in your department, but rather to focus our skills in toxicology and environmental chemistry. At the same time, we sought to nurture a strong relationship with your department both for consulting services in statistics and basic research. I would regard your establishment of a formal graduate program as a major advance in this cooperative agreement, and would gain some satisfaction that we have made the right choice in supporting UMD rather than duplicate your specialized expertise. It is my view that graduate students in mathematics in Duluth would find added excitement and research experience in their graduate training through collaborative studies with our staff. I can assure you of my complete support and in expanding joint research in our many areas of mutual interest.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Gilman D. Veith".

Gilman D. Veith, Ph.D.  
Associate Director for Research Operations



UNIVERSITY OF MINNESOTA  
DULUTH

Natural Resources Research Institute  
3151 Miller Trunk Highway  
University of Minnesota, Duluth  
Duluth, Minnesota 55811  
(218) 720-3060

December 11, 1985

Duane E. Anderson  
Associate Head Math-Stat.  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

Dear Duane:

On the basis of reviewing your draft proposal for a Master of Science and Computational Mathematics degree and your meeting with the Natural Resources Research Institute staff on the program, I would like to offer this letter of support.

In particular, I see that the NRRI is going to require the capability to mathematically model processes and expertise in the area of statistical analysis. Your program would be very supportive of this need at NRRI and within the industries that we serve.

I would encourage you to interact with other university disciplines, particularly in the area of science and engineering. Experience in the area of statistical design of experiments is an invaluable aid to the thought process of an engineer or scientist.

Good luck in your endeavor.

Sincerely,

Michael J. Lalich, Director  
Natural Resources Research Institute



UNIVERSITY OF MINNESOTA  
DULUTH

Natural Resources Research Institute  
214 Research Laboratory Building  
2205 East 5th Street  
Duluth, Minnesota 55812

(218) 726-6138

October 25, 1985

Professor Duane E. Anderson  
College of Science & Engineering  
Department of Mathematical Sciences  
320 Math-Geology Building  
University of Minnesota, Duluth  
Duluth, Minnesota 55812

Dear Professor Anderson:

After discussing the proposed Master of science program in Applied Mathematics and Computer Science with you and other faculty in the Mathematics Department and reviewing your draft degree proposal, I am submitting this letter in strong support of the program. I feel your proposed program will contribute greatly to many areas of interest to the Minerals Division of NRRI.

The proposed graduate program in Applied Mathematics and Computer Science will also provide graduates with the training required by Minnesota's growing high technology industries. Interaction with such a program as you propose is a must for such industries.

With your proposed program, you will be offering a unique opportunity for Northeastern Minnesota which will definitely be needed. I particularly envision applications in mathematical modeling and advanced statistics where the advanced training to be offered by your proposed program will be the necessary ingredient for success.

If there is anything I can do to aid you further in implementing your proposal, please contact me.

Sincerely,

Thys B. Johnson  
Associate Director for Minerals

TBJ/ga



UNIVERSITY OF MINNESOTA  
DULUTH

Natural Resources Research Institute  
214 Research Laboratory Building  
2205 East 5th Street  
Duluth, Minnesota 55812

(218) 726-6138

Date: November 18, 1985  
To: Duane E. Anderson, Associate Head Math/Stat.  
Via: Michael Lalich, Director, NRRI  
From: Eugene Skull, Associate Director for Energy  
Subject: Support for the M.S. in Applied and Computational  
Mathematics Degree Proposal

A program leading to an M.S. in Applied and Computational Mathematics can be a distinct asset to the Energy Division in the Natural Resources Research Institute. Countless potential projects in the new Institute might benefit from the contributions of UMD faculty and well-equipped graduate students. Simulation modeling of combustion and gasification systems, and statistical design and analysis of fermentation processes are two typical applications of computational mathematics and statistics immediately expected. Of particular value to the Energy Division would be students pursuing the emphases in deterministic applications to physical phenomena, and in computational mathematics.

At the same time, NRRI and its Energy Division can contribute to the degree program through their scientific and engineering staff and their physical resources. The professional staff will be able to provide a variety of experiences in design and analysis, and probably financial support for them. The computer facilities at NRRI will be a valuable complement to those normally available at the UMD Computer Center and in the College of Science and Engineering.



DEPARTMENT OF THE AIR FORCE  
DETACHMENT 420, AIR FORCE ROTC (ATC)  
UNIVERSITY OF MINNESOTA, DULUTH  
DULUTH, MN 55812-2403

REPLY TO  
ATTN OF

Lt Col Robison, Commander, AFROTC Det 420/UMD

22 Nov 85

SUBJECT Proposed Master of Science Degree in Applied Mathematics

cc Dr. Anderson - Dept. Head, Mathematics/UMD

1. In response to my recently becoming aware of the future proposal for establishing a Master of Science Degree in Applied Mathematics at the university, I would like to take this opportunity to add my support for this future proposal. This extra graduate degree would add flexibility to my Air Force officer commissioning program here at the university by allowing our detachment to recruit UMD seniors contemplating immediate UMD graduate school after receipt of their Bachelor's Degree who also simultaneously want to become commissioned officers in the United States Air Force.

2. Recently, the Air Force has shifted its emphasis from recruiting undergraduate engineers to other needed areas in anticipation of future specialty requirements. Applied Mathematics is one such area that is receiving increased Air Force support. Future Air Force needs in this area are projected to increase. This UMD degree implementation will help us in this detachment recruit quality officer candidates ultimately helping the Air Force achieve its manning goals while simultaneously expanding the, already, excellent educational programs we have available here at UMD.

A handwritten signature in cursive script, reading "Douglas B. Robison".

DOUGLAS B. ROBISON, Lt Col, USAF  
Commander

# Honeywell

MEL GEOKEZAS  
Director of Research

16 August 1985

Professor Duane E. Anderson  
Professor Mark A. Luker  
Department of Mathematical Sciences  
University of Minnesota  
Duluth, MN 55812-2496

Gentlemen:

A number of our senior research and supervisory staff have met with representatives of your curriculum planning group on the subject of proposed programs for Master of Science degrees in applied mathematics and computer science. The three research science areas primarily concerned with these fields of knowledge have prepared letters of support which are enclosed. In addition to their comments, I would like to add my own.

The MS degree programs in applied mathematics and computer science which were discussed with your faculty would produce graduates of value to our research programs. It is essential to our research efforts that we have access to graduate degree holders who have been trained and have experience with the tools, methods, and topics that are used in today's research programs. Without personnel skilled in these areas, we would be unable to compete in the high technology product areas that Honeywell pursues.

Your planned programs in applied mathematics and computer science, with options for research focus and the possibilities for exchange seminars and internships, offer a unique opportunity to match graduate training to Minnesota's high technology industry needs. I want to encourage both of the new departments in their efforts to fill this critical need, and I thank you for your willingness to accept our suggestions in designing these MS programs.

Sincerely,

*Mel Geokezas by R.E. Peterson*

Mel Geokezas, Ph.D.

MG/SCM134

# Honeywell

9 August 1985

Professor Duane E. Anderson  
University of Minnesota/Duluth  
College of Science and Engineering  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, MN 55812-2496

Dear Prof. Anderson:

Control Sciences deal with analysis of dynamical systems and synthesis of controllers for such systems. The technologies involved require a significant background in Applied Mathematics, particularly in the areas of analysis, optimization, approximation, and problem formulation. The proposed MS program in Applied Mathematics at UMD could provide the necessary background for potential workers in this area.

Graduate programs in Applied Mathematics and Computer Science at the University of Minnesota, Duluth (UMD) can provide graduates with the education needed for work in Minnesota's high technology industries including the Honeywell Systems and Research Center. The proposed involvement of personnel from these industries in the UMD graduate programs make these programs especially worthy of our support.

Sincerely,



Thomas B. Cunningham  
Manager, Systems & Control Sciences

TBC/sc

# Honeywell

9 August 1985

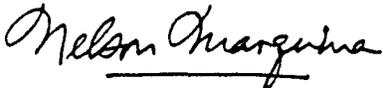
Professor Duane E. Anderson  
University of Minnesota/Duluth  
College of Science and Engineering  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, MN 55812-2496

Professor Anderson,

I strongly support your proposed Master of Science program in Applied Mathematics. The needs of high technology companies such as Honeywell far surpass the availability of appropriately-trained individuals in the Midwest region. This situation will remain with us for the foreseeable future unless programs such as yours are implemented to allow industry and academia to work together to find joint solutions.

Thank you for the opportunity to express our opinions. We are looking forward to an active program of participation and exchange between our engineers and scientists and your faculty and students.

Sincerely,



Nelson Marquina, Ph.D  
Research Section Chief  
Artificial Intelligence Technology

NM/sc

scml26



• **minnesota power** / 30 west superior street / duluth, minnesota 55802 / telephone 218-722-2641

June 10, 1985

Dr. A. G. Law  
Associate Professor  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

Dear Dr. Law:

I want to thank you for the help and cooperation you have given me in solving the river flow curve fit problem. Your time and expertise was the key factor in solving the problem. Not only I, but my superiors who are managing the project, are also grateful.

I would also like to address the possibility of UMD offering a Masters Degree in mathematics. I believe a Masters Degree geared toward applications would be very beneficial to the area. My current involvement with the river flow project shows there is a need in the area for more education in mathematical applications. I feel the UMD Mathematics department would offer an excellent Masters Degree. As an undergraduate of UMD, I received an outstanding education from the Mathematics Department. The faculty ranks very high both in and out of the classroom.

Again, thank you for all your help and cooperation. I will be in touch when the project is completed to invite you to tour our facility.

Sincerely yours,

*Daniel J. Beddow*

Daniel J. Beddow  
Engineer Programmer



UNIVERSITY OF MINNESOTA  
TWIN CITIES

All-University Council on Aging/CURA  
330 Hubert Humphrey Center  
301 19th Avenue South  
Minneapolis, Minnesota 55455  
(612) 625-9099

October 16, 1986

Dean Robert T. Holt  
The Graduate School  
University of Minnesota  
321 Johnston Hall  
Minneapolis, MN 55455

Dear Dean Holt:

Please find appended the proposals for a Ph.D. level Minor and an M.A./M.S. level Minor in Gerontology which we are submitting for consideration by the appropriate Policy and Review Committees. We are requesting implementation of the program in the Fall Quarter of 1987.

The documents are the products of extensive discussions held during meetings of the Subcommittee on Graduate Aging Studies of the Academic Development Committee of the All-University Council on Aging (AUCA). This Subcommittee was formed early in the 1985-86 academic year to explore the feasibility of a graduate level area of specialization in Gerontology. Members of the Committee included Professors Miriam Cohn (Social Work), Harlan Copeland (Education), Nancy Eustis (Humphrey Institute of Public Affairs), Bart Galle (Chair, All-University Council on Aging), Rosalie Kane (Social Work and Public Health), and Frank Lassman (Otolaryngology).

In addition, members of the AUCA Policy Committee (which includes representatives from all academic units and coordinate campuses of the University) have reviewed and approved the work of the Subcommittee at its meetings in May and October. Associate Vice President Betty Robinett, who is an Ex Officio member on the AUCA Policy Committee, and Associate Dean Kenneth Zimmerman have assisted by reviewing drafts of the proposal.

Since the creation of the All-University Council on Aging in 1975, the viability of multidisciplinary work in the field of Gerontology and Aging Studies has been demonstrated through the generation of research projects; the enrollment of students in courses; the receptivity by the University community of seminars, faculty development efforts, and newsletters; and the increased visibility of Gerontology research and instruction at the University. The faculty members who have been

Dean Robert T. Holt  
October 16, 1986  
Page 2

working on these proposals believe that the time is right to organize existing educational efforts into more visible and accessible forms for graduate students at the University who are interested in Gerontology. Thus, the proposals to establish a Ph.D. level Minor and an M.A./M.S. level Minor in Gerontology are unanimously and enthusiastically supported by the faculty serving on the Subcommittee on Graduate Studies and the AUCA Policy Committee.

Sincerely yours,

  
Harlan G. Copeland, Ph.D.  
Associate Professor  
Co-Chair, Academic Development Committee  
All-University Council on Aging

encl.

HGC/mc

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College Graduate School, University of Minnesota Code No.                       
2

I. General Information

A. Program Title Minor Program in Gerontology (Ph.D. and M.A./M.S. Levels)

8 27

B. Program Review Category:  Regular  
(check one)  Experimental (If Experimental, give Reporting Date:        /        /       )  
28 29 30 32 34

C. Proposed Implementation Date: 09 / 01 / 87

D. Program Length: Total Cr/hr                       
36 38 40 42 45 46 49 50 53  
Ph.D. Minor = 18 quarter credits  
M.A./M.S. Minor = 9 quarter credits  
Classroom                      Laboratory                     

E. Administrative Unit Immediately Responsible for Program: All-University Council on Aging and  
the Graduate School  
54 73

F. Describe the Program (in 50 words or less):

Minor Program in Gerontology at the Ph.D. and M.A./M.S. levels. Enrollees  
8 64  
2 are graduate students majoring in traditional Ph.D. and M.A./M.S. programs  
65 120  
3 offered by units in Education and Psychology, Social Sciences, and Health  
8 64  
3 Sciences. Curriculum will provide a multidisciplinary foundation in Geron-  
65 120  
4 tology, and a concentration in at least two of the following four areas:  
8 64  
4 Biological or medical sciences; Psychological, behavioral, or social sciences;  
65 120  
5 Humanities or fine arts; Public policy, practice, economics, politics, or law.

G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	87-88		89-90	
	First Year: <u>      </u> (Yr.) 8	Student Credit or Contact Hours	Full Operation: <u>      </u> (Yr.) 40	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	20	140	60	420
Other Students	120	360	120	360
Total	140	500	180	780
b. Program Graduates/Completers				

A. Projected Costs of the Program:

II. Budget Data

6

7

	First Year: 87-88								Full Operation: 89-90							
	New				Re-assigned				New				Re-assigned			
	No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		
a. Faculty	.15	\$ 5,250			\$			\$		.25	\$ 8,750			\$		
b. Civil Service		\$		.05	\$ 1,000			\$			\$		10	\$ 2,000		
c. Equipment, Supplies, etc.		\$			\$ 100			\$			\$			\$ 200		
Total Direct Costs (a+b+c)		\$ 5,250			\$ 1,100			\$ 8,750			\$ 2,200			\$		
d. One-time Costs		\$			\$			\$			\$			\$		
e. Space Rental		\$			\$			\$			\$			\$		
f. Indirect Costs		\$			\$			\$			\$			\$		
g. Total Program Costs (a+b+c+d+e+f)		\$ 5,250			\$ 1,100			\$ 8,750			\$ 2,200			\$		

B. Expected Sources of Funds for Program:

8

9

	First Year: 87-88						Full Operation: 89-90					
	Dollar Amount		% of Annual Expend.	One Time Input		Dollar Amount		% of Annual Expend.	One Time Input			
a. Local	\$			\$		\$			\$			
b. State	\$ 4,318		.68	\$		\$ 7,446		.68	\$			
c. Tuition	\$ 2,032		.32	\$		\$ 3,504		.32	\$			
d. Federal	\$			\$		\$			\$			
e. Private	\$			\$		\$			\$			
f. Dedicated Fees	\$			\$		\$			\$			
g. Other (Specify)	\$			\$		\$			\$			
h. Total	\$ 6,350		100%	\$		\$ 10,950		100%	\$			

10

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions: \_\_\_\_\_

D. System Verification:

----- 8	----- 15	----- 22
_____	_____	_____
Authorized Institution or System Signature	Title	Date
----- 29	----- 40	----- 42
39	47	47

## SECTION I

### Attachment A

The Budget Data indicate only a fractional FTE for faculty, whereas the Enrollment Data indicate a significant student population. This reflects the fact that the courses comprising the Minor in Gerontology are presently offered by faculty whose effort is (and will continue to be) reported in existing programs. Other efforts by the Graduate Faculty in Gerontology will consist of examination committees and standing committees of the program. Such efforts are not reported under the conventions related to FTE.

The faculty FTE listed in Table IIA represents the projected efforts of the Director of Graduate Studies. This value increases as the program becomes fully operational.

## Section II

Program Title: Minor in Gerontology (Ph.D. and Master's Levels)

### 1. Summary Description of Program

Gerontology is a relatively new field of scientific inquiry. The objects of the inquiry--the aging process and older people--are sufficiently complex and interrelated as to require analytical approaches that cross the traditional boundaries of the biological, psychological, behavioral, and the social sciences.

Program Objectives The establishment of a Minor Program at the doctoral and master's degree levels will accomplish the following objectives:

- 1) Define general areas and provide a list of courses that will provide a broadly representative foundation in Gerontology;
- 2) Provide a central listing in the Graduate School Bulletin of the courses that are appropriate for inclusion in a student's individual program for a Minor in Gerontology;
- 3) Define a formal program in Gerontology that can be evaluated for its strengths and deficiencies by periodic internal and external review processes;
- 4) Provide a listing of Minor program offerings in national and state publications that will aid in recruiting high-quality graduate students for extant graduate programs;
- 5) Further and foster productive collaboration among the faculty interested in Gerontology at the University of Minnesota.

Admission Requirements Graduate students electing the Ph.D. or M.A./M.S. Minor in Gerontology must have been accepted by the Graduate School and the Major Program in which they are enrolled. Admission to the Minor Program will therefore be contingent upon enrollment in good standing within a recognized Ph.D. or M.A./M.S. granting program at the University of Minnesota, and possession of the prerequisites for the core course proposed for the Minor in Gerontology.

The Curriculum A Minor Program in Gerontology may be pursued at both the Ph.D. and the M.A./M.S. levels. The minimum number of graduate level quarter credits required for the Ph.D. Minor is eighteen (18), and the minimum number of credits required for the M.A./M.S. Minor is nine (9). The program for an individual student will be developed in consultation between the student and a Director of Graduate Studies designated by the All-University Council on Aging. The programs will be submitted to the Gerontology Minor Faculty Steering Committee for approval.

The "Multidisciplinary Perspectives on Aging" course (four credits) will be required for both the doctoral and master's Minor Programs. This course focuses on a multidisciplinary introduction to aging and the ag-

ing process. The remaining courses will be selected from at least two of the following four general areas:

- Biological or medical sciences
- Psychological, behavioral, or social sciences
- Humanities or fine arts
- Public Policy, practice, economics, politics, or law.

A list of courses for inclusion in the Minor programs will be developed and revised annually.

Completion Requirements and Standards A student electing the Minor in Gerontology must maintain academic standing in accordance with Graduate School standards. Completion of the program requires completion of the courses included in the approved student's program. Students must obtain at least a "B" average for coursework applied to the Minor.

Student Interest in the Programs It is estimated that 10 to 20 candidates will be admitted to the Ph.D. and the M.A./M.S. Minor program options in any given academic year. This estimate could prove to be conservative since the "Multidisciplinary Perspectives on Aging" course has attracted between 70 and 100 students each fall quarter that it has been offered. The All-University Council on Aging (AUCA) office reports that there were approximately 50 inquiries about graduate work in Gerontology during the 1985-86 academic year.

Resources Required for the Program The Graduate Faculty in Gerontology will be comprised of faculty with primary appointments in a variety of departments. Since the proposed Minor Program in Gerontology will principally gather, focus and coordinate existing course offerings, the resources required for implementation are minimal.

The only faculty member for whom a re-assignment of effort is anticipated is the Director of Graduate Studies (DGS). Support in the amount of \$5,250 (15 percent of \$35,000 salary for nine [9] months) is required for a DGS to administer the program.

These funds will be used to offer an augmentation in salary or to reimburse the academic department for release time or both in order to attract a senior faculty member to accept this responsibility. The necessity for working with faculty and students across many disciplines and academic departments makes it inappropriate for a single academic department to assume the costs of this function.

In addition, support services will be provided by the All-University Council on Aging staff and committee system. The libraries of the University are adequate to support the proposed program. Space and equipment are also considered adequate.

## 2. Need for the Program

Gerontology instruction in American colleges and universities developed rapidly in the 1970s and continues to receive increasing interest and support. At the present time, graduate programs in the study of Gerontology/Aging are offered or being proposed by nine of the Big 10 Schools. Five institutions (Michigan State, Northwestern, Ohio State, Purdue, and the University of Wisconsin) have a Ph.D. program with a major or concentration in Gerontology/Aging through departments such as Family and Child Ecology, Education, Psychology, Recreation Education, Developmental Psychology, Sociology, Child Development and Family Studies, and Educational Psychology. Four institutions offer a master's (University of Michigan, Michigan State, Ohio State and Purdue), and two offer a minor at the Ph.D. or master's level (University of Wisconsin and Michigan State). In addition, two programs are proposed--a Master's in Gerontological Nursing (University of Michigan) and a Ph.D. minor in Gerontology Education (Indiana University). Nationally, nineteen master's degree programs were identified in 1984.

An estimate of student interest in the Ph.D. and M.A./M.S. Minor program was presented above. The students' interests are influenced by the growing presence of older adults in our society as older people grow in absolute numbers and in proportion to the total population.

Since the proposed program is a Minor, it is anticipated that graduates will seek employment in their Major area of specialization such as Social Work, Nursing, Education, Public Health, and similar fields. Thus, the graduate's specialization should directly enhance her or his employability, especially if the employing agency is involved with older people in any capacity. The opportunity to list a Minor in Gerontology on one's resume and transcript is viewed as a major advantage for persons seeking employment in today's aging society.

Peterson noted in 1984 that Gerontology "as a new instructional field includes no accreditation of instructional efforts, no required length for programs, and no stipulations of curricular content external to the institutions offering the degrees." However, some curricular guidelines have been developed by the Education Committee of the Western Gerontological Society (now the American Society on Aging), and the Foundations Project of the Association for Gerontology in Higher Education and the Gerontological Society of America.

The creation of a free-standing Minor in Gerontology would alleviate the loss of qualified graduate students with an interest in Gerontology to other institutions. It would provide current students with an interest in Gerontology in the traditional disciplines at the University with a coherent educational program in Gerontology.

### 3. Mission

The creation of a Minor in Gerontology fits well within the total educational mission of the University of Minnesota. The proposed approach to formal training in Gerontology is consistent with the philosophy of AUCA in recognizing the multidisciplinary nature of the field of Gerontology. The proposed program will strengthen our present system of traditional department majors, will attract qualified graduate students to present programs, and will facilitate interdepartmental research and instruction among University faculty interested in Gerontology.

### 4. Comparative Program Analysis

There exists no similar program for a Minor in Gerontology at the Ph.D. or M.A./M.S. level among the institutions of higher education in Minnesota. The present offerings include: 1) undergraduate certificates (College of St. Scholastica, University of Minnesota, St. Cloud State University); 2) undergraduate minors (Mankato State University, St. Cloud State University); 3) bachelor's degree with a concentration in Gerontology (Metro State University, University of Minnesota); 4) bachelor's interdisciplinary degree program that includes areas that related to Gerontology (College of St. Theresa); 5) graduate degree major with a focus in Gerontology (College of St. Scholastica, Mankato State University); and 6) two-year Associate Degree in Human Services with a focus in Gerontology (Inver Hills Community College).

The nature of graduate-level programs in Gerontology available within the Big 10 institutions was described above.

### 5. Duplication

The configuration of the proposed Minor in Gerontology does not duplicate existing programs in the region. It is designed to provide a coherent and visible focus in Gerontology in graduate education at the University of Minnesota. The Minor in Gerontology will strengthen our present system of traditional department Ph.D. and M.A./M.S. programs in the disciplines and professional fields which directly or indirectly address the aging process and older adults by providing a specialization in Gerontology. The proposed multidisciplinary model to formal training in Gerontology is the more common organizational approach to providing instruction in Gerontology in the United States; the other approach used by a few universities is to create a separate academic unit for Gerontology. The interdisciplinary approach has been the one preferred by the faculty of the University of Minnesota.

### 6. Cost/Benefit

The net cost of this program to the University of Minnesota is minimal since the proposed Minor Program will principally gather, focus, and co-

ordinate existing course offerings. The only faculty member for whom a re-assignment of effort is anticipated is the Director of Graduate Studies. Financial support will be requested to offer an augmentation in salary or to reimburse the academic department for release time or both in order to attract a senior faculty member to accept this responsibility. The necessity for working with faculty and students across many disciplines and academic departments makes it inappropriate for a single academic department to assume the costs of this function.

The cost of this program to an individual student will also be negligible since a Ph.D. or M.A./M.S. student must presently declare a Minor or a related field. Thus, a Minor in Gerontology can be obtained by an individual student at no increase in cost above the present options available to the Ph.D. or M.A./M.S. student.

The benefits of this program are numerous. The proposed program will provide the University of Minnesota with a modest curriculum in Gerontology. The proposed program will stimulate interdisciplinary research and investigation by graduate students and faculty beyond the current levels of activity promoted by AUCA. Thus, the esteem of the University in gerontological research can be raised within the scientific community. The proposed program can also be expected to aid recruitment of highly qualified graduate students to traditional department major programs. The advising of students interested in Gerontology will be strengthened as well, and the products of our graduate programs--the students--will be better trained in Gerontology which will reflect positively upon the University of Minnesota.

#### 7. Hypothesis to be Tested

This is not an experimental program.

Section III

December 10, 1986

Proposal for: Minor in Gerontology (Ph.D. and M.A./M.S. levels)

Submitted by the: Academic Development Committee

of the: All-University Council on Aging

The proposal has been reviewed and approved by:

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APPROVAL CERTIFICATION

BWA Galt 12/10/86  
Chair, All-University Council on Aging (date)

ADDITIONAL APPROVALS

[Signature] 12/11/86  
Dean, Graduate School (date)

\_\_\_\_\_  
Vice President, Health Sciences (date)

\_\_\_\_\_  
Vice President, Academic Affairs (date)

Approval by Regents: \_\_\_\_\_ (date)

First Reading by CAC: \_\_\_\_\_ (date)

Second Reading by CAC: \_\_\_\_\_ (date)

Recommendation by the MHECH:  
\_\_\_\_\_  
\_\_\_\_\_  
(date)

Confirmation by Regents: \_\_\_\_\_ (date)

### SECTION III

#### The Proposal to Establish a Doctoral and a Master's Minor in Gerontology for Graduate Students in the Social, Behavioral, and Health Sciences

##### A. Introduction

Gerontology is a relatively new field of scientific inquiry. The objects of the inquiry -- the aging process and older people -- are sufficiently complex and interrelated as to require analytical approaches that cross the traditional boundaries of the biological, psychological, behavioral, and the social sciences.

A recent attempt to create a definitive bibliography of the biomedical and social science research and the professional aspects of aging for the years 1954 - 1974 yielded approximately 50,000 titles. While a vast body of knowledge is accumulating, gerontologists acknowledge that they are only beginning to scratch the surface in understanding aging when the plight of a large percentage of old people in society is noted. At the present time, aging as a social issue is receiving perhaps even more attention than it is as a scientific question.

Gerontology instruction in American colleges and universities developed rapidly in the 1970s and presently continues to receive increasing interest and support. At the graduate level, certificate programs, master's degrees, and doctoral concentrations in selected disciplines and professional fields are available to students. In a few universities, academic departments of gerontology were created to offer these programs. The more common organizational approach has been to use an interdisciplinary model to provide instruction in gerontology; this interdisciplinary approach has been the one preferred by the faculty at the University of Minnesota.

Graduate programs in the study of aging are offered by nine of the Big 10 Schools. Five institutions have a Ph.D. program with a major or concentration in gerontology/aging through departments such as Family and Child Ecology, Education, Psychology, Recreation Education, Developmental Psychology, Sociology, Child Development and Family Studies, and Educational Psychology (Michigan State, Northwestern, Ohio State, Purdue, and the University of Wisconsin). Four institutions offer a master's (University of Michigan, Michigan State, Ohio State, and Purdue) and two offer a minor at the Ph.D. or master's level (University of Wisconsin and Michigan State). In addition, two new programs are proposed, a Master's in Gerontological Nursing (University of Michigan) and a Graduate Certificate or Ph.D. Minor in Gerontology Education (Indiana University).

Nationally and internationally, leadership in the field has been provided by organizations such as the International Congress of Gerontology (ICG), the Gerontological Society of America (GSA), the American Society on Aging (ASA), [formerly the Western Gerontological Society] and the Association for Gerontology in Higher Education (AGHE). These organiza-

tions sponsor meetings, publish journals, and carry out functions generally associated with established professional associations. The professional organization concerned with gerontology in Minnesota is the Minnesota Gerontological Society (MGS).

At the University of Minnesota, the All-University Council on Aging (AUCA) was organized in 1975 to coordinate and facilitate gerontological interests among faculty and students. The Council is a large and broadly representative organization of over 500 University faculty and students interested in aging and older people.

The Policy Committee of AUCA consists of twenty-four faculty members nominated by the administrators of Colleges, Schools and the Coordinate Campuses and appointed by the Vice Presidents of Academic Affairs, Health Sciences, and Agriculture, Forestry and Home Economics. Four faculty members are elected At-Large within the University. The work of the Council is done through several standing committees: the Academic Development Committee is responsible for providing leadership for educational programs in Gerontology at the University.

The Council works with academic departments in developing and offering courses; sponsors workshops, special lectures and seminars; evaluates academic programs in aging studies; confers seed grants to faculty and students for pilot studies on aging; counsels students into aging studies; and generally promotes scholarship and research on aging. The Council recently published an inventory of research on aging at the University of Minnesota for the years 1980-1985; the inventory consisted of over 130 citations representing the diverse fields of the University.

Thus, Gerontology is a field of knowledge pursued actively by many faculty and students in academic units of the University. However, Gerontology is not as yet recognized as a unique field of knowledge within the educational structure of the Graduate School. The creation of a free-standing Minor in Gerontology would alleviate the loss of qualified graduate students with an interest in Gerontology to other institutions, and provide current students with an interest in Gerontology who are seeking the Ph.D. and the M.A./M.S. in traditional disciplines at the University of Minnesota with a coherent educational program in Gerontology.

#### B. The Proposed Program

Program Objectives: The present proposal for a Ph.D. level Minor and an M.A./M.S. level Minor in Gerontology is designed to address some of the needs outlined above and in Section C (below). Establishment of these Minor programs will accomplish the following objectives:

1. Define broad areas and list courses within these areas that will provide a broadly representative foundation in Gerontology.
2. Provide a central listing in the Graduate School Bulletin of the courses that are appropriate for inclusion in a student's individual program for a Minor in Gerontology.

3. Define a formal program in Gerontology that can be evaluated for its strengths and deficiencies by the periodic internal and external review process of the Graduate School.
4. Provide a listing of the Minor program offering in national and state publications for gerontologists. This publicity will aid in the recruitment of high-quality graduate students for extant graduate programs.
5. Further and foster productive collaboration among the faculty interested in Gerontology at the University of Minnesota.

Admission Requirements: Graduate students electing the Ph.D. or M.A./M.S. Minor in Gerontology must have been accepted by the Graduate School and the Major Program in which they are enrolled. Admission to the Minor Program will therefore be contingent upon enrollment in good standing within a recognized Ph.D. or M.A./M.S. granting program at the University of Minnesota, and possession of the prerequisites for the core courses for the Minor in Gerontology.

#### The Curriculum

M.A./M.S. Minor in Gerontology The Minor program requires a minimum of nine (9) graduate level quarter credits which would include the "Multidisciplinary Perspectives on Aging" course (4 credits). The remaining five or more credits would be taken in courses selected from a designated list in two of the four areas shown below:

Biological or medical sciences  
 Psychological, behavioral, or social sciences  
 Humanities or fine arts  
 Public policy, practice, economics, politics or law

The program for an individual student will be developed in consultation between the student and a Director of Graduate Studies designated by the All-University Council on Aging. The program will be submitted to the Graduate Minor Faculty Steering Committee for approval. See Section E below for a description of the composition and function of the Committee.

Ph.D. Minor in Gerontology The Minor program requires a minimum of eighteen (18) graduate level quarter credits including the "Multidisciplinary Perspectives on Aging" course (4 credits). The remaining 14 or more credits would be taken in courses selected from the designated list of courses shown below. The program must include at least two courses in two of the following four areas:

Biological or medical sciences  
 Psychological, behavioral, or social sciences  
 Humanities or fine arts  
 Public policy, practice, economics, politics or law

The program for an individual student will be developed in consultation between the student and the Director of Graduate Studies designated by

the All-University Council on Aging. The program will be submitted to the Graduate Minor Faculty Steering Committee for approval.

The "Multidisciplinary Perspectives on Aging" course will be required for both the doctoral and master's minor program. This course was developed under the sponsorship of AUCA and is now cross-listed in eight departments/colleges of the University (Child Psychology, Education, Health Science Units, Public Affairs, Public Health, Social, Hospital and Pharmacy Continuing Education, Sociology and Social Work). The content focuses on a multidisciplinary introduction to aging and aging process. Topics include biological, social, psychological aspects of aging; theories of aging; death and bereavement; issues and problems of older adults in America; human services and their delivery systems such as social services, health nutrition, long term care, and education; public policy and legislation; environments and housing; advocates; retirement; lifelong learning; and leisure. The responsibility for coordinating the course has been assumed by faculty from the academic units offering the course; the content is presented by University faculty who are invited to present lectures about their research and contributions from their disciplines as it pertains to the topics addressed in the course.

#### Completion Requirements and Standards

A student electing the Minor in Gerontology must maintain academic standing in accordance with Graduate School standards. Completion of the program requires completion of the courses included in the approved student's program. Students must obtain at least a "B" average for coursework applied to the Minor.

#### C. Educational and Social Need for the Program

Student Interest in the Program: It is estimated that 10 to 20 candidates will be admitted to the Ph.D. and the M.A./M.S. Minor program options in any given academic year. This estimate could prove to be conservative since the "Multidisciplinary Perspectives on Aging" course has attracted between 70 and 100 students each fall quarter that it has been offered. Data pertaining to the current number of Ph.D. and M.A./M.S. students who include gerontology coursework in their related field for their Ph.D. or M.A./M.S. degree are not available. However, there were approximately 50 inquiries about graduate work in Gerontology directed to the AUCA office during the 1985-86 academic year.

Employment Prospects: Since the proposed program is a Minor, it is anticipated that graduates will seek employment in their Major area of specialization such as Social Work, Nursing, Public Health, Education and similar fields, Thus, the graduate's specialization in Gerontology may, in fact, enhance his or her employability especially if the employing agency is involved with older people in any capacity. The opportunity to list a Minor in Gerontology on one's resume and transcript is also considered to be an advantage for persons seeking employment in today's aging society.

**List of Courses for Inclusion in the Ph.D. and M.A./M.S.  
Minor Program in Gerontology**

<u>AREA</u>	<u>COURSE NAME, NUMBER, CREDIT HOURS, AND INSTRUCTOR</u>
Biological or Medical Sciences	<p>Biology of Aging, HSU 5031/SHCE 5007, 2cr Galle</p> <p>The Elderly: A High-Risk Population, PubH 5517, 3 cr, Ostwald</p> <p>Pathophysiology of Aging, PubH 5381, 2 cr, Leon</p> <p>Assessment of the Elderly, PMR 8810, 3 cr, Amundsen, Huss, Ellingham</p> <p>Nutrition and Aging, FScN 8627, 2 cr, Thenen</p> <p>Directed Studies: Aging Auditory System, Otol 5970, Credits Arranged, Lassman</p> <p>Epidemiology of Aging, PubH 5356, 2 cr, Schuman</p> <p>Introduction to Gerontology and Geriatric Medicine, FPCH 8223, 2 cr, Pattee</p> <p>(UM-D) Adult Language Disorders, CD 8205, 3 cr, Mizuko</p> <p>(UM-D) Neuromuscular Speech Disorders, CD 5375, 3 cr, Mizuko</p> <p>(UM-D) Communication Disorders in Chronically Ill and Aged, CD 5500, 3 cr, Hawk</p>
Psychological, Behavioral or Social Sciences	<p>Psychology of Aging, Psy 5138, 4 cr, McGue</p> <p>Aging and the Life Course, Soc 5938, 4 cr, McTavish</p> <p>Sociology of Death, Soc 5956, 4 cr, Fulton</p> <p>Death, Grief and Bereavement, Soc 8956, 3 cr, Fulton</p> <p>Aging and Intergenerational Dynamics, Soc 5939, 4 cr, Fischer</p> <p>The Older Woman: A Feminist Perspective, WoSt 5104/SW 5010, 4 cr, Quam</p> <p>Aging Families, FSoS 5240, 3 cr, Rettig, Strelow</p> <p>Directed Studies in Aging, CDiS 5970, Credits Arranged, Lassman</p> <p>Seminar: Social Gerontology, Soc 8938, 3 cr, McTavish</p> <p>Advanced Theories of Human Growth and Change, SW 5211, 3 cr, Cohn, Quam</p> <p>Interdisciplinary Team Training in Health Services Delivery, SW 5013/PubH 5013, 3 cr, Cohn, Schwanke</p> <p>(UM-D) The Elderly in Families, HE 5640, 2 cr, Watts</p> <p>(UM-D) Caring for the Dying and Bereaved, BhSc 5560, 3 cr, Davis</p>

List of Courses for Inclusion in the Ph.D. and M.A./M.S.  
Minor Program in Gerontology  
(Continued)

<u>AREA</u>	<u>COURSE NAME, NUMBER, CREDIT HOURS, AND INSTRUCTOR</u>
Humanities or Fine Arts	Humanities and Aging, SHCE 5008/HSU 5030, 2 cr, Galle Humanistic Case Studies in Health Care, HSU 5029, 3 cr, Galle. Also cross-listed as Engl 5910 or 5920 Topics in English and American Literature (1-4 cr per qtr) Social Welfare in America, Hist 5349, 4 cr, Chambers
Public Policy, Practice, Economics, Law or Politics	Economic and Social Security, Econ 5534, 4 cr, Williams, Jr. Social Welfare Reform and Income Support Policy, PA 5433, 3 cr, Patten Long-Term Care, PA 5412, 3 cr, Patten Seminar: Aging Policy, PA 5413, 3 cr, Eustis Seminar: Health Care Policy, PA 8451, 3 cr, Kudrle Administration of Services to an Aging Clientele, PubH 5749, 3 cr, Stryker-Gordon Recreation for the Aging, Rec 5240, 3 cr, Weiss Special Topics in Social Work Policy: Long Term Care, SW 8150, Credits Arranged, Kane Special Topics: Mental Health Practice and the Elderly, SW 8450, 3 cr, Abramson Impact of Chronic Illness in Families, SW 8423, 3 cr, Kitto Special Topics: Individualized Research in Aging, SW 8970, Credits Arranged, Cohn, Kane, Quam (UM-D) Clothing: Elderly/Handicapped, HE 5050, 3 cr, Sletten (UM-D) Elderly and Special Needs Consumers, HE 5710, 3 cr, Collins

#### D. Comparison with Similar Programs

There exists no similar program for a Minor in Gerontology at the Ph.D. or M.A./M.S. level in Minnesota. The present offerings include: 1) undergraduate certificates (College of St. Scholastica, University of Minnesota, St. Cloud State University); 2) undergraduate minors (Mankato State University, St. Cloud State University); 3) bachelor's degree with a concentration in Gerontology (Metro State University, University of Minnesota); 4) bachelor's interdisciplinary degree program that include areas that relate to Gerontology (College of St. Theresa); 5) graduate degree major with a focus in Gerontology (College of St. Scholastica, Mankato State University); and 6) two-year Associate Degree in Human Services with a focus in Gerontology (Inver Hills Community College).

As the only resident Ph.D. degree-granting institution in Minnesota, the University of Minnesota is unique in its ability to offer an academic specialization in Gerontology at the Ph.D. level. While the Supporting Program option has been used in lieu of a Minor in the past, a student may graduate without the breadth and depth that would be obtained from a minor program.

The configuration proposed in the Minor in Gerontology does not duplicate existing programs in the state. The program is designed to provide a focus on Gerontology in graduate education at the University of Minnesota. The Minor in Gerontology will strengthen our present system of traditional department majors. This proposed approach to formal training in Gerontology is consistent with the philosophy of recognizing the multidisciplinary nature of the field of Gerontology and of facilitating interdepartmental research and instruction through an All-University Council rather than a separate academic department or college.

#### E. Quality Control

Qualifications of Graduate Faculty: Many faculty members at the University of Minnesota have a research or educational interest in Gerontology. Membership in the Graduate Faculty for Gerontology shall be restricted, however, to those faculty who are involved in and willing to make a commitment to research and graduate education in Gerontology.

Election to the Graduate Faculty in Gerontology shall be granted, upon application, to those faculty of the University of Minnesota who accept and fulfill the responsibilities outlined below. The appointments to the Graduate Faculty will be at the "E" level since the proposal is to establish a Minor program in Gerontology:

1. The faculty should be actively engaged in research in Gerontology. Evidence of such activity should include such things as recent grant support, financial support of graduate students, and recent publications in refereed journals.
2. The faculty should be willing and able to act as advisers to degree candidates in extant, graduate degree-granting programs.
3. The faculty should direct or provide a major contribution to at least one graduate level course in the area of Gerontology at least once every five years.

4. The faculty should present one research seminar at the University of Minnesota at least once every five years.
5. The faculty should be available for service on both standing and ad hoc committees for the Gerontology program.

Periodically, but no less than five-year intervals, the All-University Council on Aging should review the program-related activities of the Gerontology graduate faculty. If individuals are identified who have not fulfilled the above obligations during the past five years, the Director of Graduate Studies should meet with such faculty to arrange for increased contributions to the Gerontology program. Those faculty who have not fulfilled their responsibilities to the program, and who cannot increase their programmatic activities, should be requested to resign from this graduate faculty. If such faculty do not wish to resign, the DGS (in consultation with the All-University Council on Aging) should present the case for review by the Dean of the Graduate School in accordance with established procedures.

#### Governance of the Program

The primary administrative responsibility for the implementation of the program will be vested in the Director of Graduate Studies (DGS). The DGS will be recommended to the Dean of the Graduate School by the Policy Committee of AUCA after the Policy Committee has consulted with the program faculty. The DGS will serve for a period of three years.

The DGS will be assisted by a Gerontology Minor Faculty Steering Committee, consisting of six (6) program faculty serving staggered terms of two years each. These members will be appointed by the Policy Committee of AUCA after taking into consideration the representatives of all subdisciplines with the intent of representing all of the subdisciplines of Gerontology. This Steering Committee will be responsible for reviewing and revising the list of courses approved for inclusion in the Minor programs and for advising the DGS regarding substantial departures from current program guidelines and practices.

#### Evaluation of the Program

One of the major reasons for establishing a Minor in Gerontology is to provide coherence and visibility for the coursework taken by students. To ensure the faculty that the Minor program is relevant and meets the desired standards, annual internal and periodic external reviews of the Gerontology program will be undertaken. Such reviews will be the primary means by which the program is evaluated. It is expected that the program faculty will take steps to remedy deficiencies identified by such reviews.

#### F. Implementation

**Time Schedule:** It is proposed that the Minor in Gerontology be initiated at the start of the academic year beginning in September, 1987.

The Initial Faculty It is proposed that the faculty members seeking Examining Status in the Graduate School for this program comprise the initial Graduate Faculty in Gerontology.

The faculty members listed in Appendix A were invited to affiliate with the Gerontology Minor Program faculty based on two criteria: 1) Currently teach course and/or involved with research in Gerontology, and 2) currently hold Full or Associate Membership with Limited Teaching Status in the Graduate School in another academic program. Three faculty members with Limited Teaching Status in the Graduate School are also included in the initial faculty Additional Faculty list because they are teaching courses proposed for the Minor Program. Other faculty included in the Additional Faculty list have demonstrated significant contribution to Gerontology through curricula development and research at the University of Minnesota.

Upon approval of this proposal, this group will invite additional applications for graduate faculty status in Gerontology and will meet to act upon these applications in accordance with the membership criteria established above. The initial faculty will also be consulted by the All-University Council on Aging on recommending an individual to be appointed Director of Graduate Studies.

University Resources The Graduate Faculty in Gerontology will be comprised of faculty with primary appointments in a variety of departments. Since the proposed Minor Program in Gerontology will principally gather, focus, and coordinate existing course offerings, the resources required for implementation are minimal.

The only faculty member for whom a re-assignment of effort is anticipated is the Director of Graduate Studies. Support in the amount of \$5,250 (15 percent of \$35,000 salary for nine (9) months) is required for a DGS to administer the program.

These funds will be used to offer an augmentation in salary or to reimburse the academic department for release time or both in order to attract a senior faculty member to accept this responsibility. The necessity for working with faculty and students across many disciplines and academic departments makes it inappropriate for a single academic department to assume the costs of this function.

In addition, support services will be provided by the All-University Council on Aging staff and committee system. The libraries of the University are adequate to support the proposed program. Space and equipment are also considered adequate.

Extra-University Resources No significant sources of external support are required for the initiation and implementation of the program.

**Proposed Faculty  
Graduate Minor in Gerontology**

Dennis A. Ahlburg, Associate Professor, Industrial Relations.  
Graduate School Status: Associate Member (Industrial Relations)  
Education: Ph.D., University of Pennsylvania, 1979  
MEC, Australian National University, 1973

Selected Publications:

- Ahlburg, D.A. and L. Kimmel "The Organizational Implications of the Changing Age Structure of the U.S. Labor Force" in K. Rowland and A. Ferris Research in Personnel and Human Resource Management, JAI Press, 1986.
- Ahlburg, D.A. "Demographic Forecasting" in S. Makridahis and S. Wheelwright (Eds.) Handbook of Forecasting, John Wiley, 1987.
- \*Ahlburg, D.A. "Alternative Forecasts of U.S. School Enrollment" International Journal of Forecasting, (1,1) 1985.
- \*Ahlburg, D.A. and M.D. Shapiro "Socioeconomic Ramifications of Changing Cohort Size" Demography (21,1) 1984.
- \*Ahlburg, D.A. "Good Times, Bad Times: The Future Path of US Fertility" Social Biology, (30,1) 1983.

Professional Associations: American Economic Association, Population Association of America, International Institute of Forecasters, Society for Social Biology

William F. Bird, Associate Professor, Health Ecology, School of Dentistry.  
Graduate School Status: (Pending) Associate Member (Dentistry)  
Education: Dr.P.H., Harvard University, 1976  
M.P.H., Harvard University, 1974

Selected Publications:

- \*Bird, W.F., Hazel, D. "Parental Dental Health Education: Non-Effect on Oral Hygiene Among American Indian Pre-School (Head Start) Children " J Prev Dent, Vol. 4, July-Aug, 1976.
- \*Bird, W.F. "Dental Orientation to the Hospital Operating Room" J of Am Dental Association, Fall, 1980.
- Bird, W.F., Bird, D.L. Dental Public Health Text Book, chapter in progress. C.V. Mosby, St. Louis.

Professional Associations: American Society of Geriatric Dentistry; American Dental Association; American Association of Public Health Dentistry; Diplomate, American Board of Dental Public Health

David O. Born, Professor, Health Ecology, School of Dentistry.  
Graduate School Status: Associate Member (Dentistry)  
Education: Ph.D., Anthropology and Educational Psychology, Southern Illinois University, 1970

Selected Publications:

- \*Born, D.O. "Psychological Adaptation and Development Under Acculturative Stress: Toward a General Model" Social Science and Medicine, 3:529-547, 1970.
- \*Born, D.O. and Burton, K. "Impact of a Computerized Placement Service on Practice Location of Recent Graduates" J of Am Dental Association, 97:175-178, 1978.

\* Refereed Journal

- \*Born, D.O. Issues in Forecasting Graduate Dental Education Manpower Supply and Requirement" J of Dental Education, 45(6):362-373, 1981.
- \*Born, D.O. and B.J. Nelson "Male Dentists at Mid-Life: An Exploration of the One Life/One Career Imperative" International J of Aging and Human Development, 18(3):219-235, 1983-84.
- \*Born, D.O. "The Career Satisfaction of Older Dentists" Gerodontology, 1:75-80, 1985.

Miriam R. Cohn, Professor, School of Social Work.  
 Graduate School Status: Associate Member (Social Work)  
 Education: M.S.S.A. University of Pittsburgh, 1945  
 Selected Publications:

- Cohn, M.R. and B. Reynolds Introductory Teamwork in Health and Human Services, book under contract, Charles Thomas, tentative publication, June 1987.
  - Cohn, M.R. "Corporate Responsibility for Retirees: The Relationship of the Corporation and the Retiree in Selected Aspects of Post-Retirement in Terms of Social Responsibility for the Elderly" Preliminary Findings, Mimeographed, School of Social Work, University of Minnesota, November, 1986.
  - Cohn, M.R. Introductory Essay--Family: Tradition/Transition: A Catalogue Prepared for Photographic Exhibit for the Society of Photographic Educators, Minneapolis, Minnesota, Katherine Nash Gallery, Spring 1985.
  - Cohn, M.R. and C. Weisman (Eds.) "The Stress of Aging: A Coping Model for Intervention", report of presentation and discussion, Yeshiva University, 1985.
- Professional Associations: National Association of Social Workers, Minnesota Public Health Association, Gerontological Society of America

Harlan G. Copeland, Associate Professor, Curriculum and Instruction.  
 Graduate School Status: Full Member (Education)  
 Education: Ph.D., University of Chicago, 1969  
 M.Ed., University of Maryland, 1957

Selected Publications:

- Copeland, H., Ploetz, G., and Winterbauer, M. "Assessing the Impact of Adult Literacy Education," Symposium Presentation, Adult Education Research Conference Proceedings, Syracuse, NY, Syracuse University, 1986.
- \*Willie, R, Copeland, H. and Williams, H. "The Adult Education Professor of the United States and Canada" J of Life-Long Learning, Vol. 4, No. 1: 55-67, 1985.
- \*Burcalow, H.B., Copeland, H.G., and Fischer, S.G. "Needs and Priorities: The Specialist's Role," J of Extension, Vol. XIX, 15-20, September/October, 1981.
- Brown, M.A. and Copeland, H.G., Eds, Attracting Able Instructors of Adults, Josse-Bass, San Francisco, 1979.

Professional Associations: Commission of Professors of Adult Education, American Association of Adult and Continuing Education, Adult Education Research Conference, Minnesota Gerontological Society, Minnesota Association for Continuing Adult Education

\* Refereed Journal

Nancy N. Eustis, Professor, Hubert Humphrey Institute of Public Affairs.

Graduate School Status: Associate Member (Public Affairs and Planning)

Education: Ph.D., University of Minnesota, 1966

M.A., University of Minnesota, 1964

Selected Publications:

Fischer, L.R. and N.N. Eustis "DRG's and Family Care of the Elderly," in preparation

Eustis, N.N., J.N. Greenberg and S. Patten. Long Term Care for Older Persons: A Policy Perspective, Brooks/Cole Publishers, 1984.

Eustis, N.N. and S. Patten, "Measurement of Effectiveness of Long-Term Care," Handbook of Research Instruments in Social Gerontology, D. Mangen, Ed., Vol. III, University of Minnesota Press, Minneapolis, 1984.

\*Eustis, N.N. "Introduction," Symposium on Relocation of the Elderly, The Gerontologist, 1981, Vol. 21:481-482.

Eustis, N.N. "Aging and Public Policy" Oct-Dec 1976, pp. 6-8.

Professional Associations: American Society on Aging, American Sociological Association, American Public Health Association, Gerontological Society of America

Lucy Rose Fischer, Assistant Professor, Sociology.

Graduate School Status: Associate Member (Sociology)

Education: Ph.D., Sociology, University of Massachusetts, Amherst, 1979

M.A., University of California, Berkeley, 1969

Selected Publications:

\*Fischer, L.R. "Transition to Grandmotherhood" Int J Aging and Human Development, 1983.

\*Fischer, L.R. "Mothers and Mothers-in-Law" J of Marriage and the Family, 1983.

Fischer, L.R. "Married Men and their Mothers" J of Comparative Family Studies, 1983.

\*Fischer, L.R. "Transitions in the Mother-Daughter Relationship" J of Marriage and the Family, 1981.

Fischer, L.R. Linked Lives: Adult Daughters and Their Mothers, Harper and Row, 1986.

Professional Associations: American Sociological Association, Midwest Sociological Society, Gerontological Society of America, National Council on Family Relations

Bart W. Galle, Chair, All-University Council on Aging; Director, Continuing Medical Education.

Graduate School Status: Limited Teaching Status (Education)

Education: Post Doctoral Study in Adult Education and Gerontology, University of Minnesota and University of Michigan

Ph.D., University of Minnesota, 1976

Selected Publications:

Galle, B.W. (Ed.) Aging: Multidisciplinary Perspectives, Minneapolis, Extension Independent Study, University of Minnesota, 1985.

\*Vaida, A., B.W. Galle, T. Kellenberger "Furosemide" Minnesota Med, 65:365-366, 1982.

\* Refereed Journal

\*Galle, B.W. "Digoxin" Minnesota Med, 195-196, 188, 1982.

Somani, S.M., B.W. Galle and A.W. Roberts "Why is There Resistance to Change and How Can it be Minimized" Hosp Pharm, 16:638-641, 645-646, 1981.

Professional Associations: Association for Gerontology in Higher Education, Gerontological Society of America; Society of Medical College Directors of Continuing Medical Education; Board of Governors, World Med 1986; International Health Care Congress

G. Kenneth Gordon, Associate Professor, Hospital and Health Care Administration, Public Health.

Graduate School Status: Examining Member (Hospital and Health Care Administration)

Education: Ed.D., Indiana University, 1965

M.S., Indiana University, 1963

Selected Publications:

\*Gordon, G.K. "The Social Readjustment Value of Becoming a Nursing Home Resident" The Gerontologist, Vol. 25, No. 4, 1985.

\*Gordon, G.K. "Developing a Motivating Environment" J of Nursing Administration, Vol XII, No. 12, 11-16, December 1982.

\*Gordon, G.K. and R. Stryker-Gordon "Education for the Long-Term Care Administrator: Independent Study Program" J of Long-Term Care Administration, Vol IV, 3:54, 1976.

\*Gordon, G.K. "Effects of Institutional Living on the Elderly" The Minnesota Pharmacist, p. 10 April, 1979.

Gordon, G.K. and R. Stryker-Gordon (Eds) Creative Nursing Home Administration, Springfield, IL, Charles Thomas Publishers, 1983.

Professional Associations: Minnesota Gerontological Society, Minnesota Association of Homes for the Aged

Lois J. Heller, Associate Professor, Physiology, University of Minnesota, Duluth.

Graduate School Status: Associate Member (Physiology)

Education: Ph.D., University of Illinois Medical Center, 1970

M.S., University of Michigan, 1966

Selected Publications:

\*Heller, L.J. and R.A. Olsson "Inhibition of Rat Ventricular Automaticity by Adenosine" Am J Physiol 248 (Heart Circ. Physiol. 17): H907-913, 1985.

\*Heller, L.J. and J.R. Prohaska "Cardiac Norepinephrine and Intrinsic Properties of Isolated Hypertrophied DOCA Hypertensive Rats" J Mol Cell Cardiol, 16:987-993, 1984.

\*Prohaska, J.R. and L.J. Heller "Mechanical Properties of the Copper-deficient Rat Heart" J. Nutrition, 112:2142-2150, 1982.

\*Heller, L.J. "Isovolumetric Properties of Ventricles of Spontaneously Hypertensive Rats" Am J Physiol 240 (Heart Circ. Physiol. 9):H927-H933, 1981.

Mohrman, D.E. and L.J. Heller. Cardiovascular Physiology McGraw-Hill Book Company, New York, Second Edition, 1986.

Professional Associations: American Physiological Society, American Heart Association (Councils on Circulation and Basic Science)

\* Refereed Journal

Patrick W. Irvine, Assistant Professor, Medicine.  
Education: M.D., University of Minnesota, 1970  
Residency, University of Minnesota, 1970

Selected Publications:

- \*Crossley, K.B., P.W. Irvine, D.J. Kasar, R.B. Lowenson "Infection Control Practices in Minnesota Nursing Homes" J Am Med Assoc, 254:2918-2921, 1985.
- \*Mulhausen, R. Parker and P.W. Irvine "Health Competition: The Teaching Hospital and the Study of Geriatric Medicine" Mn J of Gerontology, Vol. 1:9-12, 1985.
- \*Irvine, P.W., N. VanBuren and K. Crossley "Causes for Hospitalization of Nursing Home Residents: The Risk of Infection" J Am Geriatric Society, 32:103-107, 1984.

Professional Associations: American College of Physicians, Gerontological Society of America, American Geriatrics Society.

Robert L. Kane, Dean, School of Public Health.  
Graduate School Status: Full Member (Epidemiology)  
Education: M.D., Harvard Medical School, 1965  
A.B., Columbia College, 1961

Selected Publications:

- \*Kane, R.L. and R. Matthias "From Hospital to Nursing Home: The Long-Term Care Connection" The Gerontologist, 24:604-609, 1984.
- \*Kane, R.A. and R.L. Kane, "The Feasibility of Universal Long-Term Care Benefits: Ideas from Canada" N Engl J Med, 312:1357-63, 1985.
- \*Kane, R.L., L. Bernstein, J. Wales, R. Rothenberg, "Hospice Effectiveness in Controlling Pain" J Amer Med Assoc, 253:2683-86, 1985.
- \*Kane, R.L., R.M. Bell, S.Z. Riegler "Value Preferences for Nursing Home Outcomes" The Gerontologist, 26:303-308, 1986.
- Kane, R.L. and R.A. Kane. A Will and a Way: What Americans Can Learn About Long-Term Care from Canada, New York, Columbia University Press, 1985.

Rosalie Kane, Professor, Social Work, Public Health.  
Graduate School Status: Full Member (Social Work)  
Education: D.S.W., University of Utah, 1975  
M.S., Simmons, 1965

Selected Publications:

- \*Kane, Rosalie and R. Kane "The Feasibility of Universal Long-Term Care Benefits: Ideas from Canada" New Engl J of Med, Vol 312:1357-1363, 1985.
- \*Kane, Robert, Rosalie Kane and Arnold Shapiro "Prevention in the Elderly: Risk Factors" Health Science Research J, Vol 19:945-1006, 1985.
- \*Kane, Rosalie "A Family Caregiving Policy: Should We Have One?" The Gerontologist, Vol. 10, 33-36, 1985.
- \*Kane, Robert, R. Bell, S. Rigler, A. Wilson, and R. Kane "Assessing the Outcome of Nursing Home Patients" 38:385-393, 1983.
- Kane, Rosalie and Robert Kane, Assessing the Elderly: A Practical Guide to Measurement, Lexington, Massachusetts, D.C. Heath, 1981.

Professional Associations: Gerontological Society of America, National Association of Social Work, American Public Health Association

\* Refereed Journal

Frank M. Lassman, Professor, Otolaryngology; Communication Disorders.  
Graduate School Status: Full Member (Otolaryngology; Communication Disorders)  
Education: Ph.D., University of Southern California, 1950  
M.A., University of Iowa, 1942

Selected Publications:

Lassman, F.M., R.O. Fisch, D.K. Vetter and E. LaBenz. Early Correlates of Speech, Language and Hearing, P.J. LaBenz and E.S. LaBenz (Eds.), Littleton, Massachusetts, Publishing Sciences Group, Inc., 1980.

Lassman, F.M. and T.N. Doyle "Variability in Hearing Following Change in Biochemical Conditions" Chapter 10 in M. Paparella (Ed.) Biochemical Mechanisms in Hearing and Deafness, Springfield, Charles E. Thomas Co., 1970.

\*Lassman, F.M. and E.S. Engelhart "Methodology in Digit Memory Testing of College Students" J Speech Hearing Research, 10:268-276, 1967.

\*Nelson, D. and F.M. Lassman "Re-Examination of the Effects of Periodic and Aperiodic Stimulation on the Auditory Evoked Vertex Response" Audiology, 16(5):409-418, 1977.

Mourad, M. and F.M. Lassman "Time Dependent Auditory Processing in Healthy Older Women" (in preparation)

Professional Associations: American Speech-Language and Hearing Association, Acoustical Society of America

Leslie V. Martens, Professor and Chair, Health Ecology, School of Dentistry.  
Graduate School Status: Associate Member (Dentistry)  
Education: D.D.S., Loyala University of Chicago  
M.P.H., University of Minnesota

Selected Publications:

\*Martens, L.V., Glasrud, P.H., and Gambucci, J.R. "Changes in Sealant Use by Private General Practices" Quintessence International In press, 1987.

\*Glasrud, P.H. and Martens, L.V. "A Study of Salary Variations of Employees" J of Dental Practice Administration In press

\*Gambucci, J.R., Martens, L.V., Meskin, L.H. and Davidson, G.B. "Dental Care Utilization Patterns of Older Adults" Gerodontics, 2:11-15, Jan-Feb, 1986.

\*DiAbngelis, A.J., Katx, R.V. and Martens, L.V. "The Practice Observation Grid: An Instrument for Structuring and Evaluating Dental Site Visits" J of Dental Education, 43(3):183-184, March, 1979.

\*Meskin, L.H., Martens, L.V. and Katz, B.J. "Effectiveness of Community Preventive Programs on Improving Oral Health" J of Public Health Dentistry, 38(8):302-309, Fall 1978.

Professional Associations: American Dental Association, American Association of Dental Schools, International Association for Dental Research, American Society for Geriatric Dentistry

\* Refereed Journal

Matthew McGue, Assistant Professor, Psychology.  
Graduate School Status: Full Member (Psychology)  
Education: Ph.D., University of Minnesota, 1981  
Selected Publications:

- \*McGue, M, Wette R., and Rao, D.C. "An Evaluation through Computer Simulation of Three Statistical Methods Used in Path Analysis" Genetic Epidemiology, 1986 (in press)
- \*McGue, M, Gottesman, I.I., and Rao, D.C. "The Analysis of Schizophrenia Family Data" Behavior Genetics, 16:75-87, 1986.
- \*White, J., McGue, M. and Heston, L. "Fertility and Paternal Age Effects for Alzheimer's Disease" J of Gerontology, 41:40-43, 1986
- \*Devor, E.J., McGue, M. Crawford, M.H., and Lin, P.M. "Transmissible and Nontransmissible Components of Anthropometric Variation in the Alexanderwohl Mennonites. I. Description of Familial Correlations" Am J of Physical Anthropology, 69:83-92, 1986.
- \*McGue, M., Rao, D.C., Iselius, L., and Russell, J. "Resolution of Genetic and Cultural Inheritance in Twin Families by Path Analysis" American J of Human Genetics, 37:998-1014, 1985.

Professional Associations: Behavior Genetics Association, American Statistical Association, Biometrics Society, American Educational Research Association

Donald G. McTavish, Professor, Sociology.  
Graduate School Status: Full Member (Sociology)  
Education: Ph.D., University of Iowa, 1964  
M.A., University of Iowa, 1960

Selected Publications:

- \*McTavish, D.G. and D. Felt "The Nursing Home as Residents See It" Sociology of Rural Life, 8:2 Spring, 1986.
- \*McTavish, D.G. and E.B. Pirro "Contextual Content Analysis" submitted to Quality and Quantity for publication, 1985.
- \*McTavish, D.G., J.L. Pierce and K.R. Knudsen "The Measurement of Job Characteristics: A Content and Contextual Analytic Look at Scale Validity" with J.L. Pierce and K.J. Knudsen, to be published in the Journal of Occupational Behavior, 1985.
- \*McTavish, D.G. and D. Felt "Nursing Home Environments: Managed Contexts for Older People" Sociology of Rural Life, 7:1 Fall 1984.
- McTavish, D.G. "Stereotypes of Old Age: A Review of Instruments, Chapter 12, Vol 1 in David J. Mangen and Warren A. Peterson Research Instruments in Social Gerontology, University of Minnesota Press, 1981.

Professional Associations: American Sociological Association, Gerontological Society of America, American Statistical Association, Midwest Sociological Society, Sociologists of Minnesota, Minnesota Gerontological Society

\* Refereed Journal

Sharon K. Ostwald, Assistant Professor, Division of Health Services Administration,  
Public Health.

Graduate School Status: Limited Teaching Status (Public Health); Pending Associate  
(Public Health)

Education: Ph.D., University of Minnesota, 1986  
M.S., University of Minnesota, 1976

Selected Publications:

\*Sheehan, M.K., S.K. Ostwald and J. Rothenberger "Contraceptive Responsibility:  
Do Young Men and Women Differ?" Pediatric Nursing, 12(1) 17-21, 1986.

\*Sund, K. and S. Ostwald "A Study of the Relationship Between Dual Earner  
Families' Stress Levels and Personal and Lifestyle-Related Variables" Nursing  
Research, 34(6), 357-361, 1985.

\*Ostwald, S.K. and J. Rothenberger "Development of a Testicular Self-Examination  
Program for College Men" J of American College Health, 33:234-239, 1985.

\*Witzig, D.K. and S.K. Ostwald "Knowledge of Toxic Shock Syndrome Among  
Adolescent Females: A Need for Education" J of School Health, 55(1), 17-20,  
1985.

\*Ostwald, S.K., O.C. Adanobi and L.K. Kochevar "Nurse Practitioners' Perceptions  
of Workplace Encroachment" Pediatric Nursing, 10(5), 337-341, 1984.

Professional Associations: American Public Health Association, Sigma Theta Tau,  
Gerontological Society of America

Sharon K. Patten, Senior Fellow, Hubert Humphrey Institute of Public Affairs.

Graduate School Status: Limited Teaching Status (Public Affairs)

Education: Ph.D., University of Minnesota, 1980  
M.A., University of Minnesota, 1976

Selected Publications:

Eustis, N.N., J.N. Greenberg and S. Patten. Long-Term Care for Older Persons: A  
Policy Perspective, Brooks/Cole Publishers, 1984.

Eustis, N.N. and S. Patten. "Measurement of the Effectiveness of Long-Term Care,"  
Chapter in Handbook of Research Instruments in Social Gerontology. Vol. 3.  
University of Minnesota Press, Minneapolis, 1984.

\*Patten, S. "One Alternative to Institutionalization: In-Home Supportive Services,"  
Minnesota Medicine, 1974.

Patten, S. "Public Policy: Income Maintenance" Chapter in study textbook on  
Aging: Multidisciplinary Perspectives on Aging (Edited by Bart Galle)  
University of Minnesota Department of Extension Independent Study, 1985.

Professional Associations: National Association of Social Workers, Academy of Certified  
Social Workers, Gerontological Society of America, American Public Health  
Association, Minnesota Gerontological Society, Minnesota Social Service  
Association

\* Refereed Journal

Jean K. Quam, Associate Professor, Social Work; Women's Studies.

Graduate School Status: Full Member (Social Work); Examining Member (Women's Studies)

Education: Ph.D., University of Wisconsin-Madison, 1981  
M.S.W., University of Nebraska-Lincoln, 1972

Selected Publications:

\*Quam, J.K. "Natural Helpers: Tools for Working with the Chronically Mentally Ill Elderly" The Gerontologist, Vol. 25, No. 2:116-118 April, 1985.

\*Quam, J.K. "The Almonership of Ollie A. Randall" The Gerontologist, Vol. 24, No. 6:564-567, December, 1984.

Abramson, N., Quam, J.K. and Wasow, M. The Elderly and Chronic Mental Illness, San Francisco, Jossey-Bass, 1986.

Professional Associations: National Association of Social Workers, Gerontological Society of America

Muriel B. Ryden, Associate Professor, School of Nursing.

Graduate School Status: Associate Member (Nursing)

Education: Ph.D., University of Minnesota, 1982  
M.A., Columbia University, 1957

Selected Publications:

\*Miles, S.H. and M.B. Ryden "Limited Treatment Policies in Long-Term Care Facilities" J of American Geriatric Soc, 33(10), 707-711, 1985.

\*Ryden, M.B. "Environmental Support for Autonomy in Institutionalized Elderly" Research in Nursing and Health, 8:363-371, 1985.

\*Ryden, M.B. "A Wellness Model Replaces the Medical Model for Stevens Square" J of Long Term Care Administration, 13(4), 115-119, 1986.

\*Ryden, M.B. "Adult Version of the Coopersmith Self-Esteem Inventory: Test-retest Reliability and Social Desirability" Psychological Reports, 43, 11890-11901, 1978.

\*Ryden, M.B. "Nursing Intervention in Support of Reminiscence" J of Gerontological Nursing, 7(8):461-463, 1981.

John R. Sheppard, Professor, Genetics and Cell Biology.

Graduate School Status: Full Member (Genetics; Cell and Developmental Biology; and Pathobiology) Examining (Neuroscience)

Education: Ph.D., University of Colorado, 1969

Selected Publications:

\*Sheppard, J.R., et al. "Forskolin Stimulation of Adenylate Cyclase in Clonal Cultures from the B16 and K1735 Murine Melanomas" Int J Cancer Res, 37:713-722, 1986.

\*Panter, S.S., et al. "Glial Fibrillary Acidic Protein and Alzheimer's Disease" Neurochemical Res, 10:1567-1576, 1985.

\*Sheppard, J.R., et al. "Experimental Metastasis Correlated with Cyclic AMP Accumulation in B16 Melanoma Clones" Nature, 308, 544-547, 1984.

\*Sheppard, J.R., et al. "The beta-Adrenergic Response of Down Syndrome Platelets," J Pharm Exp Ther, 225, 584-588, 1983.

\* Refereed Journal

\*Sheppard, J.R., et al. "Chromosomal Assignment of the Gene for the Human beta2-Adrenergic Receptor" Proc Natl Acad Sci USA 80, 233-236, 1983.

Professional Associations: Alexander Von Humboldt Stiftung, Bonn, West Germany; American Association for Advancement of Science; American Association for Cancer Research; American Society for Cell Biology; American Society of Human Genetics

Ruth Stryker-Gordon, Associate Professor, Long-Term Care Administration, Public Health.

Graduate School Status: Examining Member (Hospital and Health Care Administration)

Education: M.A., College of St. Thomas, 1967

R.N., B.S., University of Minnesota, 1948

Selected Publications:

Stryker-Gordon, R. How to Reduce Turnover in Nursing Homes and Other Health Care Facilities, Springfield, Illinois, Charles Thomas Publishers, 1981.

Stryker-Gordon, R. and G. Kenneth Gordon (Eds.) Creative Long Term Care Administration, Springfield, Illinois, Charles Thomas Publishers, 1983.

\*Stryker-Gordon, R. "The Effect of Managerial Interventions on High Personnel Turnover in Nursing Homes" J of Long-Term Care Administration, X:2:21-33, Summer, 1982.

\*Stryker-Gordon, R. "Leadership in Care of the Elderly: Assessing Needs and Challenges" J of Nursing Administration, XII:10:41-44, October, 1982.

Stryker-Gordon, R. "How to Develop a Therapeutic Community" J of Nursing Administration, April 1980.

Professional Associations: American Nurses' Association, Minnesota Gerontological Society, Minnesota Heart Association, American College of Health Care Administrators

June Louin Tapp, Professor, Institute of Child Development.

Graduate School Status: Full Member (Child Psychology; Psychology)

Education: Ph.D., Syracuse University, 1963

M.S., University of Southern California, 1952

Selected Publications:

Tapp, J.L. "The Jury as a Socialization Experience: A Socio-Cognitive View." in R. Rieber (Ed.), Advances in Forensic Psychology and Psychiatry, Vol. II. Ablex: Norwood, NJ, 1986.

Tapp, J.L. "Kurt Lewin Memorial Award: Bluma Zeigarnik" J of Social Issues, 40(2), 1984

Tapp, J.L. "Child Development Principles and Legal Policy Perspectives: Wald "Intervention to Protect Abused and Neglected Children." in M. Perlmutter (Ed.), Development and Policy Concerning Children with Special Needs: Minnesota Symposia on Child Psychology, (Vol. 16). Hillsdale, NJ: Earl Baum, 1983.

Tapp, J.L., and G.B. Melton "Preparing Children for Decisionmaking: Implications of Legal Socialization Research. in G.B. Melton, G.P. Koocher and M.J. Sacks (Eds.), Children's Competence to Consent, New York: Plenum, 1983.

\* Refereed Journal

Tapp, J.L., M. Gunnar and D. Keating "Socialization: Three Ages, Three Rule Systems" in D. Perlman C. Cozby (Eds.), Social Psychology and Social Action Issues. New York: Holt, Rinehart, Winston, 1983. (French Edition: Paris, Les Edition HRW, Ltd, 1984.)

Professional Associations: American Psychological Association, Interamerica Society of Psychology,

James W. Vaupel, Associate Professor, Humphrey Institute of Public Affairs.

Graduate School Status: Associate Member (Public Affairs)

Education: Ph.D., Harvard University, 1978

M.A., Harvard University, 1971

Selected Publications:

\*Vaupel, J.W. and A.I. Yashin "Targeting Lifesaving: Demographic Linkages Between Population Structure and Life Expectancy", Forthcoming in the European J of Population

\*Vaupel, J.W., Z. Yi and A.I. Yashin "Marriage and Fertility in China: A Graphical Analysis" Population and Development Review, 11:721-736, December 1985.

\*Vaupel, J.W., K.G. Manton and E. Stallard "Alternative Models for the Heterogeneity of Mortality Risks Among the Aged" J of the American Statistical Association, 81, September 1986.

\*Vaupel, J.W. and A.E. Gowan "Passage to Methuselah: Some Demographic Consequences of Continued Progress Against Mortality" American J of Public Health, 76: 430-433, April 1986.

Professional Associations: Population Association of America; Association for Public Policy Analysis, and Management; Member, Scientific Review Committee, National Institute on Aging.

Caroline R. Weiss, Associate Professor, Division of Recreation, Park and Leisure Studies.

Graduate School Status: Associate Member (Recreation, Park and Leisure Studies)

Education: Ed.D., Columbia University, 1971

M.S., Columbia University, 1968

Selected Publications:

\*Weiss, C.R. "A Mapping Project to Facilitate Reminiscence in a Long Term Care Facility" accepted for publication in Therapeutic Recreation Journal.

\*Weiss, C.R. "Affective Aspects of an Age-Integrated Water Exercise Program" accepted for publication in The Gerontologist.

\*Upgrading Therapeutic Recreation Service to Severely Confused Elderly" Therapeutic Recreation Journal, First Q, 1986.

\*Weiss, C.R. "The Influence of Older Adults' Activity Selection on Their Progeny's Expectations for Their Own Future" Activities, Adaptation and Aging, Summer, 1985.

\*Weiss, C.R. "Recreation and the Rules: Effecting Change in Long Term Care" Aging and Leisure Living, January, 1980.

Professional Associations: Minnesota Gerontological Society, National Council on the Aged, National Therapeutic Recreation Society, Minnesota Recreation and Park Association (Aging Interest Group)

\* Refereed Journal

Shirley L. Zimmerman, Associate Professor, Family Social Science.

Graduate School Status: Associate Member (Family Social Science)

Education: Ph.D., Social Work, University of Minnesota, 1977

Post-Doctoral Fellow, Family Impact Analysis Training Program, Family Study Center, University of Minnesota, 1978

Selected Publications:

- \*Zimmerman, S.L. "Adult Day Care: Correlates of Its Effects on Families with an Elderly Disabled Member" J of Family Relations, Vol. 35, No. 2:305-312, April, 1986.
- \*Zimmerman, S.L. "Families and Economic Policies: An Instrumental Perspective" Social Casework, Vol. 66, No. 7, September, 1985.
- \*Zimmerman, S.L. "The Mental Retardation Family Subsidy Program: Its Effects on Families with a Mentally Handicapped Child" J of Family Relations, Vol. 33, No. 1:105-118, January, 1984.
- \*Zimmerman, S.L. "The Reconstructed Welfare State and the Fate of Family Policy" Social Casework, Vol. 64, No. 8:459-465, October, 1983.
- Zimmerman, S.L., H. McCubbin, and D. Olson "Family Dynamics: Strengthening Families Through Action Research" in Action Research in the Social Sciences, R. Rapaport (Ed.), New York: Cambridge University Press, 1985.

\* Refereed Journal

OCT 7 1986

College of Education



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Vocational and Technical Education  
Vocational and Technical Education Building  
1954 Buford Avenue  
St. Paul, Minnesota 55108

October 1, 1986

MEMORANDUM

TO: Dennis Clayton, Assistant to the Dean, Graduate School  
FROM: George H. Copa, Chairperson *George Copa*  
SUBJECT: Proposal for Revised Ph.D. Program

Attached is a proposal for a Ph.D. in Education with emphasis in Vocational Education. When approved, this degree program will replace the Ph.D. in Vocational Education and the Ph.D. in Education with emphasis on the General Education Aspects of Vocational Fields. The proposal has been approved by our graduate faculty and favorably reviewed by the Education Subcouncil on Graduate Studies chaired by Carol Carrier.

The Graduate School Dean's Office informed me that I should send the proposal to you for directing it through the review process by the Graduate School. Let me know if you have questions. I would appreciate the opportunity to be present when the proposal is first brought to the Education and Psychology Policy and Review Council of the Graduate School for discussion.

GHC:ks

Attachment

CC: Carol Carrier  
Jerry Moss

PROPOSAL FOR  
PH.D. IN EDUCATION WITH EMPHASIS IN VOCATIONAL EDUCATION\*  
Submitted by the Faculty of the  
DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION  
College of Education

Department Mission

The mission of the Department of Vocational & Technical Education is to improve educational programs designed to teach people about work and to prepare them for work. Such programs are suitable for persons of all ages and are carried out in many settings, both in the public and private sector and through many kinds of institutions, organizations, and agencies.

The mission of the Department is carried out by:

1. Creating, developing, and testing important ideas in vocational and technical education.
2. Providing undergraduate and graduate programs for the initial preparation, updating and upgrading of vocational and technical education professional personnel, and for contributing to the preparation of personnel in other fields. Special attention is given to identifying and meeting needs for the highest levels of professional training.
3. Extending its influence upon vocational and technical education by sharing specialized knowledge and skills with appropriate individuals, organizations, and agencies at the local, state, national, and international levels.
4. Maximizing its contributions to the field by regularly reassessing its mission and priorities and its ongoing programs.

Purpose of Graduate Program

The purpose of the graduate programs in the Department of Vocational and Technical Education is to prepare professionals capable of integrating scholarship and practice. The focus on scholarship aims at using and extending a knowledge base relevant to practice through research. The focus on professional practice aims at reflective application of the knowledge base to problems of the field. Both scholarship and professional practice require sensitivity, justice, imagination, and creativity.

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\*Once approved, this degree program will replace the Ph.D. in Vocational Education and the Ph.D. in Education with Emphasis on the General Education Aspects of Vocational Fields.

### Field of Practice and Scholarship

The field of professional practice and scholarship embraced by the graduate program is defined as education that prepares individuals for vocations in institutions such as families, businesses, organizations, and agencies. Its distinguished feature is its aim of critically socializing individuals and groups to manage the vocational aspects of their lives in a way that is to their benefit and that of the larger community, as is befitting in a democracy. Vocations are directed-life activities which are significant to people because of the consequences they accomplish for them and others. People can have several vocations at the same time, involving both consumer and producer roles. Education is viewed as a broad concept and includes training.

### Relation Among Graduate Degree Programs

All programs, viewed as a system, represent a comprehensive approach to professional education as described by the department mission. The Ed.D. and Ph.D. programs represent a higher level of education than the M.Ed. and M.A. The Masters programs stand in a similar relation to the B.S. program. In contrasting the Ph.D. program with the Ed.D. program, and similarly the M.A. program with the M.Ed. program, the Ph.D. and M.A. programs require a commitment to the production of research and professional roles where producing research is a significant expectation. The Ed.D. and M.Ed. programs require a commitment to the application of research and professional roles where applying research is a significant expectation.

### Objectives of the Ph.D. Program

Ph.D. students are expected to plan programs of study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of:

1. The purposes, practices, issues, and problems of vocational education;
2. The contexts within which vocational education exists such as the social, economic, historical, political, cultural, educational, technological and psychological;
3. The purposes, practices, issues, and problems of a specialization in vocational education; and
4. Modes of research to contribute to the knowledge base in the area of specialization.

It is not only necessary for students to possess the knowledge described above; it is also necessary for them to demonstrate scholarly competence and leadership potential.

Framework for the Ph.D. Program

The framework for the Ph.D. degree is developed along two dimensions. The first dimension includes the program components of major and supporting field. The major consists of courses taken in the Department of Vocational and Technical Education; the supporting field consists of courses taken outside the Department. The exception is that thesis credits are also considered part of the major. Students are encouraged to take courses in other units of the College of Education and the wider University. The second dimension subdivides the program into the following content components in relation to the objectives stated above:

- General aspects (Objectives 1 and 2);
- Specialization and optional subspecialization (Objective 3); and
- Research (Objective 4).

The combination of these two dimensions forms the basic framework for programs as shown in Figure 1.

Content Component Program Component	General Aspects	Specialization/ Subspecialization	Research Preparation
Major	General aspects offerings in the Department	Specialization offerings in the Department	Research offerings in the Department
Supporting Field (Minimum of 18 credits)	General aspects offerings outside the Department	Specialization offerings outside the Department	Research offerings outside the Department

Figure 1. Framework for Ph.D. Program

General Aspects

General aspects of the program refer to areas of study which are important to developing a scholarly perspective of vocational education and, more broadly, of education and vocations. A common set of courses for all students is proposed as a minimum to make up the general aspects of vocational education in the major. Additional coursework selected from outside the Department and which is related to the study of education and vocations forms the general aspects of education and vocations in the supporting field.

### Specialization/Subspecialization

Specializations represent a cohesive programmatic thrust with a minimum of three faculty who have graduate school membership and demonstrated expertise to teach, advise, conduct, and direct research. Specializations proposed are:

- Agricultural Education
- Business Education
- Extension Education
- Home Economics Education
- Industrial Education
- International Vocational Education and Training
- Marketing Education
- Training and Development
- Vocational Education

Additional specializations may be added in the future.

Within a specialization, programs may express one or more optional subspecializations to emphasize preparation in a functional, subject matter, or client group area. Functional areas might include evaluation, planning, curriculum, administration, teacher education, and so on. Subject matter areas focus on specific subject dimensions of specializations and might include entrepreneurship, family social science, nutrition, consumer economics, organization development, management, marketing, industrial relations, office management, technology assessment, transportation, communications, horticulture, farm management, accounting, and so on. Client group areas refer to particular groups of individuals to be served and might include adult education, special needs, parent education, and so on. As shown in Figure 1, courses for the specialization and subspecialization can be drawn from the major (selected from within the Department) and supporting field (selected from outside the Department).

### Research

A common set of courses for all students is proposed as a minimum to make up research preparation in the major. Additional research preparation is required beyond this common set of courses and can be taken in the major or supporting field.

### Program Distribution Requirements

The Ph.D., being an examination degree, is not subject to definition by credits earned in a particular component of the degree. Since competence upon which the student is examined may be developed in a variety of ways, describing the minimum content of each component is difficult. In spite of its shortcomings, the components are described in terms of "credits," but the expectation is in terms of credit equivalents of competency gained through formal study, self study or professional experience rather than through only the completion of formal courses. The program is defined, therefore, as preparation for examination.

Generally, a program would consist of the following credit equivalents:

Component	Minimum Credit Equivalents
Course Credits	Minimum of 90
General Aspects	24, to include 9 credits of required courses in the major.
Specialization/ Subspecialization	24
Research	24, to include 13 credits selected from the supporting field or major and 11 credits of required courses in the major; the 2 required seminar credits, included in the 11 credits of required research courses, will be used to meet partially the Graduate School's requirement of 36 Thesis credits.
Thesis Credits	34 (36 less the 2 required research seminar credits)
Electives	18
Total Credits	124, including thesis credits

Figure 2. Minimum Credit Equivalent Requirements for Ph.D. Programs

#### Common Program Requirements

Because the clientele served by the Ph.D. program in the Department of Vocational and Technical Education come from very diverse backgrounds and aim for widely diverse careers, it is unlikely that any two Ph.D. programs will present the same evidence of competency in vocational education. There are, however, courses that should appear in each program.

General Aspects: Each student program will be expected to include a minimum of 24 credits including the following three courses in the major:

VoEd 8100, Critical Issues in Vocational Education (3 cr)  
 VoEd 8xxx, Comparative Systems in Vocational Education (3 cr)  
 VoEd 8400, History and Philosophy of Vocational Education (3 cr)

(Two of these courses are revisions of existing courses--VoEd 8100 and VoEd 5400--while the third course is a new course.)

Research: Each student program will be expected to include a minimum of 24 credits including the following four courses in the major:

- VoEd 5xxx, Introduction to Research in Vocational Education (3 cr)
- VoEd 8xxx, Planning Analytic-Empirical Research in Vocational Education (3 cr)
- VoEd 8xxx, Planning Interpretive and Philosophic Research in Vocational Education (3 cr)
- VoEd 8xxx, Seminar in Vocational Education Research (1 cr; minimum of 2 cr required; existing divisional courses may be substituted; emphasis on thesis topic development and critique)

(Two of these courses are revisions of several existing courses and two are new courses.)

Recognizing that there are different schools of thought about which particular mode or method of inquiry is appropriate in the diverse fields represented in vocational education, each program must provide evidence that at least one mode has been studied to the extent that the student is capable of applying that mode's appropriate research tools to vocational education.

#### Specialization/Subspecialization Options

The common elements of programs have already been addressed. Individual program differences will be most readily discernible in the component of Specializations and Subspecializations, since these are the areas where the relationship of program to student background and career objectives will be most sharply focused. Differences will also emerge in the courses students elect to complete the specified minimums over the required courses within the General Aspects and Research components of their programs.

To illustrate the diversity that might occur within the Specialization/Subspecialization component, contrast two students, one with a career goal in farm management education and one with a career goal in cooperative agricultural extension.

Student 1: SPECIALIZATION: AGRICULTURAL EDUCATION

- AgEd 5043 - Farm Management
- AgEd 5049 - Agricultural Education for Adults
- AgEd 5051 - Enterprise Analysis
- AgEd 5052 - Farm Business Management Education
- AgEd 8020 - Seminar: Agricultural Education
- AgEd 8091 - Field Problems

Student 1: Subspecialization: Agricultural Economics

- AgEc 5750 - Agricultural Trade and Commercial Policy
- AgEc 5840 - Management of the Farm Business
- AgEc 5860 - Economics of Agricultural Production
- AgEc 8231 - Agricultural Prices
- AgEc 8245 - Agricultural Marketing Economics

In this example, all of the supporting work in the subspecialization is drawn from a technical department and has a clear connection to the specialization in agricultural education.

Student 2: SPECIALIZATION: EXTENSION EDUCATION

AgEd 5021 - Education Through Extension Methods  
AgEd 5024 - Extension History and Philosophy  
HEEd 5025 - Extension Program Development  
HEEd 5026 - Extension Administration  
YoSt 5200 - Working with Youth through Adults  
HEEd 8510 - Seminar: Improvement of Instruction in Adult Education

Student 2: Subspecialization: Evaluation

AgEd 5215 - Extension Evaluation  
VoEd 5200 - Evaluation of Local Vocational Education Programs  
EPsy 5240 - Principles and Methods of Evaluation  
EPsy 5243 - Practicum: Instruments and Procedures for Evaluation  
EPsy 8245 - Seminar: Special Topics in Educational Evaluation  
Soc 5661 - Rural Community Analysis

In this instance, the subspecialization is drawn partly from within the department and partly from other units of the University to build a competence in techniques related to evaluation.

Even without the labels, it would be clear that both students had declared a specialization—one in agricultural education and one in extension education—and clear that the two students had distinctly different career goals. One familiar with the fields would have little difficulty in determining the subspecialization interest of each candidate, or in making the connections between the competence developed in the subspecializations and the main focus of the specialization.

Operating Procedures

The operating procedures for the Ph.D. in Education with an emphasis in Vocational Education shall follow the policies and procedures of the Graduate School. What follows are extensions of these policies and procedures as they relate specifically to the above program.

Responsibilities of Department Graduate Studies Committee

The Department Graduate Studies Committee will recommend, interpret, and review implementation of policies and standards for the Ph.D. program. The Committee, acting on behalf of the faculty, will review and act upon individual student admissions, programs, petitions, examining committees, and thesis proposals, as well as graduate faculty status requests to result in recommendation to the Graduate School. The Committee will be responsible for communicating interpretations of policy and standards and recommendations with rationale to the faculty of the Department.

Admission

Final decisions on admission to the Ph.D. program shall be based on all the evidence made available by the applicants. The required admission material/

information to be submitted by each prospective student shall include:

- Graduate School Admission Application form;
- Official transcripts, undergraduate and graduate, from all previous colleges attended;
- Miller Analogies Test score;
- Evidence of education, experience, or publications related to the area of specialization sought; and
- Letters of recommendation, an interview, or other forms of evidence may be required when necessary to assist in making a recommendation concerning admission.

The level of academic performance indicators generally sought for applicants is as follows:

- A total undergraduate GPA of 3.0 or higher;
- A total graduate GPA of 3.25 or higher; and
- Raw score on the Miller Analogies Test which converts to about the 40th percentile or higher on the Graduate School "all scores" norm.

Additional indicators of scholarly potential, if available, may be considered if one of these criteria is not met.

#### Transfer of Credit

Rules pertaining to the transfer of credits to the doctoral program shall be the same as specified in the "Transfer of Credits" section of the Graduate School Bulletin.

#### Residence

Residence shall be as described in the Graduate School Bulletin. However, the expectation is that the candidate will spend a minimum of three consecutive quarters after admission to the doctoral program, having regular contacts with faculty and other graduate students.

#### Student Program Planning

The quality of the doctoral program is not determined simply by the number of courses or credits taken. Coursework is generally considered as preparation for degree examinations. Regarding the content of the program, the following policies and requirements have been established:

- Each student's program will be planned individually by the student and the advisor to meet (a) the objectives and requirements common to all students in the doctoral program and (b) the objectives they identify as unique to the student's particular needs.
- Each program should be submitted to the Graduate Studies Committee accompanied by a written rationale explaining the program of study as related to the Ph.D. program objectives (see page 2); Minimum Credit Equivalent Requirements for Ph.D. Programs (see Table 2), and the student's individual goals.

- Further program planning details may be specified in the Student Handbook to be developed upon approval of this proposal.

### Examinations and Thesis Proposal

The purpose of the written and oral preliminary examinations is to determine the students' achievement of their program objectives and their ability to integrate and synthesize the program content. The purpose of the final oral examination is for students to defend their theses. In addition to Departmental procedures, the Graduate School guidelines will be followed. For the preliminary examinations, every student should be examined on all content components (i.e., General Aspects, Specialization/Sub-specialization, and Research) and objectives of the Ph.D. program. Evidence of passing required courses in the major is part of the portfolio of evidence of reaching the Ph.D. program objectives. The emphasized areas in the preliminary examinations may vary from student to student, depending on the focus of the student's program.

Written Preliminary Examination: Concurrent with submission of the program of study to the Department Graduate Studies Committee for review and recommendation, a recommended examining committee for the preliminary examination will be submitted to the Committee by the advisor in consultation with the student. The roster shall include three faculty members from the major (Vocational Education) and two faculty members from the supporting field. No more than two of the faculty members from the major area of study shall be from the same specialization (except for a specialization in Vocational Education) within the Department of Vocational and Technical Education. For a specialization in Vocational Education, no more than two faculty members shall be from the same division. The Graduate Studies Committee may substitute other faculty on the examining committee before submitting a recommended roster of examiners to the Graduate School for confirmation and appointment, based on the graduate committee examining loads of faculty and the extent to which the committee represents the student's program.

Upon completion of a substantial part of the approved program of study, the student will indicate to the advisor his/her readiness to take the written examination. Upon concurrence that the student is prepared, the advisor will be responsible for administering the written examination. All committee members will be invited to submit questions. Committee members representing the major will submit questions designed to address the student's command of the general aspects, specialization, and research components of the student's approved program. Examiners submitting examination questions shall determine and specify to the advisor the procedures to be followed in administering their portion of the examination (e.g., amount of time allowed, open/closed book). The examiners submitting questions for response shall be responsible for judging if the student passed or failed their respective questions and informing the advisor. If one or more examiners judge that the student has not passed on that examiner's question, the committee shall meet and formulate a committee recommendation. The written examination must be passed prior to scheduling the oral examination through the Graduate School. The advisor will be responsible for making the student's responses to the written examination available to the entire committee prior to convening the oral examination.

Oral Preliminary Examination: The oral examination will also focus on the student's achievement of the student's degree program in the context of the Ph.D. program objectives and may include questions regarding written preliminary examinations, scholarly competence and leadership potential. The advisor shall be responsible for implementing the oral examination in accordance with Graduate School procedures.

Thesis Proposal and Final Oral Examination: A 250 word description of the proposed thesis shall be submitted to the Graduate Studies Committee for approval of the scope and nature of the study. Concurrent with the submission of the thesis title proposal to the Department Graduate Studies Committee for review and recommendation, a recommended examining committee for the oral final examination will be submitted by the advisor in consultation with the student. The roster shall include three faculty members from the major (Vocational Education) and two faculty members from the supporting field. No more than two of the faculty members from the major area of study shall be from the same specialization (except for a specialization in Vocational Education) within the Department of Vocational and Technical Education. For a specialization in Vocational Education, no more than two faculty members shall be from the same division. The committee members may or may not be persons who served on the student's preliminary examination committee. The Graduate Studies Committee may substitute other faculty on the examination committee before submitting a recommended roster of examiners and the thesis topic to the Graduate School for approval, based on the graduate committee examining loads of faculty and the appropriateness of the committee members relative to the proposed thesis title.

It will be the responsibility of the major advisor to convene the members of the final oral examining committee representing the major, before the implementation phase of the study is initiated, to review a detailed proposal for the thesis. Unanimous approval is required before the student proceeds with the implementation phase of the study. Subsequent major changes in the study require the approval of the committee representatives from the major. When the thesis reviewers indicate that the thesis is ready for defense, the final oral examination committee, following Graduate School procedures, will conduct the examination.

#### Current Faculty with Identified Specializations

Currently proposed specializations are listed on page 3. The following is a list of the faculty members currently associated with each of these specializations and their current Graduate School membership level\*:

##### Agricultural Education

Forrest Bear (FM)	Curt Norenberg (AM)
Patrick Borich (AM)	Edgar Persons (FM)
George Copa (FM)	Roland Peterson (FM)
Richard Krueger (AM)	Gordon Swanson (FM)
Gary Leske (FM)	George Wardlow (AM)

##### Business Education

Richard Ashmun (FM)	Judith Lambrecht (FM)
Charles Hopkins (FM)	Gary McLean (FM)

---

\* Membership level listed is highest level held by faculty members in programs related to vocational education.

Extension Education

Forrest Bear (FM)  
Shirley Baugher (AM)  
Patrick Borich (AM)  
Richard Krueger (AM)  
Gary Leske (FM)  
Jerry McClelland (AM)  
Curtis Norenberg (AM)

Edgar Persons (FM)  
Roland Peterson (FM)  
Jane Plihal (AM)  
Marilyn Rossmann (FM)  
Mary Ann Smith (AM)  
Gordon Swanson (FM)  
Ruth Thomas (FM)  
George Wardlow (AM)

Home Economics Education

Shirley Baugher (AM)  
Jerry McClelland (AM)  
Jane Plihal (AM)

Marilyn Rossmann (FM)  
Mary Ann Smith (AM)  
Ruth Thomas (FM)

Industrial Education

David Bjorkquist (FM)  
James Brown ((AM)  
Stephen Miletich (AM)  
Jerome Moss, Jr. (FM)

David Pucel (FM)  
Richard Swanson (FM)  
Karen Zuga (AM)

International Vocational Education and Training

Forrest Bear (FM)  
Gary Leske (FM)  
Jerry McClelland (AM)  
Gary McLean (FM)  
Stephen Miletich (AM)  
Curtis Norenberg (AM)

Edgar Persons (FM)  
Roland Peterson (FM)  
Jane Plihal (AM)  
Gordon Swanson (FM)  
Richard Swanson (FM)  
Ruth Thomas (FM)  
George Wardlow (AM)

Marketing Education

Richard Ashmun (FM)  
Charles Hopkins (FM)

Judith Lambrecht (FM)  
Gary McLean (FM)

Training and Development

Richard Ashmun (FM)  
David Bjorkquist (FM)  
James Brown (AM)  
Charles Hopkins (FM)  
Judith Lambrecht (FM)  
Gary Leske (FM)  
Gary McLean (FM)  
Stephen Miletich (AM)

Jerome Moss, Jr. (FM)  
Curtis Norenberg (AM)  
David Pucel (FM)  
Marilyn Rossmann (FM)  
Mary Ann Smith (AM)  
Gordon Swanson (FM)  
Richard Swanson (FM)  
George Wardlow (AM)  
Karen Zuga (AM)

Vocational Education

Richard Ashmun (FM)  
Forrest Bear (FM)  
David Bjorkquist (FM)  
James Brown (AM)  
George Copa (FM)  
Charles Hopkins (FM)  
Judith Lambrecht (FM)  
Gary Leske (FM)  
Jerry McClelland (AM)  
Gary McLean (FM)  
Stephen Miletich (AM)  
Jerome Moss, Jr. (FM)

Curtis Norenberg (AM)  
Edgar Persons (FM)  
Roland Peterson (FM)  
Jane Plihal (AM)  
David Pucel (FM)  
Marilyn Rossmann (FM)  
Mary Ann Smith (AM)  
Gordon Swanson (FM)  
Richard Swanson (FM)  
W. Westley Tennyson (FM)  
Ruth Thomas (FM)  
George Wardlow (AM)  
Karen Zuga (AM)



UNIVERSITY OF MINNESOTA  
DULUTH

Graduate School  
431 Darland Administration Building  
10 University Drive  
Duluth, Minnesota 55812-2496

GRADUATE SCHOOL

OCT 14 1986

OFFICE OF THE DEAN

October 8, 1986

MEMORANDUM

TO: Robert T. Holt, Dean, Graduate School

FROM: John T. Hatten, Assistant Dean, Graduate School *JTH.*

RE: Proposed change in graduate program in Communication Disorders

As you know, the Graduate School Constitution provides for two types of changes in existing graduate programs. Major modifications require a complete written proposal following the format of the Koffler-French memorandum of 1978. Minor modifications are deemed the responsibility of the department, but require that the Graduate School be notified for information purposes.

The enclosed proposal for a change in the Communication Disorders M.A. program appears to be minor in scope. The credit load for the students will be essentially the same as students took prior although 9 credits are formally added. Although no time line will be published for students, most will take two years to complete the program. This appears to me to be sound practice since both research experience and significant clinical skills development are not easily acquired in shorter time frames.

I forward this for your information.

JTH/mj  
attachment



UNIVERSITY OF MINNESOTA  
DULUTH

Communication Disorders Program  
College of Education and Human Service Professions

Department of Allied Clinical Health  
242 Montague Hall  
10 University Drive  
Duluth, Minnesota 55812-2496  
(218) 726-7974

MEMORANDUM

DATE: September 26, 1986

TO: Dean Robert T. Holt  
Graduate School

FROM: Cindy S. Spillers, Director *ESS*  
Graduate Studies in Communication Disorders

RE: Information on M.A. degree program changes.

There have been several course revisions and additions in our graduate program since the last bulletin copy was prepared. These changes will appear in the UMD 1987-1989 Bulletin and are included in the new bulletin copy which is enclosed for your information.

The total number of hours required for the M.A. degree in this revised description is approximately the same as the average number of hours completed by students most recently in the program. However, students have had difficulty in completing the degree requirements in the five quarters recommended, and the department has extended the M.A. degree sequence to seven quarters of full-time study. This pattern is typical of similar graduate programs in the country, and will accommodate the intensive clinical practicum required at the graduate level.

The Department would also like to use the degree title, "Communication Disorders," rather than the current "Communicative Disorders." Communication disorders appears a more appropriate title since it is more consistent with the majority of programs nationwide, there is no question as to the grammaticality of the title (as there is with Communicative), and it is simply easier to use.

/ek  
cc: John Hatten  
Larry Bright  
Graduate Faculty Committee

enc

## COMMUNICATION DISORDERS

(Department of Allied Clinical Health)

M.A. (Plan B)

Assistant Professor Cindy S. Spillers,  
Director of Graduate Studies

*Prerequisites for Admission* -- Applicants must have completed a bachelor's degree in communication disorders or 50 quarter credits in speech/language pathology, audiology, speech/language/hearing science, or related areas. Also required are three letters of recommendation evaluating the applicant's scholarship (at least two from academic faculty).

*Language Requirement* -- None.

*Major Requirements* -- At least 51 credits in communication disorders are required. Those credits must include the following: CD 5060, 5076, 5276, 5375, 5472 or 5476, 5500, 5505, 5550, 5575, 5600, 5956 (6 cr), 8100, 8176, 8205, 8305, and 8900.

*Related Field Requirements* -- At least 8 credits of approved courses from related areas are required.

*Other Requirements* -- Final written and oral examinations are required. Plan B projects are completed in conjunction with CD 8900. All such projects must be planned and carried out in consultation with a faculty member from the department.



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Division of Biometry  
School of Public Health  
1226 Mayo Memorial Building  
420 Delaware Street S.E.  
Minneapolis, Minnesota 55455

(612) 373-8042

GRADUATE SCHOOL

OCT 18 1985

OFFICE OF THE DEAN

October 18, 1985

Dean Robert Holt  
Graduate School  
316 Johnston Hall

Dear Dean Holt:

The Biometry and Health Information Systems graduate program hereby applies for the following changes in our graduate program:

- a. A change of name from "Biometry and Health Information Systems" to "Biometry".
- b. The elimination of the Health Information Systems track within the program, retaining Biometry as the only track.

The changes are further outlined in the attached resolution which was passed unanimously by a recent meeting of the graduate faculty and the "Rationale" which explains the reasons why we consider these changes desirable. Our application for these changes is simultaneous with the application of the Division of Health Computer Sciences for a graduate program in Health Informatics. The approval by the Graduate School of these two applications will constitute the administrative recognition of a separation between the two tracks of the current Biometry and Health Information Systems program which already exists to a large extent. Although the two tracks are now jointly administered, there has been increasing separation between the research interests of the two faculties and the study programs of the two types of students.

I will be glad to discuss the changes with you or the P&R Health Sciences Council and supply any further information which you might need.

Sincerely,

Anne I. Goldman, Ph.D.  
Professor  
Director of Graduate Studies

AIG:kd  
cc. R. Zimmerman, L. Gatewood, M. Kjelsberg

PROPOSAL FOR CHANGES IN THE  
BIOMETRY AND HEALTH INFORMATION SYSTEMS  
GRADUATE PROGRAM

The following resolution was passed unanimously by the BHIS graduate faculty:

RESOLUTION:

1. The BHIS graduate faculty endorses the application by the HIS-track faculty to the November meeting of the Health Sciences Policy and Review Council for a new graduate program, possibly to be named Health Informatics. That program's curriculum and requirements for admission and graduation with the MS or PhD degrees will be generally those now in effect for the HIS track.
2. The DGS for the Biometry and Health Information Systems graduate program will apply to the November meeting of the Health Sciences Policy and Review Council for a name and program change to Biometry. The curriculum and requirements for admission and graduation with the MS or PhD degrees will be generally those now in effect for the Biometry track.
3. Students admitted after September 1985 will be admitted for a specific track only.
4. Any student, who started or was admitted to the program before the final approval by the University of these changes, may complete the MS or PhD degree by fulfilling the current requirements. After the final approval, an HIS-track student may transfer to the new program on request. All students, of course, also have the option of applying to the Graduate School in the usual way for a change to any graduate program.

Rationale

During the 1960's, large scale electronic computers became increasingly available in medical research centers. It became obvious that the statistical analysis of data from the biologic and health sciences should be carried out using these facilities. The Biometry graduate program recognized this trend and was one of the first programs to offer and require training in computers.

As the capacity and software for computers increased so did the variety of health science applications beyond the management and statistical analysis of clinical and laboratory data. The graduate program was expanded and the name changed from "Biometry" to "Biometry and Health Information Systems" in order to also provide educational opportunities for the growing numbers of graduate students who wished to train for careers in such areas. A two track curriculum with separate requirements was started, which retained a common core of biostatistics and health computing courses within the one graduate program. The program is administered centrally through the Division of Biometry, but the planning and advising for the tracks is by the two faculty groups who have separate administrative homes in the School of Public Health (the Division of Biometry) and the Medical School (the Division of Health Computer Sciences).

Although other universities in the country have programs in biometry and in health computing, as far as we know we are the only to have ventured a joint program. The union developed historically out of the common interest in the use of the computer and the association with health sciences. During the last ten

years, health computing has grown to a recognized science, now called health informatics, with refereed journals, annual conferences, international societies and a new professional college. With the growing development and sophistication of these activities, the research of the two faculties and the interests of the two groups of students have become quite disparate. A singular focus is harder to define for the graduate program, which is confusing to the students and troublesome to the faculty. Continued joint administration of the two tracks is increasingly cumbersome. Recruitment of students is difficult because prospective students come from such different backgrounds and undergraduate programs. A disproportionate amount of time is spent in trying to explain the organizational peculiarities.

These difficulties were apparent to the External Review Committee of the graduate program in 1980, which stated that "the situation should not be allowed to continue." The committee's suggestion of a task force to study possible resolution was tabled in favor of an internal review by the BHIS faculty to review options and effect changes. It is our opinion that the best action is the separation into two distinct graduate programs. Administratively, one way to effect this change is by two actions: the formation by the HIS-track faculty of a new graduate program, and the change of the current Biometry and Health Information Systems program back to the original focus and name of Biometry.

*Women's Studies*



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Center for Advanced Feminist Studies  
496 Ford Hall  
224 Church Street S.E.  
Minneapolis, Minnesota 55455  
(612) 376-2162

GRADUATE SCHOOL

OCT 11 1985

OFFICE OF THE DEAN

October 10, 1985

Dean Robert Holt  
Graduate School  
321 Johnston Hall

Dear Dean Holt:

The Center for Advanced Feminist Studies and The Women's Studies Program are applying for approval of a graduate Minor in Feminist Studies. As discussed in the proposal you have received, the minor is a structured program of core courses, electives, and advising, which began operating in the Fall of 1984 as a supporting program. Since a minor is obviously the more appropriate format for such a program, we seek authorization to offer one.

Both the Center and the Program developed out of the increasingly multidisciplinary and interdisciplinary work of feminist graduate students and faculty at The University. The demand for a minor came first and foremost from graduate students interested in critical feminist work emerging within their disciplines and aware that such work requires intellectual training and community that crosses disciplinary boundaries.

The uniformly positive responses we have received from departments we have approached about affiliating with the Center and our ability, prior to any national recruiting, to admit two very strong classes of students (of fifteen and eleven) attest both to the need of such a program and the perceived excellence of this one. The Women's Studies Program is one of the nation's best, and the University is especially strong in many of the departments in which our students are most likely to be enrolled. Our efforts at cooperative recruiting have already had considerable success and indicate that the minor will be helpful to departments in recruiting talented students.

Our program is unique in the state and the area and, given its scholarly emphasis and the range of areas in which students can study, may be unique in the country. By the same token, graduates will be in very good positions for academic and nonacademic employment. The growth of undergraduate Women's Studies programs, social service, and policy agencies concerned with women's issues, and critical feminist perspectives at the leading edge of many disciplines have not yet been matched by growth in relevant graduate programs.

We will be glad to answer any questions you may have about the Program or the proposal. We are enthusiastic about them and have been very gratified by the work we have done so far. We look forward to receiving authorization to move ahead.

Thank you for your attention.

Sincerely,

*Ruth-ellen B. Joeres*

*Riv Ellen Frell*

*Naomi Scheman*

*Susan Geiger*

Ruth-ellen B. Joeres, Director

Riv-ellen Frell, Chair

Naomi Scheman, DGS (1984-85)

Susan Geiger, DGS (1985-86)

Enc. Proposal for a Minor in Feminist Studies  
list of faculty of The Center for Advanced Feminist  
Studies  
list of affiliated departments  
curricula vitae for CAFS officers and instructors of core  
courses, '84-'85 and '85-'86  
list of electives for '84-'85  
representative syllabi for electives

OCT 23 1985

Office of the Dean



UNIVERSITY OF MINNESOTA  
TWIN CITIES

College of Liberal Arts  
215 Johnston Hall  
101 Pleasant Street S.E.  
Minneapolis, Minnesota 55455

October 21, 1985

Kenneth Zimmerman  
Associate Dean  
Graduate School  
321 Johnston Hall

Dear Ken:

Thank you for sharing the proposal for a minor in Feminist Studies with the College. This letter is to record CLA administration concerns in response to the proposal.

In regard to the cost of the program, it should be clear that CLA is assuming no budgetary commitment in the event the proposal is approved. The teaching of current offerings is conducted on a transfer-of-effort basis. A number of successful graduate programs are handled in this manner. We expect that similar arrangements would be the case here. There is no collegiate commitment for faculty positions or for a separate programmatic budget.

I should also add that we are disturbed about plans to limit access to the minor. It would be preferable that the requirements parallel those of other established graduate minor programs.

Sincerely,

A handwritten signature in cursive that reads "Craig".

Craig Swan  
Associate Dean &  
Executive Officer

CS/cms

c: Fred Lukermann  
Rick Asher  
Julieann Carson  
Mary Blomquist

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College Twin Cities Code No. 2

I. General Information

A. Program Title Feminist Studies, Minor

B. Program Review Category: X Regular  
(check one) 28 Experimental (If Experimental, give Reporting Date: 30 / 32 / 34)

C. Proposed Implementation Date: 05 / 01 / 86  
36 38 40

D. Program Length: Total Cr/hr MA: 16 cr Classroom PhD: 20 cr Laboratory N/A  
42 45 46 49 50 53

E. Administrative Unit Immediately Responsible for Program: Center for Advanced Feminist Studi  
54 73

F. Describe the Program (in 50 words or less):

The Minor in Feminist Studies will provide interdis-  
plinary breadth, depth, and intellectual community for Masters  
and Doctoral students engaging in feminist scholarship. It  
will teach the fundamentals of feminist theory and methods  
and develop the skills of critically utilizing multi-disciplinary  
research sources and writing and teaching for multi-disciplinary  
audiences.

G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	86-87		89-90	
	First Year: (Yr.)	Student Credit or Contact Hours	Full Operation: (Yr.)	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	40	320	45	360
Other Students	400	1600	500	2000
Total	440	1920	545	2360
b. Program Graduates/Completers	3	-	15	-

A. Projected Costs of the Program: II. Budget Data

THERE ARE NO EXPENSES DIRECTLY RELATED TO THE MINOR Operation \_\_\_\_\_

6

7

	New		Re-assigned		New		Re-assigned	
	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost
a. Faculty	10	\$ 15	57	\$ 63	10	\$ 16	57	\$ 63
b. Civil Service	13	\$ 21	60	\$ 68	13	\$ 21	60	\$ 68
c. Equipment, Supplies, etc.		\$ 26		\$ 73		\$ 26		\$ 73
Total Direct Costs (a+b+c)		\$ 31		\$ 78		\$ 31		\$ 78
d. One-time Costs		\$ 36		\$ 83		\$ 36		\$ 83
e. Space Rental		\$ 41		\$ 88		\$ 41		\$ 88
f. Indirect Costs		\$ 46		\$ 93		\$ 46		\$ 93
g. Total Program Costs (a+b+c+d+e+f)		\$ 51		\$ 98		\$ 51		\$ 98

B. Expected Sources of Funds for Program:

8

9

	First Year:			Full Operation:		
	Dollar Amount	% of Annual Expend.	One Time Input	Dollar Amount	% of Annual Expend.	One Time Input
a. Local	\$ 10	51	\$ 65	\$ 10	51	\$ 65
b. State	\$ 15	53	\$ 70	\$ 15	53	\$ 70
c. Tuition	\$ 20	55	\$ 75	\$ 20	55	\$ 75
d. Federal	\$ 25	57	\$ 80	\$ 25	57	\$ 80
e. Private	\$ 30	59	\$ 85	\$ 30	59	\$ 85
f. Dedicated Fees	\$ 35	61	\$ 90	\$ 35	61	\$ 90
g. Other (Specify)	\$ 40	63	\$ 95	\$ 40	63	\$ 95
h. Total	\$ 45	100%	\$ 100	\$ 45	100%	\$ 100

10

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions: \_\_\_\_\_

D. System Verification:

\_\_\_\_\_ 8 \_\_\_\_\_ 15 \_\_\_\_\_ 22 \_\_\_\_\_  
 Authorized Institution or System Signature Title Date  
 \_\_\_\_\_  
 29 39 40 42 47

## Section II

Program Title: Graduate Minor in Feminist Studies

### 1. Summary Description of Program

#### Program Objectives

The purpose of the Center for Advanced Feminist Studies Graduate minor is to provide a coherent, integrated, interdisciplinary graduate curriculum for students specializing in feminist studies. To that end, the Program seeks to enable persons to acquire skills and competencies in four general areas:

- 1) general, interdisciplinary knowledge of the scope of feminist studies
- 2) feminist theory and method
- 3) competency in feminist method in a specific field
- 4) feminist practice through teaching or internships

#### Admission Requirements

Admission to CAFS Graduate Minor Program is contingent upon prior admission to the Graduate School of the University of Minnesota and to a degree-granting department. The minor is available at both the M.A. and Ph.D. level. Admissions take place twice a year, in the Fall and Spring Quarters. It is anticipated that no more than fifteen students will be admitted each year; and under full operation an equal number should graduate each year.

Applicants are expected to have a general knowledge of feminist scholarship. Attention to interdisciplinary or crossdisciplinary work is desired. The candidate should demonstrate a commitment to and evidence of research or organizational experience in feminist concerns. CAFS does not require a major in Women's Studies as a prerequisite for admission to the program.

#### The Curriculum

The Center offers integrated, interdisciplinary courses directed toward the development of research and analytical skills and theoretical perspectives for students in varied home departments. The Center will also encourage the development of complementary, but more narrowly defined seminars to be offered in disciplinary units.

All Center graduate students are required to take the core curriculum courses, WoSt 8510/8511, upon entering the program. In addition, M.A. students must take eight credits of electives. Ph.D. students must take four credits of Feminist Research (WoSt 8710) and the course, Feminist Writing (WoSt 8910). These requirements are outlined as follows:

<u>M.A. Minor Program</u>			
WoSt 8510/8511	Feminist Theory and Methods		8 cr
	Electives*		8 cr
			-----
			16 cr

<u>Ph.D. Minor Program</u>			
WoSt 8510/8511	Feminist Theory and Methods		8 cr
WoSt 8710	Feminist Research **		4 cr
WoSt 8910	Feminist Writing **		4 cr
	Electives*		4 cr
			-----
			20 cr

\* Electives may be selected from a list of approved courses, obtainable from the Center.

\*\* These seminars may also be taken by M.A. students as electives.

## 2. Need for The Program

In '84-'85 the program has been in effect as a structured Supporting Program to which fifteen students were admitted last spring. They are pursuing degrees in American Studies, Ancient Studies, Educational Administration, English, Family Social Science, History, Philosophy, Political Science, Public Affairs, Social Work, and Sociology. A number of these students chose to come to Minnesota specifically because of the Center, despite the lack of a certified minor and in the absence of any publicity beyond the academic grapevine.

We are negotiating agreements with a growing number of departments (eleven to date) concerning cooperative recruiting effort, shared TA appointments, and the involvement of Center advisors on students' examining committees. The response so far has been uniformly positive, including many referrals to CAFS of students with interests in feminist research and a number of requests for letters in support of departmental nominees for Graduate School Fellowships. Needless to say, when we begin national publicity and can offer a formal minor, we have no doubt about our ability to recruit a class of fifteen each year.

Feminist research is at the forefront of most social scientific and humanities disciplines and in most of those disciplines is coming to be recognized as a necessary part of the

curriculum. There is thus good reason to believe that students whose graduate work includes a minor in feminist studies will be especially attractive candidates for academic positions in the disciplines in which they are receiving their degrees, and, given the absence of Ph.D. programs in Women's Studies, they will be extremely appropriate candidates for full-time or shared appointments in Women's Studies programs.

We also anticipate that students seeking non-academic positions will find the minor an advantage because of the growing recognition of the importance of issues of gender in the economic, social, cultural, and public policy realms and because of the greater intellectual flexibility associated with interdisciplinary work.

An additional benefit of the minor concerns the research component of the Center. We are working on strengthening interdisciplinary faculty research and connections between faculty and feminist researchers at other institutions and in the community. Furthermore, we have already in place and will be expanding a colloquium series, many of the events of which are co-sponsored, often with Women's Studies, Feminist Studies in Literature, the Center for Humanistic Studies, and other units. Finally, there is an active program of bag lunches and informal seminars for the presentation of research-in-progress and discussion of shared concerns. In all of these projects the students in the minor, along with the faculty, comprise the core of the intellectual community that CAFS wishes to foster, and they will benefit from the opportunity to participate not only in separately interesting events and projects but in the development of a research community.

### 3. Mission

As discussed in 2, feminist research is of increasing importance in the humanities and social sciences. This development is more recent than the Ph.D.'s of most faculty working in these areas and is essentially interdisciplinary. For these reasons, graduate students cannot be adequately trained as feminist scholars within a discipline without a coordinated structure for research and teaching. Such a structure will also revitalize research and teaching within CLA departments, directly for faculty and students affiliated with CAFS and indirectly for others.

### 4. Comparative Program Analysis

There are between 450 and 500 women's studies programs in the U.S.. Of these, 51 have some kind of graduate program, ranging from departmentally-based MAs or PhDs (in, for example, women's history) to interdisciplinary degrees in women's studies. Eleven schools have a graduate minor: Arizona, Cincinnati, CUNY Graduate Center, Clayton University (St. Louis), Cornell, George Washington, Harvard Divinity, Indiana, NYSUC (Brockport & New

Paltz), and Wisconsin. In Minnesota there is an MS in Women's Studies offered through Continuing Studies at Mankato State.

There is, therefore, nothing directly comparable to the proposed minor in this state. Mankato's program has a less scholarly and more practical orientation than our proposal, offers a degree rather than a minor, and offers only an M.S.. Wisconsin is the only neighboring university that offers a minor; one major difference between their program and our's is in the much greater connection here between the undergraduate program and the research center.

5. The program duplicates nothing in Minnesota or in neighboring states and is one of very few such programs in the U.S..

#### 6. Cost/Benefit

The cost of the program is minimal. In fact, no new University resources (and no extra-University resources) are currently required. The Director of Graduate Studies does not presently receive release-time or a stipend, and the course teaching is part of the regular teaching load of faculty in Women's Studies or as transfer of effort from faculty housed elsewhere. Program support staff and other expenses are included in the budgets for Women's Studies and the Center. Particularly since the supporting program structure is already in place, the move to the minor does not impose any new expenses.

The expected benefits are great: Minnesota will be the best place in the country to pursue a graduate degree with a focus on feminist theory and method in a number of disciplines, and among the best in several more. Faculty research, community outreach, and undergraduate education will also benefit directly and indirectly from the intellectual community of which the program's students and faculty will be the core.

#### 7. Hypothesis to be Tested

The program is not experimental.

### Section III

October 4, 1985

Proposal for: Graduate Minor in Feminist Studies

Submitted by the: Center for Advanced Feminist Studies and The Women's Studies Program

of the: University of Minnesota, Twin Cities

The proposal has been reviewed and approved by:

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APPROVAL CERTIFICATION

ADDITIONAL APPROVALS

*Ellen Prell* 10/11/85

*Kathleen B. Jones* 10/11/85

(Dept. Chair or (Date)  
Equivalent)

*[Signature]* 11/26/85  
(Dean) (Date)

*[Signature]*  
(Dean) (Date)

(Vice President, (Date)  
Institutional Relations)

(Vice President, (Date)  
Academic Affairs)

(Vice President, (Date)  
Health Sciences)

(Deputy Vice (Date)  
President, Agriculture,  
Forestry & Home  
Economics)

Approval by Regents: \_\_\_\_\_  
(Date)

First Reading by CAC: \_\_\_\_\_  
(Date)

Second Reading by CAC: \_\_\_\_\_  
(Date)

Recommendation by the MEHCB \_\_\_\_\_

\_\_\_\_\_

## Section III: The Proposal

### A. Introduction

The proposed minor in Feminist Studies is a response to the interest of faculty and graduate students in the establishment of a structured, interdisciplinary course of study for students doing feminist graduate work in a range of different departments. The Center for Advanced Feminist Studies was started in the Spring of 1984 with the aim of providing both a graduate component and an intellectual community and research development center for resident and visiting faculty and independent scholars.

For many years graduate students in a number of departments have been pursuing feminist scholarship, taking 5xxx level Women's Studies courses, and utilizing Women's Studies faculty as outside members of their committees. This *ad hoc* strategy lacked certain critical elements: a coherent structure for their supporting programs, 8xxx level graduate seminars on interdisciplinary feminist scholarship and research, and a structure to facilitate continuing intellectual community among the students, the faculty with whom they worked, and the feminist community.

The undergraduate Women's Studies Program is one of the best known and most highly regarded in the country (out of a total of over 450), and students from around the country interested in feminist graduate work have frequently come to Minnesota precisely for that reason. But without any institutional format for that work, they have had to legitimate on their own their work in their departments and to find and build an interdisciplinary intellectual community. Many have done so, but the Center and a recognized minor would enable them to pursue their work rather than having to spend their time creating the conditions within which it is possible.

Feminist research is at the leading edge of most humanities and social scientific disciplines, posing within and to these disciplines the most fundamental and far-reaching questions. Consequently, it cannot be confined within any one discipline, and a competent feminist scholar needs to be conversant with work in a variety of fields. The faculty of the Center have been participating in a faculty development seminar since Fall Quarter of 1983, which has as one of its principal goals preparing more of the faculty in the Center for teaching graduate level courses in Women's Studies (a field that did not yet exist when its present teachers received their graduate training). This monthly seminar, consistently attended by 15-25 faculty, has been enormously successful, with obvious benefits to faculty research as well as to graduate teaching and advising.

## B. The Proposed Program

The purpose of the Center for Advanced Feminist Studies' Graduate Minor is to provide a coherent, integrated, interdisciplinary graduate curriculum for students specializing in feminist studies. To that end, the Program seeks to enable persons to acquire skills and competencies in four general areas:

- 1) general, interdisciplinary knowledge of the scope of feminist studies
- 2) feminist theory and method
- 3) competency in feminist method in a specific field
- 4) feminist practice through teaching or internships.

The first three areas will be dealt with in the required core curriculum and the fourth will be addressed by the graduate TA policy.

The Center offers integrated, interdisciplinary courses directed toward the development of research and analytical skills and theoretical perspectives for students in varied home departments. The Center will also encourage the development of complementary, but more narrowly defined seminars to be offered in disciplinary units. Through the combined resources of the Center and these other units, students will be able to share their individual understandings of what it means to be a feminist historian, anthropologist, biologist, political scientist, literary critic, etc..

Admission to the CAFS Graduate Minor Program is contingent upon prior admission to the Graduate School of the University of Minnesota and a degree-granting department. The minor is available at both the M.A. and Ph.D. level. Admissions take place twice a year, in the Fall and Spring Quarters. It is anticipated that no more than fifteen students will be admitted each year. Those admitted will begin their course of study in the fall.

Applicants are expected to have a general knowledge of feminist scholarship. Demonstrated interest in interdisciplinary or cross-disciplinary work is desired. The candidate should demonstrate a commitment to and evidence of research or organizational experience in feminist concerns. CAFS does not require a major in Women's Studies as a prerequisite for admission to the program.

The application form will request, in addition to the usual personal, educational and experiential/employment data, the following information and documentation:

- 1) Notification of admission to the Graduate School of the University and to a degree-granting department.
- 2) A sample of writing on a topic related to feminist scholarship experience, or an annotated list of the candidate's recent feminist readings in the area of concentration.
- 3) Three letters of recommendation. These letters should address (a) the applicant's intellectual ability, ability in research, professional skills and creativity; (b) the quality of the applicant's previous work and promise of productive scholarship.

All applications for admission are evaluated by the Admissions Committee, which will include the Director of Graduate Studies, a member of The Center's Advisory Board, and a faculty representative from the Graduate Curriculum Committee.

All Center graduate students are required to take the core curriculum courses, WoSt 8510/8511. (These courses are described in the next section.) In addition, M.A. students must take eight credits of electives. Ph.D. students must take four credits of Feminist Research (WoSt 8710), two to three credits of Feminist Writing (WoSt 8910), and four credits of electives. These requirements are outlined as follows:

M.A. Minor Program

WoSt 8510/8511	Feminist Theory and Methods	8 cr
	Electives*	8 cr
		-----
		16 cr

Ph.D. Minor Program

WoSt 8510/8511	Feminist Theory and Methods	8 cr
WoSt 8710	Feminist Research**	4 cr
WoSt 8910	Feminist Writing**	4 cr
	Electives*	4 cr
		20 cr

\* Electives may be selected from a list of approved courses, obtainable from the Center. (See below for such a list for '84-85.)

\*\* These seminar may also be taken by M.A. students as an elective.

It will be noted that the CAFS Minor Program requires an admissions procedure that is not usually or regularly required of graduate students who seek to establish a minor outside their home department. This procedure is, on the one hand, an appropriate response to present reality, and on the other, a reflection of our conceptualization of an integrated and thoughtfully conceived program of minor concentration at the

graduate level.

The reality with which we must contend is that, at present, only a few members of the CAFS affiliated faculty (see attached list) are willing and/or able to offer the advanced interdisciplinary seminars that constitute the core of the minor, though their contribution to elective offerings is crucial to the breadth of our graduate program. Those to whom responsibility for core minor courses falls must include this teaching in regular schedules; hence, the number of times we can offer any one seminar remains limited. An advanced graduate seminar ideally contains no more than fifteen students. For staffing as well as widely acknowledged pedagogical reasons, we therefore need to limit access to the formal minor.

The admissions procedure also reflects our view of the importance of coherence in a graduate minor; in Feminist Studies, and the extent to which the Center seeks to facilitate and promote a sense of ongoing scholarly community and collaborative research as significant aspects of the graduate program. It is our understanding and experience that many graduate students interested in feminist studies seek to apply methods and theories in the field to and within their major discipline. While this may be true with respect to other minors, it is certainly not necessarily the case.

Finally, it should be noted that all graduate electives are open to all graduate students, so that anyone who wishes to take advanced courses can do so. Moreover, the Feminist Theory and Methods seminars are open, through permission of instructor, should there be space available.

### Course Descriptions

WoSt 8510/8511. Feminist Theory and Methods. (4cr per qtr; prerequisite six courses in WoSt or their equivalent and permission of the instructor) These two courses will form part of the core curriculum of all Center graduate students.

This seminar will acquaint students with multi-disciplinary methods, expose them to feminist theories, explore frameworks within which feminist work becomes possible, articulate differences between feminist research and traditional research, develop skills for challenging core assumptions in methods and theories that define traditional fields, introduce students to collaborative research, and identify University feminist faculty and resources for research.

WoSt 8710. Feminist Research. (4cr; prerequisite 8511 required of Ph.D. students in the Center for Advanced Feminist Studies (CAFS) supporting program or minor, open to MA students in CAFS)

This seminar will examine and compare feminist research methods in several disciplinary and interdisciplinary contexts. Students will explain and examine their own research and other feminist research in their field in critical comparison with feminist research methods in other fields.

WoSt 8910. Feminist Writing Seminar (Cr arr, max 4 cr, may not be taken more than twice; prerequisite WoSt 8511) Required of all Ph.D students, but may be taken by M.A. students as one of their electives.

This seminar, offered for advanced graduate students, will insure rigorous feminist research and thoughtful writing as elements in their final degree work. Objectives of this seminar include: to enable students to write a chapter or comparable segment of writing, e.g. draft of a Plan B paper if Masters candidate; to explore advantages and problems inherent in multi-disciplinary and/or interdisciplinary writing; to examine students' relationships to multiple - complementary or conflicting - audiences and to work on the development of a writing "voice".

WoSt 8970. Directed Research. (Cr ar; prerequisite permission of faculty)

This course involves independent study under the direction of appropriate faculty. Work may include, but is not restricted to, research on the M.A. or Ph.D. thesis.

WoSt 8980. Directed Instruction. (Cr ar; prerequisite permission of faculty)

This course provides graduate students with the possibility to serve as TA's for course credit.

#### CAFS GRADUATE TEACHING ASSISTANT POLICY

It is recommended that graduate students in the CAFS minor have at least one quarter's TA experience (equivalent to .25 FTE) in Women's Studies or in feminist courses offered in their degree departments. A student can pursue this TA experience at any time in her/his graduate career; the second or third year of residency in CAFS is recommended as most appropriate.

CAFS supports this TA work for the following reasons:

- (1) Teaching in feminist classrooms provides an opportunity to apply principles of feminist theory and pedagogy.
- (2) Teaching provides a vital means of translating feminist theory into practice.
- (3) TA work that includes teaching, grading, and preparing for classes develops skills that will be of use in a

variety of different life and career plans.

- (4) Graduate students from CAFS are an important resource within the University, since their training in CAFS will enable them to bring a unique and challenging learning experience to undergraduate students. This exchange between graduate and undergraduate students is an important component in feminist education.

The Center hopes to support students as TA's through a variety of means. However, such support is contingent upon availability of funds in any given year. Given limitations of funding, TA positions may be obtained in any of the following ways:

- (1) Students may apply for regular TA appointments within Women's Studies.
- (2) Students may apply for joint appointments within Women's Studies and their degree department (.25 FTE in Women's Studies and .25 in FTE degree department). CAFS will make a special effort to secure as many such shared appointments as possible.
- (3) Students may also, through consultation with an advisor and appropriate faculty, undertake a directed instruction under Women's Studies 8980. This will only apply for courses with no regularly appointed TA.

It is recommended that all TA's, whether appointed or enrolled under directed instruction, set up with their faculty a specific contract outlining TA and faculty responsibilities to one another and to the course. Teaching should be part of all such contracts.

#### CAFS ADVISING SYSTEM

Each fall, the Center will host a reception for feminist faculty and graduate students. The primary purpose will be to introduce new students to their campus resource group and to let those of us already familiar with CAFS begin to orient newcomers. Each incoming student will see the Director of Graduate Studies in Women's Studies. At this entry level advising session, the student will be paired both with a faculty and peer advisor. These two people will serve as the student's advisory core for the duration of her/his affiliation with the Center unless either the student or the advisor desires a change. Any such changes will be arranged through the Office of the Director of Graduate Studies. The faculty advisor will serve on the student's preliminary exam committee and/or dissertation committee within the student's degree-granting department.

Each student may seek advice from both faculty and peer advisors about any programmatic decisions and about elective courses in feminist subject matter. Faculty and peer advisors need not be versed on formal procedures of the Center's academic program. That

is the responsibility of the Director of Graduate Studies, freeing the faculty and peer advisors to establish more collegial relationships with their advisees.

At the completion of each student's program with the Center, she or he will be asked to submit a written evaluation of the advising system. In addition, any student wishing to do so is encouraged to have an exit interview with the Director of Graduate Studies to provide additional information about their experiences while affiliated with the Center.

### C. Educational and Social Need for the Program

We anticipate no difficulty in recruiting entering classes of fifteen graduate students a year, many of whom will be in their first year at Minnesota, although students may enter the minor at any point in their graduate career. Since '84-'85 the program has been in effect as a structured Supporting Program to which fifteen students were admitted in Spring of '84. They are pursuing degrees in American Studies, Ancient Studies, Educational Administration, English, Family Social Science, History, Philosophy, Political Science, Public Affairs, Social Work, and Sociology. A number of these students chose to come to Minnesota specifically because of the Center, despite the lack of a certified minor and in the absence of any publicity beyond the academic grapevine.

We are negotiating agreements with a growing number of departments (thirteen to date) concerning cooperative recruiting effort, shared TA appointments, and the involvement of Center advisors on students' examining committees. The response so far has been uniformly positive, including many referrals to CAFS of students with interests in feminist research and a number of requests for letters in support of departmental nominees for Graduate School Fellowships. (Two such successful nominees are in the first class.) Needless to say, when we begin national publicity and can offer a formal minor, we have no doubt about our ability to recruit a class of fifteen each year.

Estimates of total student enrollment after the first few years are difficult, because of the varying lengths of time students are in graduate programs and the different stages in their graduate careers at which students may enter the minor.

Typically, however, students will take the two quarters of 8510/8511 in their first year in the minor and 8710 and 8910 in subsequent years. (MA students will be encouraged to take the latter two courses, though they will not be required to do so.)

Consequently, students will be likely to be enrolled in core and elective courses over a three-year period, leading to a total expected annual enrollment of students in the minor of forty-

five.

Enrollment in core courses will in general be restricted to students in the minor. Other interested students will, of course, enroll in the 5000 level Women's Studies and the 5000 and 8000 level courses in other units that comprise the electives list for students in the minor. (Undoubtedly some of those students will be pursuing an independent supporting program in feminist studies.) A rough estimate of the enrollment in such courses in '84-'85 is 400, a number likely to grow somewhat as inter-disciplinary studies acquire increased visibility on campus.

As discussed in A (above) feminist research is at the forefront of most social scientific and humanities disciplines and in most of those disciplines is coming to be recognized as a necessary part of the curriculum. There is thus reason to believe that students whose graduate work includes a minor in feminist studies will be especially attractive candidates for academic positions in the disciplines in which they are receiving their degrees, and, given the absence of Ph.D. programs in women's studies, they will be extremely appropriate candidates for full-time or shared appointments in women's studies programs.

We also anticipate that students seeking non-academic positions will find the minor an advantage, because of the growing recognition of the importance of issues of gender in the economic, social cultural, and public policy realms and because of the greater intellectual flexibility associated with interdisciplinary work.

An additional benefit of the minor concerns the research component of the Center. We are working on strengthening interdisciplinary faculty research and connections between faculty and feminist researchers at other institutions and in the community. Two such efforts, already underway, are a two-year project on comparable worth (with primary funding of \$100,000 from the Northwest Area Foundation and Graduate School Grants-in-Aid-of-Research for Professors Sara Evans and Barbara Nelson, and an alternative research grant from CURA and Academic Affairs) as well as an on-going working group on the uses of autobiography, biography, and oral histories in research (with funding from the College of Liberal Arts for a working conference in the spring of 1986).

Furthermore, we have already in place and will be expanding a colloquium series, many of the events of which are co-sponsored, often with Women's Studies, Feminist Studies in Literature, the Center for Humanistic Studies, and other units. One continuing series, "Writers/Artists/Critics", is designed to bring into continuing dialogue feminists who address similar issues from opposite sides of one or another divide: academic/artistic, Anglo-American/continental, etc.

There is an active program of bag lunches and informal

seminars for the presentation of research-in-progress and discussion of shared concerns. In all of these projects the students in the minor, along with the faculty, comprise the core of the intellectual community that CAFS wishes to foster, and they will benefit from the opportunity to participate not only in separately interesting events and projects but in the development of a research community.

#### D. Comparison with Similar Programs

There are between 450 and 500 women's studies programs in the U.S.. Of these, 51 have some kind of graduate program, ranging from departmentally based MAs or PhDs (in, for example, women's history) to interdisciplinary degrees in women's studies. Eleven schools have a graduate minor: Arizona, Cincinnati, CUNY Graduate Center, Clayton University (St. Louis), Cornell, George Washington, Harvard Divinity, Indiana, NYSUC (Brockport and New Paltz), and Wisconsin. In Minnesota there is an MS in Women's Studies offered through Continuing Studies at Mankato State.

There is, therefore, nothing directly comparable in the state. Mankato's program has a less scholarly and more practical orientation than our proposal, offers a degree rather than a minor, and offers only an MS. Wisconsin is the only neighboring university that offers a minor; one major difference between their program and ours is in the much greater connection here between the undergraduate program and the research center.

#### E. Quality Control

The faculty of CAFS (see attached list) are the graduate faculty of Women's Studies. Since neither unit is a graduate degree-granting unit, all the faculty have examining status. Most, however, have full or associate status in their home or other departments.

The faculty and activities of the Center for Advanced Feminist Studies are essentially an expansion of those of the Women's Studies undergraduate program. Since goals and faculty overlap, the Center's administrative structure dovetails with that of Women's Studies.

The Center is headed by a Director who serves as the primary spokesperson. With the aid of an Administrative Assistant, this person handles inquiries internally and externally about the Center and its affairs, and initiates research activity. The Director also plans and coordinates conferences, visiting scholar opportunities, faculty development seminars, and similar activities.

There is also a Director of Graduate Studies, who in addition to advising students chairs the Graduate Committee. This Committee is responsible for all matters having to do with admission, advising, recruitment, scholarships, course offerings and teaching assignments. The Committee reports items for action to the Women's Studies Governing Council for approval.

Two other positions include a Fund Raising Officer and a Community Outreach Officer. The Fund Raising Officer is responsible for establishing liaison relationships with various agencies and programs in the local community and for raising funds for various activities of the Center. The Community Outreach Officer is responsible for organizing meetings of the proposed community advisors, and for creating and maintaining links with Twin Cities women's organizations such as At the Foot of the Mountain, WARM Gallery, Iris Video, and the Minnesota Women's Consortium.

These four positions, along with two appointed CAFS graduate students, comprise the main governing body of the Center, the Advisory Board. (Chairs of special task forces and/or projects will also attend Board meetings). The Advisory Board will meet at least twice each quarter. Its responsibilities include such matters as budgetary requests to the University and CLA for on-going support for CAFS, review of all policy decisions, and planning for continuing development of the Center.

In addition to serving on the Advisory Board, CAFS graduate students will have the opportunity to serve on the Women's Studies Governance Council (2 positions) and the Women's Studies Curriculum Committee (1 position), though these three latter graduate positions need not necessarily be filled by students admitted to the Center.

Educational development activity has been on-going since '82-'83, including the submission and approval of the core courses (approval of 8710 is still pending), the development and teaching (in fall '84 and winter '85) of 8510 and 8511, and the Faculty Development Seminar. Prof. Janet Spector, who is scheduled to teach 8710 in the Spring of '86, has received an EDP small grant to work on the development of that course.

There are no relevant external accrediting or certification agencies, although the Center has been admitted to membership in the National Council for Research on Women, and Women's Studies belongs to the National Women's Studies Association. Internally, the minor will be subject to continuing review; in particular, students are urged to communicate with the DGS about the quality of instruction and advising, and the Faculty Development Seminar provides a forum for faculty discussion of these issues. Formal reviews will be undertaken in conjunction with the bi-annual reports on plans and priorities for CLA.

#### F. Implementation

Students, including those already enrolled in the supporting program, will be admitted to the minor at the time of final Regents approval. Of the courses, 8510 and 8511, were offered in '84-'85 and will be offered in '85-'86. 8710, if approved, will be offered in Spring '86. 8910 will be offered for the first time in '86-'87. Each of the courses will be offered thereafter

once annually.

No new University resources (and no extra-University resources) are currently required. The Director of Graduate Studies does not presently receive release-time or a stipend, and the course teaching is part of the regular teaching load of faculty in Women's Studies or as transfer of effort from faculty housed elsewhere. Program support staff and other expenses are included in the budgets for Women's Studies and the Center. Particularly since the supporting program structure is already in place, the move to the minor does not impose any new expense.

We are, however, developing a library to supplement the University's holdings and to make frequently consulted reference works and periodicals readily available. That, along with our newly implemented visiting and independent scholars programs, will eventually require more space than we now have.

CAFS Electives 1984-85

Fall Quarter

English 5910/Philosophy 5911, Topics: Marriage in Novel and Films (Scheman)

8710, Studies in Criticism: Feminist Studies in Criticism (Sprengnether)

Psychology 8120, Personality Therapy, and Women (Faunce)

Women: 5910, Women, Feminism, and Power (Faunce)

5970, Directed Studies

8510, Feminist Theory and Method (McNaron)

Winter Quarter

English 5620, British & American Women Writers: Silence & Breaking Silence (McNaron)

5680, Studies in the English Language: Language & Sex (Escure)

Public Affairs 8650, Women & Public Policy (Nelson)

Sociology 8501, Contemporary Research on Marriage & Family (Laslett)

Spanish & Portuguese 8911 Feminist Perspectives on Hispanic & Luso-Brazilian Cultural Discoveries (Sullivan)

Women's Studies 5910, Topics: Women & Public Policy & Comparable Worth (Evans & Nelson)

5970, Directed Study

8511, Feminist Theory & Method (Geiger &

Kaminsky)

Spring Quarter

American Indian Studies 5690, Topics: American Indian Women (wiger)

Anthropology 5960, Anthropology of Gender, Race, & Ethnicity (Rowe)

English 5620, British & American Women Writers (Reddy)

History 5436, Social History of African Women, 1850-present (Geiger)

Humanities 5970, Directed Studies: Gender, Representation, & Cultural Politics (Wolff)

Political Science 8234, Selected Thinkers & Topics in the Development of Political Thought: Hannah Arendt (Dietz)

Psychology 8121, Achievement Motivation & Women (Faunce)

Public Affairs 8253, Workshop: Women & Social Policy (Fraser)

Social Work 5010/WoSt 5104, The Older Woman: A Feminist Perspective (Quam)

5102, The Changing Roles of Men & Women (Jones)

Women's Studies 5103, Gender & Class (Maynes & Laslett)

5377, Feminist Therapies (Faunce)

5910, Topics: Women in Western Political Thought (Dietz)

5970, Directed Study

Faculty of the Center for Advanced Feminist Studies

Ronald Aminzade, Sociology 1  
Terence Ball, Political Science 1  
Ellen Betz, Student Counseling Bureau  
Maria Minich Brewer, French 1  
Linda Brooks, Studio Arts 2  
Clarke Chambers, History and American Studies 1  
Shirley Clark, Education Policy & Administration  
Christine Cook, Design, Housing, & Apparel 1  
Mary Dietz, Political Science  
Lois Erickson, Psychology  
Sara Evans, History  
Patricia Faunce, Women's Studies  
Lois Fiedler, Student Counseling Bureau  
Arvonne Fraser, Humphrey Institute  
Shirley Garner, English  
Susan Geiger, Women's Studies  
Sunny Hansen, Educational Psychology  
Andrea Hinding, Walter Library  
Ruth-Ellen Boetcher Joeres, German  
Indira Junghare, Southwestern Asian Studies 1  
Amy Katz Kaminsky, Women's Studies 1  
Diane Kjervik, Nursing  
Barbara Knudson, Institute for International Studies  
Margot Kriel, Independent scholar 2  
Barbara Laslett, Sociology  
Dorothy Loeffler, Student Counseling Bureau  
Doris Grieser Marquit, Independent scholar 2  
Elaine Tyler May, American Studies  
M.J. Maynes, History  
Susan McClary, Music 1  
Toni McNaron, English  
Jeylan Mortimer, Sociology  
Barbara Nelson, Humphrey Institute  
Riv-Ellen Prell, Anthropology  
Jean Quam, Social Work  
Julia Robinson, Architecture 1  
Phyllis Jane Rose, independent scholar 2  
Martin Roth, English  
Naomi Scheman, Philosophy  
Amy Sheldon, Linguistics 1  
Janet Spector, Anthropology  
Madelon Sprengnether, English  
Constance Sullivan, Spanish & Portugueses  
Anne Thorsen Truax, Women's Center  
Gayle Graham Yates, American Studies  
Jacquelyn Zita, Women's Studies

- 1 Examining Status pending Graduate School approval
- 2 Limited Teaching Status pending Graduate School approval

Affiliated Departments

American Studies  
Anthropology  
English  
French and Italian  
German  
History  
Law School  
Philosophy  
Political Science  
Sociology  
Spanish and Portuguese

Pending final approval

Family Social Science  
Humphrey Institute  
Social Work

(curriculum vitae are appended to original proposal on file in Deans office)



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Rhetoric  
(Technical Communication Program)  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, Minnesota 55108

30 July 1985

Kenneth Zimmerman  
Associate Dean  
Graduate School  
325 JohH  
Minneapolis Campus

Dear Dean Zimmerman:

Enclosed is the Rhetoric Department's proposal for a Master of Science in Technical Communication. We request that you also consider the upgrading of the faculty presented with the proposal to a graduate school grade appropriate for participation in the program.

I'll be absent on a sabbatical during the coming year. Your contact person in the department for information and assistance with the proposal will be Professor Victoria Winkler Mikelonis (6-4636). Professor Laurie Hayes (3-1784) is also available for assistance. Professor James Connolly (3-0917) will be acting head.

Thank you for your help and cooperation during the preparation of this proposal.

Sincerely,

Thomas E. Pearsall  
Professor and Head

TEP:lh

cc: Dean C. Eugene Allen  
Dean R. A. Skok  
Dean Keith McFarland  
Associate Dean Keith Wharton  
Victoria Winkler Mikelonis  
Laurie Hayes  
James Connolly

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College Agriculture Code No. 30

I. General Information

A. Program Title Master of Science in Technical Communication

B. Program Review Category:  Regular  
(check one)  Experimental (If Experimental, give Reporting Date:      /      /     )

C. Proposed Implementation Date: 9 / 15 / 86  
Plan A: 45-53

D. Program Length: Total Cr/hr 44 Classroom      Laboratory     

E. Administrative Unit Immediately Responsible for Program: Department of Rhetoric

F. Describe the Program (in 50 words or less):

Program objectives are to educate the student in the tasks performed  
by technical communicators that include interviewing, writing and  
editing, research, and management. Both a Plan A and Plan B will be  
offered. Completion can lead to positions as technical communicators  
in business and government or to positions teaching technical  
communication.

G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	First Year: <u>86-87</u> (Yr.)		Full Operation: <u>90-91</u> (Yr.)	
	Number (Headcount) Expected	Student Credit or Contact Hours	Headcount Capacity	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	20	900	50	1900
Other Students				
Total	20	900	50	1900
b. Program Graduates/Completers			15	

A. Projected Costs of the Program:

II. Budget Data

	First Year: 1986-87*								Full Operation: 1990-91*							
	New				Re-assigned				New				Re-assigned			
	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost	No. FTE	Annual Cost		
a. Faculty		\$	1.7	\$ 63,407.							2.05	\$ 72,199				
b. Civil Service	.5	\$ 11,424		\$	.5	\$ 11,424		\$				\$				
c. Equipment, Supplies, etc.		\$		\$ 3,413		\$		\$ 3,413		\$		\$ 3,413		\$		
Total Direct Costs (a+b+c)		\$ 11,424		\$ 66,820		\$ 11,424		\$ 75,612		\$ 11,424		\$ 75,612		\$		
d. One-time Costs		\$		\$		\$		\$		\$		\$		\$		
e. Space Rental		\$		\$		\$		\$		\$		\$		\$		
f. Indirect Costs		\$		\$		\$		\$		\$		\$		\$		
g. Total Program Costs (a+b+c+d+e+f)		\$ 11,424		\$ 66,820		\$ 11,424		\$ 75,612		\$ 11,424		\$ 75,612		\$		

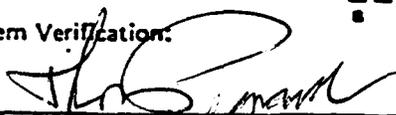
\* In 1985-86 dollars

B. Expected Sources of Funds for Program:

	First Year: 1986-87*						Full Operation: 1990-91*					
	Dollar Amount	% of Annual Expend.	One Time Input	Dollar Amount	% of Annual Expend.	One Time Input	Dollar Amount	% of Annual Expend.	One Time Input			
a. Local	\$		\$	\$		\$		\$				
b. State	\$ 192,024	81.	\$	\$ 405,384	81.	\$		\$				
c. Tuition	\$ 45,576	19.	\$	\$ 96,216	19.	\$		\$				
d. Federal	\$		\$	\$		\$		\$				
e. Private	\$		\$	\$		\$		\$				
f. Dedicated Fees	\$		\$	\$		\$		\$				
g. Other (Specify)	\$		\$	\$		\$		\$				
h. Total	\$ 237,600	100%	\$	\$ 501,600	100%	\$		\$				

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions:

D. System Verification:

  
 Authorized Institution or System Signature

Professor and Head  
 Title

30 July 1985  
 Date

## Section II: Proposal Summary

### 1. SUMMARY DESCRIPTION OF PROGRAM

The objective of the proposed program is to provide graduate level education in technical communication to include audience analysis, informational interviewing, designing messages, media selection, coordinating technical illustrations, writing and editing, project scheduling and management, communication research, and training, supervising, and evaluating other technical communicators. To accomplish this objective, the content of the program requires 3 core courses in audience analysis, message design, and media selection and an internship in technical communication. The core is supplemented by a program designed by the student and his or her advisor that can include courses in communication research, managerial communication, interviewing, dissemination of information, advanced editing, document design, and transfer of technology. Both a Plan A and Plan B Master of Science will be offered. The Plan A program will require a 29-37 hour course sequence, plus 16 thesis credits. The Plan B will require a 36-hour course sequence, plus an 8-hour design project.

Students will meet all standard graduate school entrance requirements. They must have a B.A. or B.S. degree. They must have taken as undergraduate work at least 30 hours of mathematics, science, and/or engineering, 12 credits in advanced communication, and 8 credits in computer science before obtaining full admission to the program. The program will be limited to 20 new students a year and after its second year should graduate 10-15 graduates a year.

The proposed program will replace, in part, an existing Master of Agriculture Program in Technical Communication that currently enrolls 64 students. The proposed program and the existing one combined will not be allowed to exceed the current enrollment of the existing Master of Agriculture program. Therefore, the new program will make no major new demands on University resources. We have sufficient faculty, library resources, space, and equipment to support the proposed program. We do need the continued services of a secretary currently on soft money. C. Eugene Allen, Dean of the College, has committed the money (currently \$22,848) to make the existing secretarial position a recurring one and has expressed strong support for the program. (See his letter in Attachment H).

### 2. NEED FOR THE PROGRAM

The proposed Master of Science in Technical Communication fills a growing need for professional communicators in technical fields. Latest estimates by the Society for Technical Communication place the number of persons in the United States working as technical communicators at 72,000. The Twin Cities with their high tech industries have an expanding need for technical communicators. Our existing undergraduate and Master of Agriculture programs are the primary technical communication programs in the North Central States. We have been graduating about 21 students a year and 75% of our graduates are placed

in the Twin Cities. Our placement rate is 92%. Since its inception in 1971, our undergraduate program has been the model for a number of other programs developed in the United States.

An M.S. in Technical Communication will enable us to meet the needs of a clientele different from those enrolled in our existing programs. Our programs currently educate people with limited or no experience in technical communication for entry level positions. However, for several years we have been approached by professional technical communicators with from five to twelve years in the field who want advanced work in rhetorical theory, message development, and document design. Also, we have had numerous inquiries from former secondary school teachers and instructors at community colleges who would like to teach technical communication at the college level. (In the last 15 years, students in technical writing/communication courses in the United States have increased from approximately 25,000 a year to over 250,000.) Our proposed program is designed to meet the needs of both these groups for graduate level instruction.

There is no accrediting body for technical communication. However, the Society for Technical Communication has a Curriculum Development Committee that acts as a liaison between the Society and colleges and universities developing degree programs. Professor Thomas Pearsall, Head of the Department of Rhetoric, has chaired this committee since 1971 and has been instrumental in setting up other programs in the United States.

### 3. MISSION

The proposed degree has relationships to other communication programs at the University of Minnesota, most notably those in Speech Communication and Mass Communication. For the most part the relationships are of a general kind. For example, all three programs have an interest in rhetorical principles and communication research and theory. Rhetoric and Mass Communication have a mutual interest in written and visual communication. Rhetoric and Speech Communication have a mutual interest in speaking and visual communication. However, the application of these general principles is quite different in technical communication, and there is no significant conflict in course work or programs. Rather, good opportunities for cooperation exist. Also, the technical communication program prepares the students for particular managerial tasks not explored in other programs. Currently, 19 other master's programs in technical communication are being offered in the United States. Most have objectives similar to those described for this program in the earlier section, "Summary Description of Program." Most have the preparing of students to be professional technical communicators as their basic mission. The proposed degree would be the only master's degree in technical communication in Minnesota. The nearest university with a similar master's degree is Iowa State at Ames.

This new degree in technical communication is a natural evolution from the existing undergraduate program. It fills a need for advanced work in technical communication that will prepare people for teaching

technical communication or for positions in technical communication beyond the entry level.

#### 4. COMPARATIVE PROGRAM ANALYSIS

There are no identical programs in Minnesota or at the University. Some similarities do exist between University programs in Mass Communication and Speech Communication and the proposed program. However, there are significant differences. Though sharing certain concepts with Mass Communication, technical communicators work in industry and government and do not generally work in the mass media. In contrast, Mass Communication's major thrust is in print and broadcast journalism. A relationship also exists between the communication theory and research concentration in Speech Communication and a similar component in technical communication. Speech Communication generates information of value to technical communication, but technical communication applies the information in looking at very specific problems in a limited number of situations. It is a healthy relationship of mutual benefit to both departments. The English Department has a writing program at the Master's level that has been predominantly belletristic in its development. While the English Department does reserve the right to deal with more practical writing in the future, the Department Chair, Professor Kent Bales, feels that no conflict is likely to occur, and, in fact, foresees opportunities for future cooperation. (See Professor Bales's letter in Attachment I.)

Master's degrees in technical communication now exist in 17 institutions: Boston University (MA), Bowling Green State University (OH), Carnegie-Mellon University (PA), Colorado at Denver (CO), Drexel University (PA), East Carolina University (NC), Eastern Washington University (WA), Houston-University Park (TX), Iowa State (IA), Miami University (OH), Memphis State University (TN), New Mexico State University (NM), Northeastern University (MA), Oklahoma State University (OK), Pennsylvania State University (PA), Polytechnic Institute of New York (NY), Rensselaer Polytechnic Institute (NY).

Most of these programs are similar in that they prepare students to become professional technical writers and editors. Only two of the stronger programs, those at Miami of Ohio and Rensselaer Polytechnic Institute, share with Rhetoric's proposed program the ability to prepare students to move rapidly past entry-level work into management in technical communication or into teaching. Rhetoric has more experience with its undergraduate program (14 years) than any of the programs except those at Carnegie-Mellon and Rensselaer Polytechnic Institute. Rhetoric is unique among all existing programs in having a faculty with teaching, research, consulting, and outreach experience in both speech and written communication. Building upon this experience and the talents of key faculty, Rhetoric's master's program should become one of the major programs in the field.

#### E. DUPLICATION

The proposed program duplicates no other degree program available in Minnesota. The closest similar degree is at Iowa State at Ames, but

Rhetoric's proposed program requires far more technical preparation and offers far more preparation in management, theory, and research than does the Iowa State program. The program answers a genuine need for technical communication in Minnesota's high technology industries.

#### F. COST/BENEFIT

A. Evaluation Rhetoric will systematically review and evaluate the master's program under the regulations which govern all graduate degree programs at the University. An advisory council, composed of 11 members, 7 from business, industry, and government and 4 from education, will be established to review and evaluate the program. Additionally, internal evaluation will be conducted by a Graduate Program Committee composed of the Director of the Graduate Program, the Department Head, two members from related areas of study such as Mass Communication and Speech Communication, two Rhetoric faculty members, and a student. Both the Advisory Council and the Graduate Program Committee will look closely at the public service and research benefits of the program. The Graduate Program Committee will regularly conduct follow-up studies of graduates and present the information gathered to the Advisory Council for their advice and counsel.

B. Cost Information In 1986-87, the program will take approximately 50% time each for two faculty members and 10% time each for seven other faculty members, approximately, therefore, 1.7 FTE. This represents a total cost at 1985-86 salaries of \$63,407. This is not new money but rather a reassignment of time currently spent on the Master of Agriculture program. The program will also take 50% of the time of a secretary currently based on non-recurring funds. The position will be made recurring, so the cost will be \$11,424 in new money committed by the Dean of the College. (See Dean Allen's letter in Attachment H.) There will also be reassigned SEE money in the amount of \$3,413. Costs, therefore, will be \$78,244 in the first year. In 1990-91 when the program is in full operation, we'll have 2.05 FTE assigned, making the cost \$87,036 in 1985-86 dollars.

We project 20 students for 1986-87 and 50 students by 1990-91. At typical students loads, the combined tuition and state support for 20 students will be \$237,600, for 50 students \$501,600. Therefore the program will be cost effective.

## Section III: The Proposal

## A. INTRODUCTION

Although technical writing as a service course has been taught in this country since 1911, technical communication as a profession and as a discipline has its roots in World War II. At that time industry hired communicators to provide the written and visual documentation needed for technical instruments and systems. Today, over 70,000 people work as technical communicators.<sup>1</sup>

As the profession grew in the 1950's academics began to take an interest in it. By the middle 1950's, Carnegie-Mellon University had established an undergraduate degree in technical communication and Rensselaer Polytechnic Institute had established a master's degree. By 1985, 56 academic institutions had established degree or certificate programs in technical communication, 19 of them master's programs. (See also section D, Comparison with Similar Programs.) Service courses in technical writing have also had tremendous growth. Today the technical writing service course is taught in thousands of schools. The number of students taking service technical writing courses had grown from approximately 25,000 in 1968 to over a quarter million by 1982.<sup>2</sup>

Professional organizations and publications have kept pace with the growth of the field. The Society for Technical Communication (STC) was founded in the 1950's. The Association for Teachers of Technical Writing (AATW) in 1971, and the Council for Programs in Technical and Scientific Communication (CPTSC), in 1974. Prominent journals in the field are Technical Communication, Journal of Technical Writing and Communication, and The Technical Writing Teacher. Additionally, articles concerning technical communication now regularly appear in other journals such as College English, College Composition and Communication, and The ADE Bulletin.

Today, the discipline and academic programs to meet its needs are increasingly well defined. The following, from a recent issue of Technical Communication, provides a generally accepted definition:

Professional communicators perform a complex array of tasks,...

they are not only writers and editors, but project managers, who must plan project schedules; prepare and follow budgets; choose vendors and arrange support services; do research; coordinate the activities of other writers, artists, and reviewers; conduct meetings; make oral presentations; and prepare documents for production. They also must design illustrations and coordinate them with written documents. Green and Nolan's research also shows the role of technical communicators as department managers, who train, supervise, and evaluate employees.

When we see the profession in this way, it is clear that our best programs--the ones that most thoroughly prepare graduates for careers in technical communication--are those whose requirements reflect the broad range of activities that technical communicators perform, not just two or three of those activities.

The Department of Rhetoric faculty have played and are playing an important role in the development of technical communication as a discipline. A partial list of their contributions includes the following:

- o Contributed major publications to the literature of the field
- o Founded CPTSC in 1974
- o Chaired STC's Curriculum Development subcommittee since 1971, playing a role as consultant to many developing technical communication programs
- o Serve as editor of the Technical Writing Teacher
- o Serve as associate editor of Technical Communication
- o Serve as Vice President of ATTW
- o Serve on the Executive Board of the Journal of Technical Writing and Communication
- o Conducted, in 1984 and 1985, a weeklong Advanced Seminar for Teachers of Technical Communication attended by participants from 30 states and two foreign countries

Rhetoric has had an undergraduate program in technical communication since 1971 that currently has 85 students enrolled. Rhetoric's undergraduate program was recently described in a journal article as a "good example" of a four-year program:

The undergraduate technical communication programs at the University of Minnesota and at Clarkson College are both good examples of four-year programs that prepare students for careers as technical communicators.

The University of Minnesota's program leads to a Bachelor of Science degree in Technical Communication. Located in the Department of Rhetoric, this program requires majors to complete at least four Rhetoric courses that develop communication skills. These include two courses in communication, one in public speaking, and

one in either professional writing or technical and scientific writing.

Students also must meet requirements in at least three areas of technical communication competency: writing and editing, oral communication, and visual communication. In the writing and editing area, students take a publications editing course and at least four additional writing courses, which can be chosen from publicity, writing for special purposes (a course in special formats and genres), and business correspondence. In oral communication, students take at least two courses (scientific and technical presentations and interviewing are required), and they take at least two courses in visual communication (recommended courses include technical drawing, basic typography, color and design, visual presentations, two-dimensional design, scientific and technical graphics, and use of scientific and technical film).

Additional requirements give students a greater understanding of communication theory and provide humanistic perspectives on science and technology. These requirements include at least two courses in each of the following areas: organizational communication, communication theory and research, and the history and philosophy of science. Finally, students complete a ten-week internship and a professional concentration consisting of at least five courses in a science, social science, or engineering discipline. At least two of these courses must be at the junior or senior level.<sup>4</sup>

For a more complete description of the undergraduate program, see Attachment C, "Guide to Technical Communication Programs."

Since 1974, Rhetoric has participated in the College of Agriculture's non-graduate school professional Master's of Agriculture program with a Master of Agriculture in Technical Communication. This M.Ag. program now has 64 students enrolled.

For reasons described in Section C, in the winter of 1984, Rhetoric began to consider seriously the development of a master's program in technical communication. In our planning we drew heavily upon previous experience developing and administering our undergraduate and M.Ag. programs. We sought help from a well established advisory network of professional technical communicators, some of them by this time our own graduates. We examined the literature available in the field. Past consulting in the establishment of other programs provided valuable lessons for the development of our program. Our planning led to the program that we discuss in Section B.

## B. THE PROPOSED PROGRAM

The aspects of the proposed program, a Master of Science in Technical Communication, include program objectives, admission requirements, curriculum, and graduation requirements. All are discussed in this section.

### Program Objectives

The objectives, generally stated, of the proposed program are to educate the student in the theory and practice of the complex tasks performed by technical communicators that include informational interviewing, audience analysis, writing and editing, designing messages, media analysis, project scheduling and management, communication research, coordinating technical illustrations, and training, supervising, and evaluating other technical communicators. All these activities are normally carried out within the context of a technically oriented business or a governmental setting.

Both the Plan A M.S. and the Plan B M.S. are to be offered. Sample Plan A thesis topics are listed in Attachment D, sample Plan B projects in Attachment E. Sample programs are described in Attachment F.

### Admission Requirements

Students will meet standard graduate school admission requirements. They will submit scores of either the GRE general test or the Miller Analogies Test. Students will provide three letters of reference, a written statement of their professional goals, and two writing samples. All applicants are expected to have

- o a B.A. or B.S. from an accredited college or university
- o 30 credits in science, technology, mathematics, and/or engineering
- o 12 credits in advanced communication courses  
(For example, writing/editing, oral communication, visual communication, organizational communication, communication theory)
- o 8 credits in computer science or management information systems or demonstrated equivalent experience

Students may be admitted to the program without the specific credits listed above, but they must complete such courses before

registering for over 20 credits in the program. These supplementary courses may not be applied to the M.S.

Each applicant's credentials will be carefully reviewed by the Technical Communication Program Director and a faculty Admissions Committee to measure the candidate's potential for success in the field. Since the program involves broad, often interdisciplinary, courses of study and a variety of emphases within the field, the faculty Admissions Committee will carefully judge the applicant's preparation in terms of communication competencies, knowledge of the subject matter, experience, and potential. The professional objective statement of the candidate and the writing samples will weigh heavily in this evaluation.

Students who are not native speakers of English will be required to furnish evidence of their proficiency in English by taking the Test of English as a Foreign Language (TOEFL) administered by the Educational Testing Service.

Only 20 applicants will be accepted into the program each year for the first three years. The enrollment limit will be imposed to maintain enrollment at a level that can adequately be served by the available faculty, facilities, and resources of the department. This limit will be evaluated and revised periodically.

### Curriculum

Complete courses of study are described in the next section, "Graduate Requirements and Standards." In this section we describe the courses available in the M.S. curriculum under the headings of Required Courses, Recommended Courses, Thesis, and Plan B Design Project.

Courses designated 5xxx and 8xxx are proposed courses. All others are existing courses.

#### o Required Courses

Rhet 8xxx Theory and Practice in Designing Messages  
Through the use of case studies, students will examine how purpose and situation shape written discourse. Students will develop and carry out strategies for delivering specific information to a specific audience for a specific purpose.

Rhet 8xxx Theory and Research in Audience Analysis  
Review of research on human learning and understanding. Theories of audience analysis and the preparation of written messages to reach defined audiences. Applications to problem-solving strategies in technical communication.

Rhet 8xxx Theory and Research in Media Selection  
Designed to assist decision making for technical communication problem solvers. Students survey the media available for transmitting messages between communication sources and receivers and analyze the factors that influence media choices.

Rhet 5180 Internship in Technical Communication  
Designed to give technical communication majors on-the-job experience at the University or in industry or government.

Rhet 5500 Research in Communication Strategies\*  
Introduction to basic research design and methodology in communication. Emphasis on application of various research methods to particular communication strategies or settings.

\*Required of Plan A students only

o Recommended Courses

Rhet 5100 Technical Communication: Special Problems  
Designed for supervised reading, research, and work on advanced technical communication projects not covered in regularly scheduled courses.

Rhet 5147 Efficient Reading  
Exploration of adult reading process with emphasis on comprehension, speed, and vocabulary development. For persons of average or above-average reading ability who wish to develop and refine college-level reading skills and to understand linguistic, psychological, and physiological aspects of the complex human skill of reading. An evaluative paper and some seminar meetings are required.

Rhet 5170 Managerial Communications  
Systematic analysis of communication techniques and procedures for the manager. Emphasis on manager's ability to achieve vertical and horizontal understanding and acceptance. Readings, guest speakers, and a term project.

Rhet 5257 Scientific and Technical Presentations  
Presentations for specific situations related to technical or scientific topics. Audience analysis and adaptation, techniques of support and visualization, organization for clarity and accuracy, and techniques of interpreting and answering questions. Students will make and evaluate technical and scientific presentations. Emphasis on seminar reports and professional conference papers.

- Rhet 5258 **Interviewing: Dynamics of Face-to-Face Communication**  
Designed to improve intrapersonal and interpersonal skills in interviewing situations. Students learn to understand and use appraisal, reprimand, complaint, persuasion, problem solving, and counseling interview techniques, and participate in a research interview project. Equal emphasis on the interviewer and interviewee roles.
- Rhet 5400 **Dissemination and Utilization of Information**  
Methods and processes of using specialized information. Study of cases and development of materials for application in professional fields. Emphasis on channels for dissemination and utilization.
- Rhet 5531 **Technical Writing Course Development**  
Students plan and develop a technical writing course. Special attention will be paid to the development of course objectives, a syllabus, and a bibliography of readings on the teaching of technical writing. Textbook selection will be discussed.
- Rhet 5541 **Readings in Scientific and Technical Prose**  
A tutorial in which students will read and discuss selected books, essays, and reports which exemplify effective scientific and technical communication. These readings will represent actual scientific and technical discourse as well as philosophical or historical discussions about science and technology.
- Rhet 5551 **Report and Thesis Writing**  
For graduate students and seniors actually working on reports or theses. Organization of reports and theses; library investigation; presentation of data; methods of documentation. Emphasis on revision of manuscripts and improvement in style of writing.
- Rhet 5561 **Advanced Editing Seminar: Electronic Publishing**  
Designed to teach students a procedure for copy preparation for publication. Emphasis on copy coding for electronic publishing, using telecommunications systems, coding and transmitting tables and charts, and editing copy and code. Familiarizes students with the principles of composing and typesetting copy for publication and communicating with typesetters and printers electronically.
- Rhet 5565 **Writing for Publication**  
The professional as communicator; analysis of markets; professional, trade, and general publications; information sources and topic selection; adaptation to the specialized and general reader; writing and preparing manuscripts for publication; marketing techniques.

**Rhet 5571 Writing for Special Purposes**

Analysis of and writing practice in a specific genre of practical writing (grant proposal, procedures and policies manual, operations manual, newsletter). Content varies from quarter to quarter.

**Rhet 5581 Document Design**

Students will be taught to design documents to meet the user's need, to complete a draft of that document, and to evaluate the effectiveness of a document. Projects will routinely include forms and software documentation in the form of user guides, reference manuals, tutorials, and input sheets. The documentation could be for databases, decision-aids, computer-aided instruction, on-line programs or visual displays. Mandatory lab time will be spent working as part of a project team with programmers, subject-matter specialists, and communication specialists.

**Rhet 5600 Transfer of Technology**

Methods of transferring scientific and technical knowledge and practice. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for managing a program. Assessment and design plan.

**Rhet 5xxx Rhetorical Theory: Persuasion and the Literature of Science**  
Introduction to principles of rhetorical analysis. Emphasis on Aristotelian theory. Practice in rhetorical criticism of contemporary scientific communication.**o Thesis**

Plan A students will meet the 16-hour thesis requirement as prescribed in the Graduate School Bulletin. See Attachment D for a list of sample thesis topics.

**o Plan B Design Project**

Plan B students will complete an 8-credit design project while enrolled in Rhet 8xxx, Design Project. The design project will emphasize problem-solving in a realistic technical communication situation. It must result in a product of professional caliber that can be subjected to critique by professional technical communicators as well as Rhetoric faculty members. See Attachment E for a list of sample design projects.

**Rhet 8xxx Design Project (4-8 cr per qtr; Plan B only)**

The Design Project will consist of an extended problem-solving situation in business, government, or industry in which the student acts as a consultant to explore the problem, identify possible solutions, introduce a solution, and apply the solution. Scheduled workshops will provide

guidance, support, and research findings to assist students in solving the problems assigned to them.

### Graduation Requirements and Standards

Both Plan A and Plan B students will meet all standards and criteria for graduation as set forth in the Graduate School Bulletin. Final examinations for both Plan A and Plan B students will be oral.

To satisfy departmental requirements, students must satisfactorily complete one of the following course sequences:

#### Plan A

<u>Core Sequence</u>	<u>Credit</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Selection	3
Rhet 5500 Research in Communication Strategies	4
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from the <u>Recommended</u> list under "Curriculum"	<u>2-4</u>
Sub-total	21

#### Related Field Sequence

Students will take a minimum of 8 credits in one or more related fields outside of Rhetoric. The sequence must follow a coherent plan and be approved by the student's advisor. 8

#### Additional Credits

Students without previous education or experience in technical communication may be required to take up to 8 additional credits to meet degree requirements. These credits will be chosen by agreement between the student and the advisor, subject to whatever restrictions the graduate faculty in the major field may place on the choice. 0-8

#### Thesis Credits

Grad 8777. Thesis Credits: Masters 16

Total 45-53

Plan B

<u>Core Sequence</u>	<u>Credit</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Selection	3
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from the <u>Recommended</u> list under "Curriculum"	<u>5-7</u>
Sub-total	20

Related Field Sequence

Student will take a minimum of 8 credits in one or more related fields outside of Rhetoric. The sequence must follow a coherent plan and be approved by the student's advisor.

8

Rhetoric Design Project

Rhet 8xxx, Design Project

8

Electives

The remaining 8 credits to meet the minimum 44-credit requirement for the degree will be chosen by agreement between the student and the advisor, subject to whatever restrictions the graduate faculty in the major field may place on the choice.

8

Total	44
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## C. NEED FOR THE PROGRAM

The need for accurate, understandable, and accessible information is crucial in business and government. The need for scientific and technical communicators expands proportionately with technological development and innovation. In addition to expanding technology, the

doubling of technical published material each decade and the increased computer applications in all fields requires documentation and training materials. Audiences with a need for technical information grow in size and number. For example, Environmental Protection Agency legislation requires citizen participation in technology assessment and decision-making. The shift in computer technology from large centralized systems to personal computers and the corresponding need for effective user documentation increases the audience for computer information. Technical communicators are the key people in designing, writing, and delivering such information. The technical communication field has been growing nationally as well as in the Twin Cities area; by all indications, it will continue to grow. William Stolgitis, Executive Director of the STC, estimates that 72,000 persons work as technical communicators. See Attachment G for a list of job titles of technical communicators in business and industry.

Our undergraduate and Master of Agriculture programs are the primary technical communication programs in the North Central states. We have been graduating about 21 students a year and 75% of our graduates are placed in the Twin Cities. Our placement rate is 92%. Our program develops competencies not only in writing and editing, but also in oral communication, visual communication, organizational communication, and communication theory and research. Since its inception in 1971, our undergraduate program has been the model for a number of other programs that have developed across the country.

An M.S. in Technical Communication will enable us to satisfy the needs of our changing clientele. Our current B.S. in Technical Communication prepares undergraduate students to fill entry level positions in technical communication. The Master of Agriculture in Technical Communication (offered through the College of Agriculture) is a practitioner's degree which enables people who already have undergraduate degrees in other areas to retrain in technical communication. The M.Ag. graduates compete for the same entry level positions as the B.S. in Tech Comm graduates; however, since the M.Ag. graduates are older and usually have more experience, they are hired at the top of the salary range. These two degrees were sufficient to meet the demands of the marketplace in the past. However, since 1981, we

have been approached by 17 professionals who have worked in the technical communication field from five to twelve years who would like to pursue an advanced degree, but for whom many of our current offerings are too elementary. These professionals need advanced work in the fields of rhetorical theory, message development, audience analysis, publications management, document design, and alternative delivery systems. Some need additional technical training in computers, electronics, the natural sciences, or the health sciences.

We have also had numerous inquiries from former secondary school teachers and instructors at community colleges who would like to retrain to teach technical writing or communication at the community college or college level. This second group also needs advanced coursework in message design and audience analysis. In addition, they need training in specialized writing and editing courses, including word processing, authoring systems, and alternative delivery systems. They need practice in teaching scientific, technical, and business writing to students from scientific and technical disciplines, and they need some business experience to understand the organizational environments and constraints their students will confront.

Members of both these groups have expressed an interest in developing the necessary skills to begin either part-time or full-time consulting and/or free lance businesses. Consequently, the publications management training, the document design courses, and the training courses would also be important to their success. The M.S. in Technical Communication for teachers and those who eventually want a Ph.D. or who want to move into research and development and for those who aspire to management positions in business and industry would enable us to meet the needs of this changing clientele.

Moreover, industry is beginning to realize the importance of effective communication to the design and development of their products as well as to product support (packaging, training, maintenance, etc.). Many corporations are beginning to regard their publication units as profit centers rather than service groups. This change marks a significant shift in attitude concerning the importance of technical communication in the marketplace. However, many industries are still placing engineers or technical people in top management positions in the

publications departments. Our program will help train technical communicators to assume these positions since they would be in a better position to understand and garner support for the special needs of communicators. There are vast differences between producing hardware, software, and documentation. Consequently publication departments need professional communicators in management positions who can act as liaison between the designers and developers of the technologies, the subject matter experts, and the clients. Our proposed graduate degrees would provide professionals with the training and skills to advance into management, teaching, or research. See Attachment J for reactions to the proposed program from technical communication professionals.

#### D. COMPARISON WITH SIMILAR PROGRAMS

Rhetoric's proposed Master in Technical Communication has some obvious relationships to other communication programs at the University of Minnesota, most notably those in Speech Communication and Mass Communication. For the most part the relationships are of a general kind. For example, all three programs have an interest in rhetorical principles and communication research and theory. Rhetoric and Mass Communication have a mutual interest in written and visual communication; Rhetoric and Speech Communication have a mutual interest in spoken and visual communication. However, the application of these general principles is quite different in technical communication. Also the technical communication program prepares the students for managerial tasks not explored in other programs.

The emphasis in the proposed technical communication graduate program is to educate the student in the broad array of tasks performed by technical communicators that include informational interviewing, writing and editing, project scheduling and management, communication research, team building, coordinating technical illustrations, and training, supervising, and evaluating other technical communicators. All these activities are normally carried out within the context of a technically oriented business or a governmental setting.

Though sharing certain concepts with Mass Communication, technical communicators work in industry and government and do not generally work in the mass media. In contrast, Mass Communication's major thrust is in print and broadcast journalism. For example, the term science

communication in Mass Communication refers specifically to scientific journalism, the reporting of scientific information in the mass media. Although some Mass Communication courses, such as Jour 5221, Publication Graphics, 5233, Graphic Design Analysis, and 5316, Theories of Visual Communication, would be valuable related field additions to a master's program in technical communication, no conflict exists between any existing or proposed Rhetoric courses and courses taught in Mass Communication. In a letter to be found in Attachment I, F. Gerald Kline, Director of the School of Journalism and Mass Communication, agrees with this appraisal.

Closer relationships do exist between Rhetoric and Speech Communication than between Rhetoric and Mass Communication. Speech Communication has three concentrations available within its graduate programs: Communication Theory and Research, Rhetoric and Public Address, and Radio and Television Broadcasting. Our proposed program in technical communication has little relationship to the last two. However, there are some strong relationships between Technical Communication and the concentration in Communication Theory and Research. The technical communication program has the development of knowledge and skills in communication theory and research as a strong component. However, such knowledge and skills are only one component in the major.

Further, the emphasis in the technical communication program is quite applied. For example, organizational communication in Speech Communication is interested in the general organizational communication problems of varied organizations, for example, church and community groups as well as business groups. The managerial communication interests in the technical communication program are more concentrated in communication within technically oriented organizations.

The relationship between technical communication and Speech Communication is in some ways analogous to the relationship between Agronomy and the College of Biological Science. The research interests of CBS generate basic biological information of value to agronomists. The agronomists, in turn, apply the biological information in very specific ways on a limited number of crops. In the same way, Speech Communication generates information of value to technical communication,

but technical communication applies the information in looking at very specific problems in a limited number of situations. It is a healthy relationship of mutual benefit to both departments. Professor Robert Scott, Chair of Speech Communication, agrees with this appraisal. (See his letter in Attachment I.) Several courses in Speech Communication are likely to be valuable related field courses in the technical communication program, notably Speech 5412, Group and Organizational Communication; 5414, Authority and Power in Task-Oriented Communication; 5421, Quantitative Research in Communication; 5411, Small Group Communication; 5431, The Process of Persuasion; 5412, Group and Organizational Communication; 5414, Authority and Power in Task-Oriented Communication; 5403, Theory Construction and Analysis in Communication; 5421, Quantitative Research in Communication; 5541, Communication in Human Organizations; 5611, Classical Rhetoric; 5615, Introduction to Rhetorical Criticism; 5625, Issues in Communication Ethics; and 8421, Seminar: Communication and Negotiation.

The English Department has a writing program at the Master's level that has been predominantly belletristic in development. While the English Department does reserve the right to deal with more practical writing in the future, the Department Chair, Professor Kent Bales, agrees with our appraisal that no conflict is likely to occur, and, in fact, Professor Bales sees opportunities for future cooperation. (See Professor Bales's letter in Attachment I.) None of the other components of technical communication, such as communication research or coordinating technical illustrations, are a part of any English program. However, several English courses in language and grammar, such as English 5831, American English, and 5851, Structure of Modern English, could be valuable related field courses in the technical communication graduate program. Because the proposed M.S. in Technical Communication requires a high level of competence in mathematics, basic science, and computer science for entrance into the program, it's unlikely that the technical communication program and programs in mass communication, speech communication, and English will compete for the same students.

#### State and Regional Programs

No graduate program in technical communication exists in Minnesota.

A masters degree in Business and Technical Communication is available through the English Department at Iowa State University. In material provided Professor Pearsall for a forthcoming edition of Academic Programs in Technical Communication, the program is described as follows:

M.A. Program in Department of English

The M.A. program in business and technical communication provides courses in Professional and Occupational Writing, Writing Proposals and Grants, Editing Principles and Practice, Teaching Business and Technical Writing, Advanced Communication Theory, History and Theory of Rhetoric, Independent Study, and Special Topics in Business and Technical Writing.

Internships in business and technical communication are available. Students may also substitute a business and technical writing project for a master's thesis. Qualified students can also receive teaching or research assistantships.

Obvious similarities exist between the Iowa State Program and Rhetoric's proposed program. However, Rhetoric's program is the more research and management oriented of the two.

National Programs

Professor Pearsall has just finished collecting information for a new edition of Academic Programs in Technical Communication to be published in 1985 by the Society for Technical Communication. The survey shows that 17 institutions offer 19 master's degrees in technical communication. These 19 degrees include 10 designated as M.A.'s, 7 as M.S.'s and 2 designated differently. Some of the 19, however, are not outright degrees in technical communication but are "concentrations," or "emphases," or "options" within another subject area. Table 1 lists the 17 schools with their degrees.

Table 1. The 17 Institutions with Master's Degrees

<u>Institution</u>	<u>Degree(s)</u>
Boston University (MA)	M.S.
Bowling Green State University (OH)	M.A.
Carnegie-Mellon University (PA)	M.A.
Colorado at Denver, University of (CO)	M.S.
Drexel University (PA)	M.S.
East Carolina University (NC)	M.A.

Eastern Washington University (WA)	M.A., M.S.
Houston-University Park, University of (TX)	M.A.
Iowa State University (IA)	M.A.
Miami University (OH)	M.T.S.C.
Memphis State University (TN)	M.A.
New Mexico State University (NM)	M.A.
Northeastern University (MA)	M.T.P.W.
Oklahoma State University (OK)	M.A.
Pennsylvania State University (PA)	M.A.
Polytechnic Institute of New York (NY)	M.S.
Rensselaer Polytechnic Institute (NY)	M.S. (2)

No Ph.D. in technical communication exists. However, Rensselaer Polytechnic Institute offers a Ph.D. in Communication and Rhetoric that has strong technical communication components.

Because technical communication is a new field, the content from one graduate program to another is likely to vary more than it would in well-established fields. However, certain patterns are beginning to emerge. A recent article in Technical Communication, the journal of the Society for Technical Communication described a prevalent pattern in this way:

Master's degree programs, like their four-year counterparts, prepare students to become professional technical writers and editors and to seek their career opportunities in the national or international market. One program, Miami University's, prepares students to move rapidly beyond entry-level work into communication management....

Like undergraduate programs, Master's degree programs generally require a combination of communication studies and professional electives, along with on-the-job experience provided through an internship. However, courses offered at the graduate level typically require more work and treat more sophisticated concepts than undergraduate courses in the same areas. Moreover, master's programs, while requiring courses in writing, editing, and other practical communication skills, often emphasize communication theory more than do undergraduate programs.

Master's programs, like their undergraduate counterparts, are built upon a core of required communication courses, including technical writing, technical editing, and oral and graphic communication.... Communication theory courses are likely to include not only those in rhetoric, linguistics, communication research methods, and organizational communication, but also more specialized courses, such as bibliographic study in technical and scientific communication from a humanistic perspective, usually by studying the history or philosophy of science, or by exploring the relationships between science or technology and human values.<sup>5</sup>

Rhetoric's proposed graduate program fits this pattern fairly well. It is built around a core of courses in technical communication. It does require an internship and preparation for work in communication management. The program demands a level of competency in basic science, mathematics, and computer science higher than most other existing programs. (For reactions to the proposed program from professors in other technical communication programs, see Attachment J.)

Rhetoric has now had 14 years' experience with its undergraduate program and 11 years with the Master of Agriculture program. Building upon this experience and the talents of key faculty, Rhetoric's master's program should become one of the major programs in the field.

#### E. QUALITY CONTROL

An Advisory Council, composed of 11 members, 7 from business, industry, and government and 4 from education, will be established to evaluate the program, to help place students in internships, and to assist in soliciting outside funding for the program. The Advisory Council would be composed of one member from each of the national professional communication societies in the Twin Cities, plus three at-large members from the local industry and four members of the Rhetoric Department. The following professional societies would be represented:

Society for Technical Communication

International Association of Business Communicators

Women In Communication

American Society for Training and Development

The three at-large members will represent such businesses as Honeywell, Control Data, 3-M, Sperry Computing Systems, Medtronic, The St. Paul Companies, Norwest Information Services, and Cray Research.

The four permanent members from Rhetoric will include the Director of the Graduate Program, the Director of the Undergraduate Program, the Head of the Rhetoric Department, and a Rhetoric faculty member.

The members of the Advisory Council from the professional societies and business will be appointed for staggered 2-year terms.

Internal evaluations of the program will be made by a Graduate Program Committee. This committee will be composed of 2 permanent members, the Director of the Graduate Program and the Department Head, and five temporary members: two representatives from related areas of study (e.g., Training and Development, Speech Communication, Industrial Relations, Management Information Systems, and Communication Resources), two at-large members of the graduate faculty in Rhetoric, and a student member. Temporary members of the Steering Committee will be selected annually. Both of these groups will establish objectives and annually review procedures. They will issue annual reports to the Graduate Program Director, the Department Head, and the Dean of the Graduate School.

Both the Advisory Council and the Graduate Program Committee will look closely at the public service and research benefits of the program. The Graduate Program Committee will regularly conduct follow-up studies of graduates and present the information gathered to the Advisory Council for their advice and counsel. Every five years, a comprehensive program review will be made by a joint committee with representation from both the Advisory Council and the Graduate Program Committee.

There is no evaluating body for Technical Communication programs. However, the Society for Technical Communication, a national organization, does have a Curriculum Development Committee which acts as a liaison between STC and educational programs in technical communication. Dr. Thomas E. Pearsall, Head of the Rhetoric Department, has chaired this Committee since 1971.

In addition, the Council for Programs in Technical and Scientific Communication (CPTSC) holds an annual national meeting with program directors to discuss problems and new directions and to share information about programs throughout the U.S. Professor Pearsall was the first president of this organization, and we have remained active in the CPTSC since its inception in 1974.

#### F. IMPLEMENTATION

The Rhetoric faculty is prepared to offer this M.S. program beginning in the fall of 1986. We will limit the number of students accepted to 20 per year for the first three years.

If the proposed M.S. is approved, the existing M.Ag. program, which currently has an enrollment of 64 students, would be scaled down. Its emphasis would be shifted to agricultural communication, and it would likely enroll fewer than 10 students per year. Therefore, the M.S. and M.Ag combined will make approximately the same demands on University resources as the current M.Ag program.

In 1986-87, the program will take approximately 50% time each for two faculty members and 10% time each for seven other faculty members, approximately, therefore, 1.7 FTE. This represents a total cost at 1985-86 salaries of \$63,407. This is not new money but rather a reassignment of time currently spent on the Master of Agriculture program. The program will also take 50% of the time of a secretary currently hired on non-recurring funds. The position will be made recurring, so the cost will be \$11,424 in new money committed by the Dean of the College. (See Dean Allen's letter in Attachment H.) There will also be reassigned SEE money in the amount of \$3,413. Cost, therefore, will be \$78,244 in the first year. In 1990-91 when the program is in full operation, we'll have 2.05 FTE assigned, making the cost \$87,036 in 1985-86 dollars.

We project 20 students for 1986-87 and 50 students by 1990-91. At typical students loads, the combined tuition and state support for 20 students will be \$237,600, for 50 students \$501,600. Therefore the program will be cost effective.

The nine faculty members who would take part in the program are listed with their qualifications and publications in Attachments A and B. All are currently active advisors in the M.Ag. program. All currently hold examining membership on the graduate faculty. At the appropriate time Rhetoric will submit the required documentation and request the advance of these faculty members to associate membership.

Current library holdings and planned acquisitions are adequate to the needs of the new program.

Notes

1. William C. Stolgitis, Executive Director, Society for Technical Communication, private communication (1985).

2. Kenneth W. Houp and Thomas E. Pearsall, Reporting Technical Information, (New York: Macmillan Publishing Company, 1984), v.

3. C. Gilbert Storms, "Programs in Technical Communication," Technical Communication, 31, No. 4 (1984): 18-19.

4. Ibid., 16.

5. Ibid., 17.

List of Attachments

- A. Graduate Faculty
- B. Bibliography: Technical Communication Faculty
- C. Guide to Technical Communication Program
- D. Sample Plan A Thesis Topics
- E. Sample Plan B Design Projects
- F. Sample Programs for M.S. in Technical Communication
- G. Job Titles of Technical Communication Graduates in Business and Industry
- H. Letter from C. Eugene Allen, Dean, College of Agriculture
- I. Letters from Within the University
- J. Letters from Outside the University

Attachment A  
Graduate Faculty

J. Michael Bennett, Associate Professor

James E. Connolly, Professor

Richard W. Ferguson, Associate Professor

Laurie S. Hayes, Associate Professor

Earl E. McDowell, Professor

Victoria M. Mikelonis, Associate Professor

Thomas E. Pearsall, Professor and Head

David Schuelke, Professor

Arthur E. Walzer, Associate Professor

**J. Michael Bennett**

Associate Professor  
Department of Rhetoric  
University of Minnesota  
202 Haecker Hall  
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(612) 376-4711

**Areas of Specialization:**

Reading; Learning to Read; Secondary School Reading; Learning to Read Efficiently (Adult); Psycholinguistic Aspects of Reading; Testing and Reading Anxiety--Diagnosis, Analysis, Attenuation; Reading and the CRT/VDU; Theoretical Aspects of the Human Brain and the Reading/Thinking Process.

**Education:**

Ed.D. in Reading Education, University of Georgia, 1976  
M.A.E. in English Education, University of Florida, 1969  
B.A.E. in English Education, University of Florida, 1969

**Administrative Experience:**

Coordinator of UM Efficient Reading Program; Doctoral-level committee member through existing Graduate School Associate Membership in College of Education; Six times Chairman, Program Chairman and/or Presentation Chairman at regional and national reading conferences; Sales Training Manager.

**Professional Service:**

Board of Directors of the North Central Reading Association.  
Frequent presenter/attendee at National Reading Conferences.  
Frequent presenter/judge/contributor to student and faculty organizations.  
Reviewer (reading and reading-related) for The Technical Writing Teacher.  
Consultant to academic institutions across the country--especially in college reading and standardized testing.  
Consultant and Seminar leader to 3M, Pillsbury, CDC, Lutheran Brotherhood, Land O'Lakes, FMC, American Institute of Banking, Norwest, Northwestern Life, Casual Corners, NSP, Postal Data Centers, National Practice Institute (Bar Review), Bermans, City of St. Paul, Minneapolis Public Libraries, and UM Continuing Management Education, on a recurring basis. Many other smaller and/or one-time academic, business, professional, and government organizations served on an as-needed basis.

**Major Publications:**

The Nelson-Denny Reading Test, Forms E and F; with James I. Brown, Houghton-Mifflin, 1980.  
Efficient Reading for Managers, American Management Association, 1981.  
Five (5) concurrent refereed journal articles reporting anxiety research; with David Wark, 1980-81.  
Seven other refereed journal articles.  
"Efficient Reading at the "U", MATRIX, 1984.  
"Efficient Reading for Professionals". Three one-hour video tapes, Rarig Center--UM, 1984.  
Four other television and radio broadcasts.

**James E. Connolly**

Professor  
Rhetoric Department  
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(612) 376-4710

**Areas of Specialization:**

Scientific and technical presentation, scientific and technical graphics, organizational communication, conflict resolution and decision-making.

**Education:**

Ph.D. in Speech Communication, University of Minnesota, 1962  
M.A. in Speech Communication, University of Minnesota, 1959  
B.S. in Speech Communication, University of Minnesota, 1958

**Administrative Experience:**

Department: Headship Review Committee (Chmn).  
College: Scholastic Standing Committee (Chmn).  
Faculty Consultative Committee (Elected).  
Presiding Officer of the College Assembly.  
University: Parliamentarian of the University Senate.  
Constitutional Revision Committee.  
Presidential Awards Selection Committee.

**Major Publications:**

Making More Effective Technical Presentations, University of Minnesota, 1980.  
Public Speaking as Communication, Burgess Press, Minneapolis, Minnesota, 1974.  
"A Philosophy for Interpersonal Communication", The Hamline Review, Volume Three, 1970.  
Effective Technical Presentations, 3M Business Press, St. Paul, Minnesota, 1967.

**Series:**

"Conducting Effective Engineering Meetings," series of six half-hour programs planned for completion in the spring of 1985 for the University of Minnesota and AMCEE.

"Making More Effective Technical Presentations," series of ten half-hour programs distributed by the University of Minnesota Continuing Engineering Education and the Association of Media-based Continuing Engineering Education.

**Consultant to:**

Bechtel Power Corporation, Control Data Corporation, General Electric Advanced Reactor Systems, Honeywell, Hughes Corporation, Medtronic, Inc., Pillsbury Corporation, Raymond-Kaiser Engineering, Sperry Corporation.

**Richard W. Ferguson**

Associate Professor  
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University of Minnesota  
202 Haecker Hall  
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(612) 376-7446

**Areas of Specialization:**

Professional and technical writing; composition theory; designing and writing technical manuals; industrial and business film, American culture studies; theories of audience analysis.

**Education:**

Ph.D. in American Studies, University of Minnesota  
M.A. in English, North Dakota State University  
B.S. in English and History, North Dakota State University

**Administrative Experience:**

Chair, Professional Communication Stem, Department of Rhetoric, University of Minnesota.  
Chair, various departmental and college committees.  
Coordinator, writing-across-the-curriculum collaboration.  
Coordinator, closed-circuit television instruction.

**Professional Service:**

Reviewer, The Technical Writing Teacher.  
Seminars for Continuing Management Education and Continuing Education for Women.  
Writing consultant for Data Card, Inc., Pillsbury Research and Development Center, Northern Telecom, Inc., United Way of St. Paul, and Star Technologies.  
Member, National Council of Teachers of English, College Composition and Communication, Association of Teachers of Technical Writing, Society for Technical Communication, American Studies Association, American Culture Association, American Business Communication Association.

**Major Publications:**

"Rhetoric and Forestry Faculty Teach Courses Together," Spectrum, 1982.  
"Item 9: The True Anatomy of an Ambiguity," The Technical Writing Teacher, 1981.  
"Designing Minors in Technical Communication for Technical Students," Technical Communication, Perspectives for the Eighties, 1981.  
"Ethical Imperatives and Technical Writing--Some Turn-of-the-Century Examples," Proceedings, 27th International Technical Communication Conference, 1980.  
"Writing Anxiety: Implications for In-House Training," Proceedings, 27th International Technical Communication Conference, 1980.

**Laurie S. Hayes**

Associate Professor  
Department of Rhetoric  
University of Minnesota  
202 Haecker Hall  
St. Paul, MN 55108  
(612) 373-1784

**Areas of Specialization:**

Rhetorical and communication theory; public speaking; interpersonal communication; small group communication; organizational communication; argumentation; rhetorical criticism of public address.

**Education:**

Ph.D. in Communication Arts, University of Wisconsin-Madison (1980)  
M.A. in Speech, University of Wisconsin-Madison (1968)  
B.A. in Speech Honors, University of Minnesota (1966)  
B.S. in Speech and Theater Arts Education, University of Minnesota (1966)

**Administrative Experience:**

Coordinator, Master of Agriculture Program in Technical Communication, Department of Rhetoric, University of Minnesota (1984-present).  
Assistant to Director, Honors Program, College of Liberal Arts, University of Minnesota (1974-76).  
Numerous departmental, college, and university committees charged with the administration of grants and educational policies and procedures.

**Professional Services:**

Member of and convention program participant for Speech Communication Association, Central States Speech Association, International Communication Association, Speech Association of Minnesota, American Forensic Association, Religious Speech Communication Association, Modern Language Association, Conference on College Composition and Communication.  
Parliamentarian, College of Agriculture (1984-present).  
Communications consultant for numerous political, religious, and professional organizations.

**Teaching Experience:**

Department of Rhetoric, University of Minnesota (1981-present)  
Department of Speech, Gustavus Adolphus College, St. Peter, MN (1977-81)  
Department of Speech-Communication, University of Minnesota (1972-74)  
Department of Speech, University of Wisconsin-Madison (1968-69)

**Major Publications:**

The Communicative Experience, with L. W. Rosenfield and T. S. Frenz, Allyn and Bacon, 1976.  
"Communicative Experience as Game Play," with L. W. Rosenfield and T. S. Frenz, Western Speech, Spring 1976.  
"Teaching Oral Argument to Beginning Public Speakers," Argument in Transition: Proceedings of the Third Summer Conference on Argumentation, Speech Communication Association, 1983.

Earl E. McDowell

Professor  
Department of Rhetoric  
University of Minnesota  
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(612) 373-0817

Areas of Specialization:

Informational interviewing, employment interviewing; cover letter and resume; speaking, listening and writing apprehension; performance appraisal interviewing; and communication style.

Education:

Ph.D. in Speech Communication with focus in Interpersonal and Organizational Communication, University of Nebraska (1974)  
M.A. in Speech Communication, West Virginia University (1971)  
B.S. Ed. Speech, English and History, Clarion State College (1965)

Administrative Experience:

Chair of Speech Division, Department of Rhetoric, 1981-1983.  
Chair, Master of Agriculture Procedures and Policy Committee, 1983-84.

Professional Service:

Editor for Communication Education, 1985.  
Board of Directors, Speech Association of Minnesota, 1979-1985.  
President, Minnesota Association of Colleges and Teachers of Agriculture, 1982.

Major Publications:

"An Exploratory Study of Teacher's Perceptions of Their Communication Style When Interacting with Students," Speech Association of Minnesota Journal, 1984.  
"Communication Needs of Agriculture, Home Economics and Forestry Alumni: Implications for Technical and Professional Communication Courses," NACTA, with V. Winkler, in press.  
"Perceptions of the Ideal Cover Letter and Resume," Proceedings, 32nd International Technical Communication Conference, with T. Pearsall, (1985), in press.  
"The New Tools: A Study of Writers' Use of Word Processors," 32nd International Technical Communication Conference, with C. Stenborg, (1985), in press.  
"Faculty Members' Perceptions of Information Adequacy and Communication Relationships in Their 'World of Work,'" Journal of Applied Communication Research, in press.  
"Administrators and Faculty Members' Perceptions of the Performance Appraisal Interview," Journal of Applied Communication Research, in press.  
"A Communication Assessment Study of United States and International Graduate Students from the Colleges of Agriculture, Forestry and Home Economics," NACTA, Journal, with C. Chung, 1982.  
"Profiles of 1981 Technical Communication Students," Journal of Technical Communication, with J. Frissell and V. Winkler, 1982.  
"Academic Programs in Technical Communication," Society for Technical Communication, with T. Pearsall and F. Sullivan, 1981.

Victoria Winkler Mikelonis

Associate Professor  
Department of Rhetoric  
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Areas of Specialization:

Electronic publishing; computers and the writing process; models and the writing process; rhetorical invention, composition theory; designing and writing user documentation; reader protocol research.

Education:

NEH Post-doctoral Fellowship. Studied Rhetorical Invention and the Composing Process with Richard E. Young. Carnegie-Mellon University (1978-79)  
Ph.D. in Language and Literature, Indiana University of Pennsylvania (1975)  
M.A. in Language and Literature, Indiana University of Pennsylvania (1971)  
B.A. in English, Alliance College (1969)

Administrative Experience:

Director of Technical Communication Programs, Department of Rhetoric, University of Minnesota (1981-present).  
Coordinator of Communication for Engineers Courses, Humanities Division, University of Pittsburgh-Johnstown (1971-78).

Grants:

Kellogg Foundation Grant of \$1.9 million over a 5-year period for a Telecommunication Center on the St. Paul Campus (1985-80). Written with Marcia Hyatt.  
IBM Grant of hardware and software to develop courseware integrating work stations in the classroom; (1985-87) for Rhetoric Department-COA proposal valued at \$49,500.  
Equipment loan from CPT Corporation (1983-85) valued at \$28,000.

Professional Service:

Editor, The Technical Writing Teacher, sponsored by The Association of Teachers of Technical Writing, 1983-present. Executive Board member (ad hoc), Association of Teachers of Technical Writing, 1983-present.  
Member, NCTE Committee on Scientific and Technical Writing, 1984-present.  
Advisory Board member, PRE-TEXT, edited by Victor Vitanza, 1979-81.

Major Publications:

"Procedures for Designing and Writing Training Materials," with D. Ferguson, 1985 ITCC Proceedings, 1985.  
"Communication Needs of Agriculture, Forestry and Home Economics Graduates," with E. McDowell, NACTA Journal, in press.  
"The Role of Models in Technical Writing," New Essays in Scientific and Technical Writing, 1983. Won the NCTE Award for best article in Theory or Philosophy of Technical Writing for 1984.  
"Creative Design and Rhetorical Inquiry: Report Writing Strategies," A Guide for Writing Better Technical Papers, IEEE Press, 1987.  
"Modes of Organization," Research in Technical Communication, Greenwood press, 1985.

**Thomas E. Pearsall**

Professor and Head  
Department of Rhetoric  
University of Minnesota  
202 Haecker Hall  
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**Areas of Specialization:**

Scientific and technical writing; audience analysis; writing in business and industry; writing across the curriculum.

**Education:**

Ph.D. in English, University of Denver (1960)  
M.A. in English, University of Texas (1956)  
A.B. in English (magna cum laude), Colgate University (1949)

**Administrative Experience:**

Head, Department of Rhetoric, University of Minnesota (1979-present).  
Founder and first coordinator of the Technical Communication Program, Department of Rhetoric, University of Minnesota (1971-79).  
Deputy Head of the English Department, United States Air Force Academy (1966-69).

**Professional Service:**

Founder and President, Council for Programs in Technical and Scientific Communication, 1974-77.  
Fellow of the Society for Technical Communication, 1979.  
Associate Editor, Technical Communication; member, Executive Board, Technical Writing and Communication; member, Editorial Board, The Technical Writing Teacher.  
Membership in and served on many committees in both participative and leadership roles for the following organizations: Association of Teachers of Technical Writing, Conference on College Composition and Communication, Council for Programs in Technical and Scientific Communication, National Council of Teachers of English, Society for Technical Communication.

**Major Publications:**

Audience Analysis for Technical Writing, The Glencoe Press, 1969.  
Reporting Technical Information, with K. Houpp, Macmillan, 1968 (Fifth edition, 1984).  
Teaching Technical Writing: Methods for College English Teachers, Society for Technical Communication, 1975.  
How to Write for the World of Work, with D. Cunningham, Holt, Rinehart and Winston, 1978 (Second edition, 1982; third edition, in press).  
Academic Programs in Technical Communication, with F. Sullivan and E. McDowell, Society for Technical Communication, 1981.  
Also, publications in Technical Communication, Technical Writing Teacher, and ADE Bulletin.

David Schuelke

Professor  
Department of Rhetoric  
University of Minnesota  
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St. Paul, MN 55108  
(612) 373-0817

Areas of Specialization:

Diffusion of innovations; organizational communication and research;  
dissemination of information.

Education:

Ph.D. in Communication, Purdue University, 1969  
M.A. in Rhetoric, University of Illinois, 1964  
B.S. in Journalism, Northwestern University, 1961

Grants:

Pinchot Institute for Conservation Studies, USDA Forest Service contract (43-246 B-O-34), programming for technology transfer liaison, 1980.  
National Science Foundation contract (NSF-OM 77 SP-0873) for Development of Evaluation Model for Electronic Information Exchange Systems Operational Trials, 1977.  
Control Data Corporation grant for evaluation of technology inventory project and preparation of technology transfer manuscript, 1976-77.

Administrative Experience:

Research Director, Information Project and Adjunct Professor, Humphrey Institute of Public Affairs, University of Minnesota (1983-present).  
Coordinator, Laboratory for Research in Scientific Communication, University of Minnesota (1973-80).  
Director of Academic Development, Director of University Communication, Governors State University, Park Forest, IL (1970-72).

Professional Service:

Consultant to The Upjohn Company, 3M Company, Triton Corporation (NIOSH), 1983-present.

Major Publications:

Communication for the Contemporary Classroom, with B. Lieb-Brihart and W. J. Seiler, Holt, Rinehart and Winston, 1984.  
Information Technologies in Minnesota Organizations, with H. Cleveland, Minnesota Wellspring, 1984.  
"An Exploratory Program for Providing Scientific and Technical Information for the Minnesota State Legislature: Background and Beginning Problems," Technology Transfer Society International Symposium, 1983.  
"Impacts of Information Technology on Organizational Wellness," Conference on Communication Therapy, 1984.  
"Minnesota Organizations and Changing Resource Needs," American Educational Research Association, April, 1985.

**Arthur E. Walzer**

Associate Professor  
Department of Rhetoric  
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**Areas of Specialization:**

Rhetorical criticism; rhetorical theory; ethics and technical communication; eighteenth-and nineteenth-century intellectual history.

**Education:**

Ph.D. in English, University of Minnesota (1975)  
M.A. in English, University of Minnesota (1969)  
B.A. in English, Fordham University (1966)

**Grants:**

Educational Development Grant, 1975  
Small Grants, 1981, 1983

**Administrative Experience:**

Chair, Required Communication Courses, Department of Rhetoric (1983-85).  
Chair, Freshman Writing Division, Department of Rhetoric (1981-83).

**Professional Service:**

President, Minnesota Council of Teachers of English, 1982-83.  
Vice-President, Program Chair, Minnesota Council of Teachers of English, 1981-82.  
Chair, Revising Conceptions About Writing, Conference on College Composition and Communication, 1985.  
Referee for The Technical Writing Teacher, 1984-85.  
Memberships in Danforth Foundation, International Society for the History of Rhetoric, Minnesota Council of Teachers of English, Modern Language Association, National Council for Teachers of English, Speech Association of America.

**Major Publications:**

"Articles from the 'California Divorce Project': A Case Study of the Concept of 'Audience,'" College Composition and Communication, 1985.  
Teaching Technical Writing: Methods for College English Teachers, with T. E. Pearsall, Society for Technical Communication, forthcoming.  
"Ethos, Technical Writing, and the Liberal Arts," The Technical Writing Teacher, 1981.  
"Counterstatement: Response to Sharon Crowley, 'Of Gorgias and Grammatology,'" College Composition and Communication, 1982.  
"Business Writing and the Liberal Arts Tradition," ADE Bulletin, 1979.

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- \_\_\_\_\_. "Literary versus Scientific Reading in College--A Comparative Analysis," with David M. Wark, Reading in the Disciplines. Yearbook of the American Reading Forum, Volume 2, 1982.
- \_\_\_\_\_. "The Secondary School Student," Efficient Reading for Managers. Education for Management, Division of American Management Association; Watertown (Boston), Massachusetts, 1981, pp. 104-105.
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- \_\_\_\_\_. "The Efficient Reading Program at the University of Minnesota--Purpose, Pedagogy, Performance," Toward Better Teaching. Volume 12, Number 3, Spring, 1979.
- \_\_\_\_\_. "The Measurement of Text Anxiety in the Reading Center," with David M. Wark, Reading World. Volume 20, Number 3, March, 1981.
- \_\_\_\_\_. "Reducing Test Anxiety Effects on Reading Comprehension of College Students," with David M. Wark, Comprehension: Process and Product. Yearbook of the American Reading Forum, Volume 1, 1981.
- \_\_\_\_\_. "The Effects of Anxiety on Reading Comprehension," with David M. Wark, College and Adult Reading. Yearbook of the North Central Reading Association, Volume 10, 1980.
- \_\_\_\_\_. "Some Effects of Anxiety on University Students," with David M. Wark, College and Adult Reading. Yearbook of the North Central Reading Association, Volume 10, 1980.
- \_\_\_\_\_. "Test Anxiety of College Students--Test of a Model," with David M. Wark, Perspectives in Reading Research and Instruction. Yearbook of the National Reading Conference, Volume 29, 1980.

- Bennett, J. Michael. "Some Thoughts on the Energy Crisis," with N. A. Bush, Efficient Reading for Managers. Education for Management, Division of American Management Association; Watertown (Boston), Massachusetts, 1981, pp. 116-118.
- \_\_\_\_\_. "Note-taking Practices of Modern College Students," with Robert A. Palmatier, The Journal of Reading. Volume 18, Number 3, December, 1974.
- \_\_\_\_\_. "Folk Speech and Legends of the Trade of House-Painting," Southern Folklore Quarterly. Volume 33, Number 4, December, 1969.
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\_\_\_\_\_. "Adapting and Testing Audio-Taped Systematic Desensitization for Public Speaking Students," with Carlene McDowell, Speech Association of Minnesota Journal. 6 (June 1979), pp. 18-23.

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- \_\_\_\_\_. "The State of Speech in Australia and New Zealand: A Report of the Communication Association of the Pacific," with Carlene McDowell, Speech Association of Minnesota Journal. 7 (June 1980), pp. 6-10.
- \_\_\_\_\_. "Evaluation of a Bachelor's Program in Technical Communication--Results of a Questionnaire," with L. D. Schuelke and C. Chung, Journal of Technical Writing and Communication. 10 (Summer 1980), pp. 195-201.
- \_\_\_\_\_. "A Study of Teacher Immediacy, Teaching Effectiveness and Student Attentiveness at the Junior High and Senior High Levels," with C. McDowell and Hyerdahl, Speech Association of Minnesota Journal. 8 (June 1981), pp. 17-23.
- \_\_\_\_\_. "A Case Study--Faculty Utilization of Instructional Methods and Media," with C. Chung, M. Frost, and W. Grabow, National Association of Colleges and Teachers of Agriculture Journal. 25 (June 1981), pp. 31-34.
- \_\_\_\_\_. "Profiles of 1981 Technical Communication Students," with J. Frissell, and V. Winkler, Journal of Technical Communication. 29 (Second Quarter 1982), pp. 11-18.
- \_\_\_\_\_. "A Communication Assessment Study of United States and International Graduate Students from the Colleges of Agriculture, Forestry and Home Economics," with C. Chung, NACTA Journal. 26 (March 1982), pp. 15-18.
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- \_\_\_\_\_. "A Communication Assessment Study of Undergraduate Students in the College of Agriculture," with Linda Baney, NACTA Journal. 27 (September 1983), p. 47.
- \_\_\_\_\_. "A Survey of Communication Skills Needed and Communication Methods used in the Dissemination of Development Information," with Linda Baney, Transfer of Technology, 8 (1983), pp. 59-67.
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- \_\_\_\_\_. "An Exploratory Study of Teachers' Perceptions of Their Communication Style When Interacting with Students," Speech Association of Minnesota Journal, 11 (June 1984), pp. 14-21.

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- \_\_\_\_\_. "A Positive Paralinguistic Structure and Its Effects on Attitude Change and Judgment of Personality Dimensions," with Carlene McDowell, Resources in Education, accepted by ERIC 1974, pp. 1-15, abstract in Resources in Education, 1974.
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- \_\_\_\_\_. "The Role of Self-Image on Reading Rate and Communication Achievement," with James I. Brown, Reading Improvement. 16 (Spring 1979), pp. 22-28.
- \_\_\_\_\_. "An Abstract of an Investigation of Innovation Variables in a Technology Inventory," and others, abstracted in Resources in Education, 1979.
- \_\_\_\_\_. "An Investigation of Sex Roles, Dimensions of Interpersonal Attraction and Communication Behavior in a Small Group Communication Exercise," with Carlene McDowell, abstracted in Resources in Education, November 1979.
- \_\_\_\_\_. "A Multivariate Study of Teacher Immediacy, Teaching Effectiveness, and Student Attentiveness at the Junior High and Senior High Level," with C. McDowell and J. Hyderdahl, abstracted in Resources in Education, 1981.
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McDowell, Earl E. "An Investigation of Source and Receiver Apprehension between United States and Australian Students at the High School and College Levels," with C. McDowell, G. Pullan, and S. Lindberg, abstracted in Resources in Education, 1981.

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\_\_\_\_\_. "Teaching Assistants' Perceptions of Formal and Informal Communications with Students," with Machiko Tomita, abstracted in Resources in Education, February, 1982, pp. 1-24.

\_\_\_\_\_. "Academic Programs in Technical Communication," with T. Pearsall and F. Sullivan, Society for Technical Communication, Washington, D. C., 1981, pp. 1-36.

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\_\_\_\_\_. "The Relationship of 17th Century Empiricism to General Semantics," Southern Speech Journal, 1970.

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- \_\_\_\_\_. Communication for the Contemporary Classroom, with Barbara Lieb-Brilhart and W. J. Seiler. Holt, Rinehart and Winston, 1984.
- \_\_\_\_\_. Information Technologies in Minnesota Organizations, with Harlan Cleveland. Minnesota Wellspring, December, 1984.
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- \_\_\_\_\_. Review of Business and Technical Writing: An Annotated Bibliography of Books, Gerald J. Alfred, Diana C. Reep, and Mohan R. Limaye, Rhetoric Society Quarterly. 12 (1982), pp. 105-109.
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- \_\_\_\_\_. "Communication Needs of Agriculture, Forestry and Home Economics Graduates," with Earl E. McDowell, NACTA Journal. In press.
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Winkler, Victoria M. "Word Processors in Technical Writing: Literature Review 1977-84," with Vicki Gervickas, The Technical Writing Teacher. Vol XII, no. 1 (Fall 1984). In press.

\_\_\_\_\_. "The Role of Models in Technical Writing," New Essays in Scientific and Technical Writing. Paul Anderson, John Brockman, Carolyn Miller, eds. Baywood Publishing Company, 1983. Won the NCTE Award for best article in Theory on Philosophy of Technical Writing for 1984.

\_\_\_\_\_. "Analogical Acts as Conceptual Strategies in Science, Engineering and the Humanities," Delaware Valley Writing Conference Proceedings. Department of Humanities-Communication, Drexel University, Philadelphia, PA, (November 1980).

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GUIDE TO TECHNICAL COMMUNICATION PROGRAMS

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This handout is a guide to the courses and procedures needed to complete the Technical Communication Programs successfully. Students and advisors alike should follow it carefully.

In the 1980 Spring Quarter, a slightly revised Technical Communication Program went into effect. Students who had registered in Technical Communication by Spring quarter 1980 may graduate using either the revised or the old program as shown in the 1979/81 College of Agriculture Bulletin. Students who became Technical Communication majors after Spring Quarter 1980 must follow the revised program as shown in this handout.

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Petitions: If you wish to petition for substitution of courses or for exemption from requirements, see Petition Procedures in College of Agriculture Bulletin.

#### APPLICATION FOR GRADUATION

Generally, you must apply for graduation at least 2 quarters before you expect to complete your degree requirements. (See Requirements for Graduation in the College of Agriculture Bulletin.)

#### CAREER DEVELOPMENT AND PLACEMENT

A college service offers help with career development and placement. (See Career Development and Placement in College of Agriculture Bulletin.)

#### DEGREES OFFERED BY COLLEGE OF AGRICULTURE

Baccalaureate Degrees--Most of the curricula of the college lead to a bachelor of science degree. Several majors and degrees are offered jointly or in cooperation with other colleges in the University:

Agricultural Business Administration--College of Business Administration (bachelor of agricultural business administration)

Agricultural Education--College of Education (bachelor of science)

Agricultural Journalism--School of Journalism and Mass Communication (bachelor of science)

Landscape Architecture--Institute of Technology (bachelor of landscape architecture)

Master of Agriculture Degree--In addition to the above, the College of Agriculture offers the master of agriculture degree, a professional, non-research-oriented degree designed for those who seek post-baccalaureate education to further advance their professional competence. For further information, obtain the brochure, The Master of Agriculture from the College of Agriculture Office, 277 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108.

Graduate Degrees--The departments in the College of Agriculture, through the Graduate School, also offer the master of science and the doctor of philosophy degrees. For information about these programs, see the Graduate School Bulletin.

#### ADMISSION

Requirements for admission to the College of Agriculture for high school graduates and transfer students are explained below. Information

for adult special students and senior citizens is also included. For requirements and procedures concerning nonresident admission, admission with advanced standing, adult special admission, and admission by examination, see the General Information Bulletin of the University (available through the Office of Admissions and Records, 130 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108).

Send requests for information to the College of Agriculture Office, 277 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108, or call (612) 373-0922.

High School Graduates--If you are a high school graduate in the upper 60 percent of your class, you may enter the college if you have completed 12 units in grades 10 through 12. For those 12 units you should choose from offerings in English, social studies and history, mathematics, the natural sciences, and foreign languages. At least 1 unit of the 12 must be in natural science or agriculture, and 3 must be in mathematics, including the following: 1 unit in plane geometry, and 1 unit in higher algebra or its equivalent.

Participation in high school vocational agriculture activities is recognized as excellent preparation for the study of agriculture at the collegiate level. Rural background and experience, however, are not required for admission to the college.

You may seek exception to the above requirements if you can provide information indicating promise of academic success.

Transfer Students--You may apply for admission to the College of Agriculture from other colleges or universities. You may be accepted if you meet the entrance requirements of the college and of the major you wish to enter. General requirements for entrance by transfer include a minimum cumulative grade point average of 2.00 (where A= 4.00, B= 3.00, C= 2.00, D= 1.00, F or no credit = 0.00) and a mathematics background at least equal to that required of high school graduates. (See above.)

You may seek exception to these requirements if you can provide information indicating promise of academic success.

After you have applied for transfer, the Office of Admissions and Records and the college office will evaluate all previous college work according to the standards of the University and the College of Agriculture. You will then be provided with a Record of Advanced Standing showing how your previous work has been evaluated.

As a transfer student, you must complete all specific courses and area distribution requirements of the college regardless of the number of credits accepted for transfer. Therefore, if you begin your degree work elsewhere intending to transfer later, you should carefully plan your pretransfer program to meet as many College of Agriculture requirements as possible. Refer to the College of Agriculture Bulletin, Section II, Curricula in Agriculture, and note especially the all-college requirements in the College of Agriculture Bulletin.

Transfer of Credit in Agricultural Courses Taken at Minnesota Non-Land-Grant Institutions--Credit for courses in agriculture taken at Minnesota non-land-grant institutions is limited to introductory courses or those similar to the introductory courses offered at the University. If you seek credit for advanced courses in agriculture, you should take examinations for credit in these courses.

Transfer of Credit from Continuing Education and Extension--To transfer credits and grades for courses taken through Continuing Education and Extension, submit a transcript of these courses to the Office of Admissions and Records for evaluation and inclusion on your record in the College of Agriculture.

Change of College within the University--To transfer to the College of Agriculture from another collegiate unit of the University, you must meet the entrance requirements of the college. Apply for transfer at the Office of Admissions and Records on the campus where you are currently registered or where you last attended classes.

Adult Special Students--If you wish to register for particular courses to meet particular needs and are not interested in working toward a degree, you may enter the college as an adult special. Both college and department approval are required. Normally, adult special students are not enrolled for a long time, but only as long as necessary to acquire the specific training desired.

If you enter the college as an adult special student with the intention of transferring later to the Graduate School, you should be aware that there are restrictions on the amount of adult special credits that may be transferred to a graduate program. Consult the Graduate School Bulletin for information.

Senior Citizens--Minnesota residents 62 years or older are admitted to all University of Minnesota classes on a space-available basis, provided they have completed specified prerequisites. If a course is taken without credit, there is no fee unless materials or other special charges are involved. If a course is taken for credit, there is a fee of \$2 per credit as well as any materials or special charges. Eligible persons should check with the Office of Admissions and Records for more information.

#### FINANCIAL AID

Freshmen--Entering freshmen interested in loans, scholarships, or grants should contact their high school guidance office for application forms. Forms are also available from the Office of Student Financial Aid, 190 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108. (Non-Minnesota residents must write directly to the Office of Student Financial Aid.) One application ensures consideration for all types of financial assistance that the University offers--scholarships, loans, educational opportunity grants, and college work-study.

Prospective freshmen must apply through high school counselors or principals and have their applications mailed to Office of Student Financial Aid by March 1. Late applications receive lower priority for financial assistance. In addition to this application, students must have their parents or guardians submit a statement of family financial resources. Forms are revised annually, so students should be sure that they have the most recent form before filling one out.

For more information about financial aid, consult the University's General Information Bulletin.

Presently Enrolled Students, Transfer Students--Undergraduate and graduate students may obtain application forms and information by contacting a University financial aid office. Applications should be completed by March 1.

## TECHNICAL COMMUNICATION MAJOR PROGRAM

Technical communicators apply modern techniques to the dissemination of technical knowledge in industry, business, education, and government. Technical communicators write for audiences that range from the scientist to management to the consumer of the products and services provided by technology. To accomplish their objectives, technical communicators must first be generalists, well acquainted with the basic principles of science, engineering, the social sciences, and management practices. In addition, they must be familiar with and must be able to apply the basic principles of writing and editing, graphics, communication research and theory, and oral communication. The interdisciplinary technical communication curriculum is designed to provide the necessary fundamental theory for application in these areas within a program flexible enough to allow you to plan a course of study appropriate to your career goals.

As a graduate of the program, you may be employed in government, education, and organizations in such fields as agriculture, communication, computer science, electronics, research and development, and transportation. You may pursue a career as a writer-editor, an extension specialist, or a training or communication specialist.

If you plan to pursue a graduate communication program, you should consult with your adviser about selection of appropriate course work early in your program.

## Major Requirements

Students majoring in the undergraduate program in technical communication must complete the requirements listed below. Course substitutions in Categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of the Department of Rhetoric.

## A. Communication, Language, Symbolic Systems--27 credits minimum

Choose one of the following:

- CSci 3101--Introduction to FORTRAN Programming (4)
- CSci 3102--Introduction to Pascal Programming (4)
- CSci 3104--Introduction to Programming and Problem Solving (4)
- AgET 3030--Introduction to Problem Solving with Computers (4)
- MIS 3300--Introduction to Computers and Management Information Systems (4)

Required Courses:

- Math 1111--College Algebra and Analytical Geometry (5)
- Rhet 1101--Writing to Inform and Persuade (4)
- Rhet 1104--Library Laboratory (1) S-N
- Rhet 1151--Writing in Your Major (4)  
(Special Section for Majors Fall '86 Walzer)
- Rhet 1222--Public Speaking (4)
- Rhet 1500--Introduction to Word Processing (2) S-N
- Rhet 3562--Writing in Your Profession (4)

- B. Physical and Biological Sciences--18 credits minimum, to be selected from the following courses:
- BioC 1301--Elementary Biochemistry I (5)
  - BioC 1302, 1303--Elementary Biochemistry II and Laboratory (3,2)
  - Biol 1009--General Biology (5)
  - Biol 1103--General Botany (5)
  - Biol 1106--General Zoology (5)
  - Bot 1009--Minnesota Plant Life (4)
  - Bot 1012--Plants Useful to Man (4)
  - Chem 1004--General Principles of Chemistry (5)
  - Chem 1005--General Principles of Chemistry (5)
  - EBB 3004--Fundamentals of Ecology (4)
  - GCB 3022--Genetics (4)
  - Geo 1001--Physical Geology (5)
  - Geo 1002--Historical Geology (4)
  - Geo 1111--Introductory Physical Geology (5)
  - MicB 3103--General Microbiology (5)
  - Phs1 1002--Human Physiology (4)
  - Phys 1001, 1005--The Physical World and Laboratory (4,1)
  - Phys 1041, 1045--Introductory Physics and Laboratory (4,1)
  - Phys 1042, 1046--Introductory Physics and Laboratory (4,1)
- C. The Individual and Society--14 credits minimum (specific requirements must be taken A-N; electives may be taken S-N)  
Suggested courses for category C include the following:
1. Analysis of Human Behavior and Institutions
    - Afro 1025, 1036, 3061, 3062, 3072, 3091, 3092, 3098, 5401, 5402
    - AgEc 1020, 1030, 3070, 5720
    - Anth 1102, 1115, 3131, 3211, 3223, 3241, 3251, 3261, 3263, 3281, 3291, 3292, 3501, 3511, 3521, 3531, 3532, 3533, 3591, 5112, 5115, 5116, 5117, 5131, 5141, 5151, 5152, 5153, 5154, 5155, 5161, 5162, 5165, 5173, 5174, 5258
    - Chic 1105, 1106, 1107, 3211
    - Chn 1032
    - Clas 1012, 1015, 1019, 3071, 3072, 3073
    - Econ 1001, 1002, 1004, 1005, 3001, 3002
    - Fren 3501, 3502
    - FSoS 1001, 1002, 1025, 3015
    - Geog 1301, 3101, 3131, 3141, 3161, 3181, 3211, 3212, 3213, 3221, 3321, 3331, 3341, 3343, 3351, 3361, 3371, 3378, 3381, 5811
    - Ger 3501, 3511, 3512, 3513
    - Indc 1504, 1506, 3501, 3502, 3506, 3507, 3511, 3533
    - Ital 3501, 3502, 3555
    - InR--all courses except 3091, 5831, 5901, 5902, 5903
    - Jour 5601, 5721
    - Jpn 1032
    - JwSt 1034, 3126, 3142, 3143, 3521
    - Ling 1001, 1005, 3111
    - MidE 1036, 3001, 3005
    - Pol 1001, 1025, 1026, 1027, 1031, 1041, 1051, 3306, 3308, 3309, 3659, 3661, 3765, 3766, 3771, 3773, 3825, 3826

Psy 1001, 1004, 1005, 3101, 3201  
 RelS--all courses except 5890, 5960, 5970, 5980  
 Rhet 3280, 5175  
 Russ 3106, 3501, 3502, 3503  
 Scan 1504, 3501  
 Slav 1501, 3501, 3502, 3503  
 Soc 1001, 1002, 1651, 3102, 3352, 3401, 3501, 3503, 3551,  
 3601, 3957  
 Span 1501, 1502, 1503, 3501, 3502  
 Spch 5611, 5616, 5617, 5618  
 SSci 3402  
 WoSt 1005, 1006, 1977, 3300, 3301

2. Development of Civilization: Historical and Philosophical Studies (You must complete at least one course from this area.)

Afro 1015, 1441, 1442, 3001, 3002, 3003, 3011, 3012,  
 3081, 3082, 3340, 3401, 5001  
 AgEc 3040  
 AgEd 1010  
 Amin 1771, 3111, 3112, 3151  
 AmSt--all courses except 1920, 3920, 3970, 5920  
 ANEJ 3117, 3501, 3502, 3505  
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 3007, 3008  
 Econ 3021  
 Hist--all courses listed under the heading "Introductory"  
 in the CLA Bulletin plus 3200, 3434, 3435, 3707,  
 3708, 3821, 3822, 3823, 5171, 5172, 5173, 5281,  
 5282, 5283  
 HSci--all courses except 5970, 5990  
 Hum--all courses except 3014, 3044, 3055, 3071, 3201, 3202,  
 3401, 3403, 3755, 3910, 3970, 3980, 5030, 5063, 5910  
 Indc 3411  
 Phil 1002, 1003, 1004, 1410, 3001, 3003, 3004, 3005, 3105,  
 3302, 3303  
 Rhet 1301, 1302, 1303, 1310, 1311, 3370, 3375, 3381

D. Literature, Humanities, and Fine Arts--16 credits minimum (may be taken S-N)

Suggested courses for category D include the following:

Afro 3101, 3102, 3105, 3108, 3301, 5595, 5597  
 Amin 3221, 3242  
 AmSt 1101, 1102, 1103  
 ArtH--all courses except 5895, 5950, 5960, 5970, 5990  
 ArtS 1401  
 Chic 3507, 3508, 3510, 3511, 3513  
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3081, 3082,  
 3083, 3145, 5102, 5103  
 CLit--all courses  
 Dsgn 1501, 5505  
 Engl--all courses except 1005, 3060, 3851, 3910, 3920, 3931,  
 3932, 3940, 3950, 3963, 3970, 3980, 5815, 5821, 5831,  
 5843, 5851, 5860, 5871, 5876, 5910, 5920, 5940, 5950

Foreign Languages--all advanced courses that deal directly with literature and that are not listed under category C may be used

Hum--all courses except 3009, 3044, 3061, 3099, 3204, 3211, 3212, 3401, 3403, 3501, 3502, 3503, 3910, 3970, 3980, 5030, 5910

LA 1022

MidE 3101, 3201, 3202, 3205, 3601, 3602, 5311, 5405, 5406, 5501, 5502, 5503, 5601, 5602

Mus 1603, 1604, 1605, 1804, 3708, 3709, 3757, 3758, 3791, 3807, 3808, 5601, 5602, 5603, 5604, 5605, 5611, 5631, 5632, 5633, 5634, 5635, 5636, 5637, 5638, 5639, 5641, 5642, 5643, 5661, 5662, 5663, 5664, 5665, 5701, 5702, 5704, 5705, 5707, 5804

Rhet--humanities courses: 1301, 1302, 1303, 1310, 1311, 3370, 3375, 3381

Th 1101, 1102, 1405, 5171, 5172, 5173, 5177, 5178, 5181, 5182, 5186

WoSt 3501, 3502, 5011

Because of the numerous changes that occur in course numbers, titles, and content, a complete list of courses that fulfill each of the above categories is difficult to maintain. Therefore, for approval of courses that do not appear on the above lists, consult the college office.

#### E. Professional Courses in the Major--70 credits minimum

Students majoring in technical communication must complete a total of 70 credits in category E with a minimum number in each competency area listed below. Required courses in certain competency areas are identified. Courses identified as recommended may be taken with the approval of your adviser. Courses not listed may be taken only with the approval of the director of the Technical Communication Program or, in his or her absence, the head of the Department of Rhetoric.

Writing and Editing--14 credits minimum

No Required Courses

Recommended Courses:

Rhet 3130--Publicity (4)

Rhet 3159--Publications Editing (4)

Rhet 3572--Grammatical Editing for Technical Writers (2)

Rhet 5561--Advanced Editing Seminar:

Electronic Publishing (2)

Rhet 5565--Writing for Publication (4)

Rhet 5571--Writing for Special Purposes:

Newsletter (2)

Grant and Proposal Writing (2)

Policies and Procedures Manuals (2)

Rhet 5581--Document Design (4)

Comp 1027--Intermediate Expository Writing (4)

GC 1425--Business Correspondence (4)

## Oral Communication--8 credits minimum

## Required Courses:

- Rhet 5257--Scientific and Technical Presentations (4)
- Rhet 5258--Interviewing: Dynamics of Face-to-Face Communication (4)

## Recommended Courses:

- Rhet 3254--Advanced Public Speaking (4)
- Rhet 3266--Communication, Discussion in Small Group Decision Making (4)
- Rhet 3270--Speech: Special Problems (1-5)
- Spch 3201--Introduction to Broadcasting Production (4)
- Spch 3203--Radio Production (4)
- Spch 5411--Small Group Communication (4)
- Spch 5431--The Process of Persuasion (4)

## Visual Communication--7 credits minimum

## Required Course:

- Ind 1600--Drafting (3)

## Recommended Courses:

- Rhet 3101--Functional Photography (4)
- Dsgn 1521--Color and Design (4)
- Dsgn 1523--Visual Presentation (4)
- Dsgn 1525--Two-Dimensional Design (4)
- GC 1536--Introduction to Commercial Art (3)
- Ind 1602--Drawing and Design (3)
- Ind 1620--Graphic Communication I (3)
- Ind 1622--Graphic Communication II (3)
- Ind 3120--Graphic Communication: Intermediate (Applied Photography) (3-9)
- Ind 3121--Graphic Communication: Advanced (3)

In addition to these recommended courses, there are many University courses in art, cinematography, television production, and photography that would satisfy this requirement. If you have a special interest in any of these areas, consult with your adviser.

## Communication Systems--7 credits minimum

## No Required Courses

## Recommended Courses:

- Rhet 5150--Direction of Training in Business and Service Organizations (4)
- Rhet 5165--Studies in Organizational Communication, Conflict, and Change (4)
- Rhet 5170--Managerial Communications (4)
- Rhet 5400--Dissemination and Utilization of Information (4)
- Rhet 5531--Technical Writing Course Development (2)
- Rhet 5600--Transfer of Technology (4)
- Spch 3111--Leadership Communication (3)
- Spch 5412--Group and Organizational Communication (4)
- Spch 5414--Authority and Power in Task-Oriented Communication (4)

## Communication Theory and Research--7 credits minimum

## Required Courses:

Rhet 1220--Principles of Human Communication (4)

Rhet 3700--Rhetorical Theory (4)

## Recommended Courses:

Clas 3045--Basic Program in Technical Terminology and  
Word Study (2)

Engl 3851--The English Language (4)

Engl 5815--History of English Language (4)

Engl 5831--American English (4)

Engl 5851--Structure of Modern English (4)

Ling 3001--Introduction to Linguistics (5)

Ling 3601--Introduction to Historical Linguistics (4)

Rhet 5500--Research in Communication Strategies (4)

Rhet 5541--Readings in Scientific &amp; Technical Prose (2)

Spch 5403--Theory Construction and Analysis in  
Communication (4)

Spch 5421--Quantitative Research in Communication (4)

Spch 5611--Classical Rhetoric (4)

Stat 5021--Statistical Analysis I (5)

Stat 5022--Statistical Analysis II (5)

## Philosophy and History of Science and Technology--7 credits minimum

## No Required Courses

## Recommended Courses:

HMed 3002--Medicine and Disease in History: 17-19th  
Centuries (4)

HMed 3003--Medicine and Disease in History: Modern (4)

HSci 1712--Technology and Western Civilization: Medieval  
(4)HSci 1713--Technology and Western Civilization: Modern  
(4)HSci 1811--Introduction to History of Science: Ancient  
Science (4)HSci 1812--Introduction to History of Science: Medieval  
Science (4)HSci 1813--Introduction to History of Science: Modern  
Science (4)

Phil 5601--Philosophy of Science (4)

Phil 5615--Minds, Bodies, and Machines (4)

Any course in the history of science and technology (HSci) may  
be used to fill the recommended portion of this  
requirement.

## Other Required Courses--6 credits minimum

Rhet 3582--Senior Seminar (2)

Rhet 5180--Internship in Technical Communication (4-6)

Note that the minimums listed in section E do not add up to the  
required 70 credits. You are expected to take more than the  
minimum number of credits in these areas.

F. Technical Electives--20 credits minimum

Through the selection of your technical electives, you are expected to develop enough competence in a science, social science, or engineering discipline to acquire an understanding of the goals and methods of science and technology. You may also use this portion of the program to prepare for employment in some specific area such as computers or foods. Technical electives will be chosen with the aid of your adviser and can be interdisciplinary as well as intradisciplinary. You may choose from such areas as agriculture, computer science, forestry, the health sciences, home economics, and the natural and physical sciences. At least 8 credits must be at the 3000 level or higher.

G. Electives to complete the 190 credits required for graduation with the bachelor of science degree.

## Technical Communication Minor Program

Technical Communication--The technical communication minor is intended to augment your major by increasing your capability to communicate in your chosen field. It requires 30-32 credits in addition to the basic communication requirements of the College of Agriculture (Rhetoric 1101, 1104, 1151, 1222, and 3562). Contact a faculty adviser in the Department of Rhetoric for assistance in planning a minor in technical communication.

## Required Courses:

- Rhet 1220--Principles of Human Communication (4)
  - Rhet 3572--Grammatical Editing for Technical Writers (2)
  - Rhet 5257--Scientific and Technical Presentations (4)
  - Rhet 5258--Interviewing: Dynamics of Face-to-Face Communication (4)
  - Rhet 5571--Writing for Special Purposes (2) (Students must register for two quarters and complete 4 credits.)
- Plus two courses from the following list:
- Rhet 1147--Efficient Reading (4)
  - Rhet 3176--The Use of Scientific and Technical Film (4)
  - Rhet 3254--Advanced Public Speaking (4)
  - Rhet 3266--Communication, Discussion in Small Group Decision Making (4)
  - Rhet 5170--Managerial Communications (4)
  - Rhet 5561--Advanced Editing Seminar: Electronic Publishing (2)
  - Rhet 5565--Writing for Publication (4)
  - Rhet 5581--Document Design (4)

## Plus one of the following courses:

- Rhet 1301--Humanities: Modern Thought and the Enlightenment (4)
  - Rhet 1302--Humanities: Modern Thought and the Industrial Revolution (4)
  - Rhet 1303--Humanities: Modern Thought and the Impact of Evolution (4)
  - Rhet 5541--Readings in Scientific and Technical Prose (2)
- (Note: Courses used to fulfill All-College Requirements cannot be applied to this minor.)

MASTER OF AGRICULTURE PROGRAM  
WITH AN EMPHASIS IN TECHNICAL COMMUNICATION

The Master of Agriculture program is a professionally oriented postbaccalaureate degree program in the College of Agriculture. The Technical Communication emphasis in this program is available within the Department of Rhetoric, an academic unit within the College of Agriculture and the Institute of Agriculture, Forestry, and Home Economics, University of Minnesota.

ALL COURSES MUST BE TAKEN AT THE 5000 LEVEL OR ABOVE.

Students admitted to the Master of Agriculture program will select a minimum of 18 quarter hours from the following graduate-level courses in Technical Communication offered by the Department of Rhetoric.

- Rhet 5100 Technical Communication: Special Problems (1-3)
- Rhet 5147 Efficient Reading (4)
- Rhet 5150 Direction of Training in Business and Service Organizations (4)
- Rhet 5165 Studies in Organizational Communication, Conflict, and Change (4)
- Rhet 5170 Managerial Communications (4)
- Rhet 5180 Internship in Technical Communication (2-6)
- Rhet 5257 Scientific and Technical Presentations (4)
- Rhet 5258 Interviewing: Dynamics of Face-to-Face Communication (4)
- Rhet 5400 Dissemination and Utilization of Information (4)
- Rhet 5500 Research in Communication Strategies (4)
- Rhet 5531 Technical Writing Course Development (2)
- Rhet 5571 Writing for Special Purposes:
  - Newsletter (2)
  - Grant and Proposal Writing (2)
  - Policies and Procedures Manuals (2)
- Rhet 5600 Transfer of Technology (4)

In addition, students may select at least 9 quarter hours in a secondary area in the College of Agriculture:

- Agricultural and Applied Economics
- Agricultural Engineering Technology
- Agricultural Journalism
- Animal Technology
- Food Technology
- Plant and Soil Technology
- Rural Sociology

Eighteen additional quarter hours taken anywhere in the University must be completed satisfactorily before the degree may be granted.

For an application to the Master of Agriculture Program, write to the College of Agriculture, University of Minnesota, 277 Coffey Hall, 1420 Eckles Avenue, St. Paul, Minnesota 55108 or call (612) 373-0921.



Attachment D: Sample Plan A Thesis Topics

Developing guidelines for the use of color in on-line documentation.

A survey of editing strategies used by a random sample of experienced technical writers.

The interdependence of technical task and rhetorical task in software documentation

Introducing a new office computer system: A case study in the comparison of face-to-face and written instructions.

Ethos and technical communication: a content analysis of five selected policy manuals.

Viewing Copernicus' De Revolutionibus as a technical communication document.

The importance of recent developments in argumentation theory for feasibility reports.

The Extension Educational Network and Data Base (EXTEND)--A case study in the dissemination and utilization of information.

Audience analysis and the relevance of traditional readability formulas for medical journals.

The use of examples in technical documentation.

The role of the technical communicator in technical controversy: partisan, objective witness, or arbitrator?

The factors that influence a manager's decision to request a technical report from one individual or from a group: A survey of relevant research.

The influence of military specifications on technical communication.

An analysis of the scientific poetry of Erasmus Darwin.

The impact of plain language laws in the United States.

Attachment E. Sample Plan B Design Projects

Workflow and functional specifications for software development projects.

Style guide for on-line documentation projects.

Tutorials for in-house publications personnel on electronic publishing.

Contingency plan for saving files in case of emergencies or power failures.

An authoring system for specialized forms used in ABC Company.

Documentation standards for user guides for ABC Company.

Screen design system for decision aids and on-line tutorials.

Scripting and developing computer controlled slide-tape presentations for educational or public relations purposes.

System design for updating and revising documentation of ABC Company.

Integrating telecommunication capabilities in a major computer company's communication network.

Attachment F (continued)

Plan A--Concentration for Teachers of Technical Writing in Two-Year Schools

<u>Core Sequence</u>	<u>Credits</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5500 Research in Communication Strategies	4
Rhet 5180 Internship in Technical Communication	4-6
Rhet 5571 Writing for Special Purposes (2 cr)	
or	
Rhet 5561 Advanced Editing Seminar (2 cr)	
or	
Rhet 5581 Document Design (4 cr)	2-4
	<u>21</u> minimum
 <u>Related Field Sequence</u>	
CISy 5201 Systems Approach to Design of Instruction	3
CISy 5205 Applications of Computers in Education	3
CISy 5507 Seminar: Practical Research in Curriculum and Instruction	
	1-4
	<u>8</u> minimum
 <u>Additional Credits</u>	
To be chosen from the Recommended Courses list	0-8
 <u>Thesis Credits</u>	
Grad 8777 Thesis Credits: Masters	<u>16</u>
Total	45-53

Attachment F (continued)

Plan A--Preparations for Doctoral Study in Rhetoric and Communication

<u>Core Sequence</u>	<u>Credits</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5500 Research in Communication Strategies	4
Rhet 5180 Internship in Technical Communication	4-6
Rhet 5171 Writing for Special Purposes (2 cr)	
or	
Rhet 5561 Advanced Editing Seminar (2 cr)	
or	
Rhet 5581 Document Design (4 cr)	2-4
	<u>21</u> minimum

Related Field Sequence

Psy 5011 Theories of Learning and Cognition	4
Psy 5015 Advanced Learning and Cognitive Processing	4
or	
Ling 5211 Semantics	4
Ling 5212 Linguistic Pragmatics	4
or	
Ling 5401 Introduction to Computational Linguistics	4
Ling 5503 Introduction to Applied Linguistics	4
or	
Spch 5611 Classical Rhetoric	4
Spch 5615 Introduction to Rhetorical Criticism	4
	<u>8</u> minimum

Additional Credits

To be chosen from the Recommended Courses list 0-8

Thesis Credits

Grad 8777 Thesis Credits: Masters 16  
Total 45-53

Attachment F (continued)

Plan B--Concentration in Business Communication

Core Sequence

Credits

Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from Recommended List	5-7
	<u>20</u> minimum

Related Field Sequence

Spch 8421 Seminar: Communication and Negotiation	3
Spch 5625 Issues in Communication Ethics	4
or	
Spch 5441 Communication in Human Organizations	4
	<u>8</u> minimum

Rhetoric Design Project

Rhet 8xxx Design Project	8
--------------------------	---

Electives

The remaining 8 credits to be chosen in consultation with the advisor	<u>8</u>
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Total 44

Attachment F (continued)

Plan B--Concentration for Documentation in the Computer Industry

<u>Core Sequence</u>	<u>Credits</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from Recommended List	<u>5-7</u>
	20 minimum
 <u>Related Field Sequence</u>	
MIS 5102 Introduction to Information Systems Analysis	4
MIS 5199 Software Engineering: Testing Software Quality	<u>4</u>
	8 minimum
 <u>Electives</u>	
The remaining 8 credits to be chosen in consultation with the advisor	<u>8</u>
Total	44

Attachment F (continued)

Plan B--Concentration for Management in Publications Departments

<u>Core Sequence</u>	<u>Credits</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from Recommended List	<u>5-7</u>
	20 minimum
 <u>Related Field Sequence</u>	
MBA 8030 Financial Accounting	4
MBA 8040 Financial Management	4
or	
MBA 8025 Decision Sciences and Information Sciences	4
DSci 8500 Management of the Decision Sciences Process	<u>4</u>
	8 minimum
 <u>Rhetoric Design Project</u>	
Rhet 8xxx Design Project	8
 <u>Electives</u>	
The remaining 8 credits to be chosen in consultation with the advisor	<u>8</u>
Total	44

Attachment F (continued)

Plan B--Concentration in Medical Writing

<u>Core Sequence</u>	<u>Credits</u>
Rhet 8xxx Theory and Practice in Designing Messages	3
Rhet 8xxx Theory and Research in Audience Analysis	3
Rhet 8xxx Theory and Research in Media Analysis	3
Rhet 5180 Internship in Technical Communication	4-6
Rhetoric courses from Recommended List	<u>5-7</u>
	20 minimum
 <u>Related Field Sequence</u>	
PubH 5420 Statistical Computing I	3
PubH 5430 Biomedical Computing I	4
PubH 5431 Biomedical Computing II	4
PubH 5432 Biomedical Computing III	4
PUBH 5433 Computer Methodology in the Delivery of Health Care I	3
PubH 5434 Computer Methodology in the Delivery of Health Care II	3
PubH 5435 Computer Methodology in the Delivery of Health Care III	<u>3</u>
	8 minimum
 <u>Rhetoric Design Project</u>	
Rhet 8xxx Design Project	8
 <u>Electives</u>	
The remaining 8 credits to be chosen in consultation with the advisor	<u>8</u>
Total	44

Attachment F (continued)

Plan B--Concentration in Industrial Communication

Core Sequence

Credits

Rhet 8xxx	Theory and Practice in Designing Messages	3
Rhet 8xxx	Theory and Research in Audience Analysis	3
Rhet 8xxx	Theory and Research in Media Analysis	3
Rhet 5180	Internship in Technical Communication	4-6
Rhetoric courses from Recommended List		<u>5-7</u>
		20 minimum

Related Field Sequence

VoEd 5750	Training in Industry and Business	4
VoEd 5760	Organization Development in Industry & Business	4
VoEd 5790	Strategic Planning in Training & Development	4
Ind 5300	Industrial Surveys	<u>3</u>
		8 minimum

Rhetoric Design Project

Rhet 8xxx	Design Project	8
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Electives

The remaining 8 Credits to be chosen in consultation with the adviser		<u>8</u>
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Total 44

Attachment G: Job Titles of Technical Communication Graduates in  
Business and Industry

The following job titles were reported by the Technical Communication alumni in a survey of our alumni conducted in Spring Quarter 1984. These titles are representative of the kinds of positions our alumni hold in business and industry.

Communication Specialist I, II, III

Contingency Specialist (Disaster Recovery Planning)

Contract Writer

Engineering Writer I, II, III

Forms Management Supervisor

Information Developer, Senior Information Developer

Manager, Publications Department

Manager, Service Literature

Marketing Specialist, Promotions

Medical Editor

Medical Writer, Senior Medical Writer

Office Systems Analyst

Owner, Consulting Firm

Personnel Consultant

President, Consulting Firm

Product Documentation Specialist

Production Editor

Proposal Production Administrator

Publications Editor

Technical Communication Specialist, I, II, III

Technical Editor

Technical Writer

Technical Trainer

Technical Writer/Analyst

Training and Development Specialist



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Office of the Dean

Attachment H

College of Agriculture  
277 Coffey Hall  
1420 Eckles Avenue  
St. Paul, Minnesota 55108

MEMORANDUM

July 10, 1985

To: Tom Pearsall

From: Gene Allen *CEA*

I strongly endorse the proposal for the Master of Science Degree in Technical Communication prepared by the Department of Rhetoric. This program proposal is in keeping with the needs of many individuals as well as a large variety of industries. I believe this is an opportunity for the Department of Rhetoric to provide a unique and highly visible program that will address some of the challenges that go hand in hand with the rapidly advancing revolution that is taking place in communications.

To provide additional support to this area of emphasis, I am committing the present Joan Prochaska position on a recurring basis. If Joan leaves this position, the money allocated for this position will be re-evaluated by me or my successor.

In addition to the Prochaska position, I am granting you permission to appoint a Search and Screening Committee for the former Somer's position. This permission is granted on the basis that the position will be defined in a manner that encompasses the appropriate priority needs related to the technical communications area. The position will be at the Assistant Professor level and should be filled by an individual capable of outstanding performance in teaching and research activities in technical communications. When the description of the position is drafted, I want to see it before giving approval for distribution. All aspects of the search must conform to all the University procedures. It should also be noted that this position cannot be filled until all obligations on the Somer's agreement have been met.

I extend my congratulations to the Department for preparing and advancing this graduate program proposal. Please keep in mind that graduate program faculty can come from more than one department when appropriate expertise is available elsewhere in the University. Likewise, the manner in which faculty are elected to or removed from graduate program faculty needs to be carefully considered and perhaps should receive some attention at this formative stage.

CEA/c<sup>2</sup>

cc: Trudy Peplinski      Dick Skok  
    Keith Wharton      Dick Sauer  
    Keith McFarland



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Speech-Communication  
317 Folwell Hall  
9 Pleasant Street S.E.  
Minneapolis, Minnesota 55455

June 13, 1985

Thomas E. Pearsall  
Professor and Head  
Dept. of Rhetoric  
202 Haecker Hall  
St. Paul Campus

Dear Tom:

Thank you for sending me a revised copy of your proposal for an M.A. in Technical Communication. I have discussed the proposal with my colleagues. It is an interesting one, very responsive to the needs of many in the business community and, if put in place, one that should appeal widely.

Given the quite definite requirements for specific scientific work as vital for students who enter the program, your masters and our own should not be competing for the same students. If anything, we should welcome some competition simply because we are now harried in our ability to accommodate persons interested in studying at Minnesota.

The currently high level of majors, both graduate and undergradate, in speech-communication as well as the demand for our courses as electives may limit our ability to give you as much support as we'd like to. But conditions may change, and we do welcome the opportunity of working with you since we think that much that we do would be of use to your program and its students.

Yours is a well conceived and written proposal. We appreciate your having consulted with us.

Sincerely yours,

A handwritten signature in dark ink, appearing to be 'R. Scott'.

Robert L. Scott  
Professor and Chair

RLS/jll



UNIVERSITY OF MINNESOTA  
TWIN CITIES

School of Journalism  
and Mass Communication  
111 Murphy Hall  
206 Church Street S.E.  
Minneapolis, Minnesota 55455-0418

May 10, 1985

Dr. Thomas Pearsall  
Department of Rhetoric  
(Technical Communication Program)  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul CAMPUS

Dear Professor Pearsall:

I have conferred with both the director of  
Graduate Affairs and the chair of the Curriculum  
Committee here at the School of Journalism and  
Mass Communication and they find no conflict  
with your proposed program.

Sincerely yours,

  
F. Gerald Kline  
Director

FGK:kd



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of English  
Lind Hall  
207 Church Street S.E.  
Minneapolis, Minnesota 55455  
(612) 373-2595

May 14, 1985

Thomas Pearsall  
Department of Rhetoric  
202 Hokr Hall  
St. Paul Campus

Dear Tom,

This letter constitutes a memorandum concerning our discussion on last Friday, May 10, about the new Master of Science degree that you propose offering in Technical Communication. Since then I have talked over with Michael Hancher, our Director of Graduate Studies, the substance of your conversation with me, and he may or may not append to this letter remarks of his own. (If what I have to say needs amplifying or adding to, he will send along his own memorandum.)

The Department of English offers a Master of Arts degree in writing: not merely in creative writing, but in various kinds of non-fictional writing as well. To date we have been able to offer only occasional courses in technical or business writing, certainly not the array of courses that we had hoped to offer and that we still plan to make available to our students. But it is nonetheless true that our degree is "belles-lettrist" in so far as requiring of all candidates 16 credits in literature and language. It is, therefore, clear that a different kind of student will be interested in taking our degree in Writing from the kind of student interested in taking your degree in Technical Communication, in which no courses in literature, as such, are required. We see as a consequence no conflict between your proposed degree and the degree we currently offer, with the exception of statements in the proposal to the effect that the English Department degree is wholly in belles lettres. As you remarked at our session on Friday, technical writers divide almost evenly into those who have been educated technically (e.g., as engineers) and those who have been liberally trained. It is likely that the "market" for your degree will be among the former, while the market for ours will be among the latter. In our market, however, there will be some interested in doing work in scientific, technical, or professional writing. We intend to continue admitting such students and educating them as well as possible. To that end, we are exploring ways of adding adjunct faculty who can help in instructing them.

We are delighted to see that some of our courses, especially the courses in

Thomas Pearsall  
May 14, 1985  
Page 2

English Language, may be recommended to students in your degree program; once your program is in place, it may well be that we will be advising students to take some courses in technical writing from you and your colleagues. I sincerely hope that some cooperation of this kind may be developed and maintained. It would strengthen both our degrees as well as both our programs.

Sincerely,



Kent Bales  
Professor and Chair

cc: C. Michael Hancher

KB/nm



UNIVERSITY OF MINNESOTA  
TWIN CITIES

College of Home Economics  
32 McNeal Hall  
1985 Buford Avenue  
St. Paul, Minnesota 55108  
(612) 373-0933

June 13, 1985

Dr. Thomas Pearsall  
Professor and Head  
Department of Rhetoric  
202 Haecker Hall  
St. Paul Campus

Dear Dr. Pearsall:

My associates in the College office are delighted that you are proposing for consideration the establishment of a Master of Science degree program in Technical Communication, this to become effective in Fall, 1986 if approved.

A majority of the baccalaureate degree holders from this College enter positions that are highly dependent upon effective technical communication skills. Many of these would add to their professional potentials by adding to their competence in this area. I am confident that the program committee chairs of the College of Home Economics would look with favor upon the availability of this additional professional improvement opportunity for their graduates.

In the more direct sense, and quite apart from its promise as a professional improvement tool for those engaged in home economics related activities, it is clear that the technical communicator is in general demand in business and industry. Minnesota students should have entree to these positions. Your proposed program would operate to this end.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'Keith McFarland'.

Keith McFarland, Dean  
College of Home Economics

K.McF:dmf

cc: Eugene Allen  
Richard Sauer



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Division of Biometry  
School of Public Health  
1226 Mayo Memorial Building  
420 Delaware Street S.E.  
Minneapolis, Minnesota 55455  
(612) 373-8042

June 26, 1985

Victoria M. Mikelonis  
Associate Professor and Director  
Technical Communication Program

Dear Professor Mikelonis:

Professor Boen has asked me, in my capacity as Acting Director of Graduate Studies for Biometry and Health Information Systems, to respond to your letter of June 8, 1985.

I would like to respond to your inquiry point-by-point:

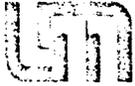
- 1) There is a new course, PubH 5420 (Statistical Computing I), which will be offered in the Fall Quarter but not listed in the 1984-86 bulletin. *(3 credits)*
- 2) Enrollment to our 5000/8000 level courses are open to all students if they meet the prerequisites in the bulletin. However, prior consultation with instructors would be helpful.
- 3) Appropriateness of a related field sequence depends on two factors, both of which are unknown to us:
  - i) Program Requirements  
(So as to determine relative weight and/or to detect any duplication)
  - ii) Student Background
    - a) If a student has strong background in Calculus (Mathematics), I would recommend
      - PubH 5450 - Biometry I
      - PubH 5452 - Biometry II
      - PubH 5454 - Biometry III, and
      - PubH 5420 - Statistical Computing I
    - b) For a student with weaker mathematical background, the sequence would consist of
      - PubH 5414 - Biometric Methods I
      - PubH 5408 - Biometric Methods II, and
      - PubH 5420 - Statistical Computing Iand then may be supplemented by
      - PubH 5460 - Demography and Health

Sincerely,

*Chap T. Le*

Chap T. Le, Ph.D.  
Associate Professor

CTL:kd



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Curriculum and Instruction  
College of Education  
Peik Hall  
159 Pillsbury Drive S.E.  
Minneapolis, Minnesota 55455

June 26, 1985

JUL 01 1985

Victoria Mikelonis  
Associate Professor and Director  
Technical Communication Program  
Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Ave.  
St. Paul, MN 55108

Dear Professor Mikelonis:

Since I must have missed your phone call June 24th or 25th, I have chosen to send this brief note in response to your query of June 18th.

1. At the present time, the 1984-86 bulletin is accurate with respect to CISy offerings at the 5000 level.
2. The students you describe are eligible for admission to these courses if the prerequisites are met.
3. I have discussed your Plan A related field sequence with our staff in Curriculum and Instruction Systems. They have expressed enthusiasm for this program and their participation in it. The sequence proposed is satisfactory.

I should call to your attention one aspect of CISy 5205 which is not listed in the bulletin as a prerequisite. Students entering this course should have some programming knowledge. The particular programming language which students have learned is not important. Those without any programming skills can obtain this knowledge in CISy 5006 or comparable courses in various departments throughout the university.

Professor Glenn is out of the country until July 1. I will bring this matter to his attention.

Yours truly,

A handwritten signature in black ink, appearing to read 'Robert Jackson', written over a horizontal line.

Robert Jackson  
Professor and Associate Chair  
Curriculum and Instruction

RJ/dlj

UNIVERSITY OF WASHINGTON  
SEATTLE, WASHINGTON 98195  
25 April 1985

*College of Engineering  
Program in Scientific and Technical Communication*

Tom Pearsall  
University of Minnesota  
of Minneapolis St. Paul  
St. Paul, MN 55108

Dear Tom:

I have read your MS degree proposal with a great deal of interest, and I am particularly pleased to send you my reactions. As you know, I have long recognized the need for advanced technical communication education with a focus on upward career mobility rather than entry level functions. You and your faculty are to be congratulated for quality of the program you propose. Surely it meets an important professional need and will quickly become one of the top graduate programs in the field.

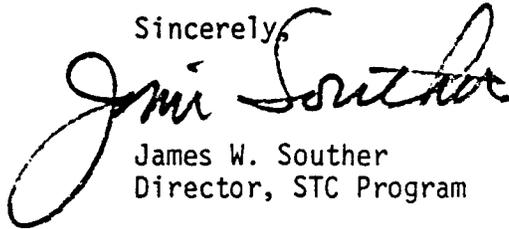
A number of qualities are outstanding in the proposal you propose. First, it stands on a highly respected undergraduate program. Second, it provides needed advanced, graduate education for the more sophisticated professionals whose own career growth will provide the motivation for seeking admission to your program. Third, the emphasis on both science and technical communication background for entrance emphasizes the need for this special combination so basic to our field. Fourth, the graduate courses, required and elective, offer effective concentration on basic areas and allow choice to match individual student interests. Last, but not least, you have an excellent faculty which can give the program depth and meaning and which already has the respect of the technical communication profession.

It is important that graduate education in a growing professional field such as technical communications strike out in new and significant directions. Your program does so in a most important way. Its success could truly set the direction for other programs. I am not surprised, of course, to see innovation and a true awareness of the needs of the profession so well developed in the program that you propose. In fact, I would have been disappointed had you and your faculty proposed less.

Tom Pearsall  
25 April  
Page 2

It is an outstanding proposal; one that the profession needs now. I am most pleased to support your proposal and I urge your institution to approve this most excellent, forward-looking educational program.

Sincerely,

A handwritten signature in cursive script that reads "James W. Souther". The signature is written in black ink and is positioned above the typed name and title.

James W. Souther  
Director, STC Program

JWS/mwh

**Carnegie-Mellon University**

Department of English  
Schenley Park  
Pittsburgh, Pennsylvania 15213  
[412] 578-2850

2 July 1985

Professor Thomas E. Pearsall  
Department of Rhetoric  
University of Minnesota  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, Minnesota  
55108

Dear Tom:

My thanks for sending me a copy of your proposal for a Master of Science in Technical Communication. I am sorry that my response has had to be so delayed, but I hope that this letter can be appended to the proposal.

As you know, we have just gone through the process of putting together an M. A. in Professional Writing, so much in the early stages of the proposal is familiar. Our department did not feel qualified to offer an M. S., hence the M. A. But the same clientele requested an advanced writing degree, and we have a good number of students pursuing it, and some who have already been granted the degree. We did not need as detailed a proposal as yours, in part because the administrative structure of a private university makes for a less complicated approval process.

I think your proposal makes great sense, and I hope the University will approve it. It is a demanding degree which fulfills a felt need. You are in the right place and have more than adequate facilities for the degree. I will be surprised if it does not draw a large number of candidates.

Three areas strike me forcibly. The first is the proposed Advisory Council, with its varied membership. I think we should have such a body. The second is the stress on oral presentation, which is totally lacking in our degree. I have always envied you that stress in the undergraduate degree, and I've tried in vain to have us offer even one course in public speaking or interviewing. I'm glad you urge such courses on the M. S. candidates. And I think the A and B tracks are a fine idea so that a student can put together a very personalized degree. We offer those

two possible plans, but not in quite such a formal way as your proposal suggests. Since most of the candidates here are adults from the business or teaching worlds, they are very capable of building the degree they think best suits their needs.

In short, the proposed M. S. degree seems very sound to me. It clearly will fill a real need in your part of the world and I hope that you can begin operations in the fall of 1986.

Again, my thanks for sending the proposal to me. I am also showing it to appropriate members of our department.

Yours sincerely,

*Beek*

Beekman W. Cottrell,  
Professor of English



Rensselaer Polytechnic Institute Troy, New York 12180-3590

May 6, 1985

Professor Thomas E. Pearsall  
Head  
Department of Rhetoric  
University of Minnesota  
St Paul, Minnesota 55108

Dear Tom:

I have reviewed the proposal for the new Master of Science program in Technical Communication in your department, and I am pleased to say that it is, in my opinion, one of the best proposals of its kind I have had opportunity to review. As you may know, I have been asked to review, in the past, programs at such places as Georgia Tech, The University of Colorado, Texas Tech, Miami University of Ohio, and Clarkson College.

Specifically, the excellence of your proposed program, and its estimable promise of succeeding, stems from the following factors:

- Its success would seem predictable because it is based on criteria which have produced success in other similar programs--yet it is also incorporates soundly innovative features;
- It will, when implemented, begin to meet a portion of the vastly increased need for professional communicators from high-tech society, which will, itself, expand greatly over the next decade;
- The exceptional quality of your participating faculty and their remarkable experience in both the discipline and profession of technical communication; and
- The reputation for excellence in technical communication which you and your faculty have built over the past decade through your undergraduate program, your group's seldom equalled national reputation, and, if I may say so, your own outstanding leadership.

To say more, would I suspect, gild the lily, but given these measures of excellence, I respectfully submit that the University of Minnesota would, in my opinion, err grievously were it to overlook opportunity to launch so important a program as your proposal defines.

If I may be of further assistance please do not hesitate to call upon me.

Sincerely,



David L. Carson  
Director,  
Master of Science  
Programs in  
Technical Communication  
and  
Executive Editor  
*The Journal of  
Technical Writing and  
Communication*

Polytechnic Institute of New York, 333 Jay Street, Brooklyn, New York 11201

DEPARTMENT OF HUMANITIES  
AND COMMUNICATIONS

**Polytechnic**

May 7, 1985

Professor Thomas E. Pearsall  
Head, Department of Rhetoric  
(Technical Communication Program)  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MI 555108

Dear Professor Pearsall:

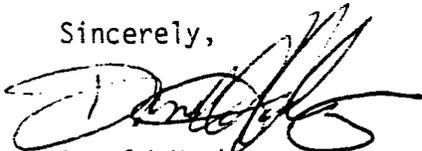
I have reviewed your proposal for a new Master of Science in Technical Communication. The program that your institution is considering differs significantly from our program. I have thought about the content of your program in terms of the professional opportunities that would exist for graduates of your program. It appears to me that a graduate of your program would be well prepared for a position in corporate communications in technologically or scientifically oriented companies.

The technical writing track in our specialized journalism program differs from yours in that we prepare our students for what might be called hi-tech technical writing. Thus, they take courses such as technical writing about digital electronics, information systems and software documentation, and writing technical manuals.

I think that there is need for both types of programs and it seems to me that you are proposing a well thought-out course of study for your graduate students.

If I can be of further assistance please do not hesitate to contact me.

Sincerely,



Donald Hockney  
Head, Dept. of Humanities  
and Communications

DH:es



Program in  
Technical Communication

1223 East Engineering Building  
Ann Arbor, Michigan 48109-1109  
313.764-1427

College of Engineering  
The University of Michigan

29 April 1985

Professor Thomas E. Pearsall  
Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, Minnesota 55108

Dear Professor Pearsall:

I greatly appreciated the opportunity to examine your proposal for Minnesota's new Master of Science in Technical Communication. As you know, I have had a long-standing interest in this area, and in fact at the University of Michigan we have been preparing a similar program proposal ourselves. As a consequence, I was particularly interested to see your program design.

My overall impression is that your program proposal is one that should be approved without difficulty. It is clearly stronger than the majority of similar programs in the sense that you have set quite demanding entrance requirements which will assure that your graduates have the technical background that so many graduates of Technical Communications programs lack. From my own experience with IBM, I am convinced that sort of technical preparation is essential for Technical Communicators. I would further describe your proposed curriculum as a varied and rich one which should produce graduates which will be in demand in industry. The list of courses available seems to cover a spectrum of needs, and your faculty appear to have the diverse backgrounds and scholarly accomplishments necessary to offer high-quality instruction in that variety of areas. In that respect also your program looks superior to many of the other programs. I also applaud your decision to keep the program small and of high quality. Although there may be opportunities (and thus temptation) for rapid expansion of such Master's programs because of industry demand, I am satisfied that quality should come before size.

I am quite certain that the program which you describe in your proposal addresses a national need. Further, I am satisfied that of the seventeen other programs available nationally, only one or two others can be seen a substantive efforts to meet that need. For these reasons, I am impressed with your proposal and optimistic for its success.

Sincerely,

Dwight W. Stevenson,  
Professor of Technical Communication,  
Director, Instructional Television



# MIAMI UNIVERSITY

Department of English  
Bachelor Hall  
Oxford, Ohio 45056  
513 529-5221

May 16, 1985

Dr. Thomas E. Pearsall  
Professor and Head  
Department of Rhetoric  
University of Minnesota  
St. Paul, Minnesota 55108

Dear Tom:

I am writing in response to your request for an assessment of the April 17 draft of the proposal for a new master's degree program in technical communication at the University of Minnesota.

The program looks very sound. Clearly, you have the faculty, the course offerings, and the extramural contacts needed to mount a high-quality, professional program in this field. Especially impressive is the large array of directly relevant courses that you are able to offer. Together with the core courses you are requiring of all students, these additional offerings will enable students to devise programs of study that are tailored to their individual interests and aptitudes while still being professionally sound.

Also impressive is the way that you are involving faculty and courses from several departments in your program. We have done the same thing in our master's degree program at Miami. The result is a greatly enriched education for the students, who are thereby enabled to study various aspects of technical communication with specialists in the pertinent fields. Further, we have not encountered any of the conflicts that one might imagine would arise between our technical and scientific communication program and programs in such fields as speech communication and organizational communication. Technical communication defines a specific and limited terrain that has not impinged upon the domains of those other programs, except in ways that have been mutually beneficial.

Based upon our experience with the master's degree program here at Miami, I do have a suggestion: make plans for the administration and advising that such a program requires. Your program will require considerable oversight. Here we have an Executive Committee that meets biweekly to discuss policy, admissions and students petitions. A program director (me) prepares the many materials needed by this committee, corresponds with prospective applicants, talks with potential employers and internship sponsors, and generally attends to the many special needs of the program and its students. Students in your program, like those in ours, will need extensive advising. They will need help in choosing between Plans A and B, and in selecting their elective courses. Internship placement and employment counseling will also consume considerable amounts of faculty time--more than a faculty member could squeeze out of a normal

Thomas E. Pearall

- 2 -

May 16, 1985

teaching load. A possible strategy for meeting these administrative and advising needs would be to designate one person as Program Director and another as Assistant Program Director for Academic Affairs (chiefly, advising). Our experience indicates that each person would need to receive a course reduction of at least one section per term in order to have enough time to devote to these important activities. It would also be important to have a secretary assigned this program.

In sum, the proposed program look outstanding. I am sure that your university will be able to attract an abundance of applications from well-qualified people, that you will be able to provide them with a stimulating, effective education, and that you will be able to place them readily in desirable positions.

Sincerely,



Paul V. Anderson  
Professor and Director  
Master's Degree Program in Technical  
and Scientific Communication



---

International Business Machines Corporation

Highway 52 & Northwest 37th Street  
Rochester, Minnesota 55901  
507/286-4011

July 2, 1985

JUL 09 1985

Ms Victoria Winkler Mikelonis  
Department of Rhetoric  
(Technical Communication Program)  
202 Haecker Hall  
1364 Eckles Avenue  
St Paul, MN 55108

Subject Master's Program in Technical Communication Proposal

Dear Ms Mikelonis

I have reviewed the subject proposal with some of the other people I work with and we feel that, overall, the proposal is a very good one. I also asked several people if they would be interested in enrolling in the proposed program, and there were a few who said they would. There were probably more though who would be interested in taking selected courses in the program.

I have always been impressed with the caliber of students we have interviewed/hired from your current program. However, I feel your proposed program is definitely in line with what we anticipate for the future technical communicators. Courses such as Transfer of Technology (Rhet 5600) and Theory and Research in Audience Analysis and Media Selection (Rhet 5XXXs) clearly cover what we see as our challenges in the future.

Again, we are very satisfied with the people we have hired from your college thus far, and I feel certain that the program you are proposing would enhance the competitiveness of the type of people we recruit. We would be very interested in helping you in any way we could in making this program happen.

Sincerely

D A Winkels, Manager  
Information Development

# TDS

INCORPORATED

Attachment J (continued)

MAY 28 1985

28 May 1985

Dr. Victoria Winkler Mikelonis  
Director of Technical Communication  
University of Minnesota  
Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108

Dr. Mikelonis:

Thank you for the opportunity to review your proposal for the Master's Program in Technical Communication. It appears to be very comprehensive. And it is certainly consistent with developments in the profession. The proposed "Advisory Council" is a particularly good idea. It would benefit the students in the program and the program itself in several important ways. You mentioned the quality control function and the aid to fund-raising, but even more important is the council's ability to provide continuing advice on the requirements of business and industry for the skills and experience provided by the Master's program. Such an advisory council is an excellent way to keep tabs on a rapidly changing profession.

As you know, TDS, Inc. is a contract technical documentation firm that uses independent sub-contractors to service a wide range of high tech clients in the Twin Cities. As sub-contractors, graduates of the proposed program would only be as useful to us as their writing experience. Currently, there is little or no market for contract pubs managers. At present, the other TDS principals and I provide all management and project supervision for our clients. However, should increased business require us to hire a project manager, being a graduate of your proposed program would certainly be a plus, particularly if combined with industry experience.

As a technical writing teacher, I would say that such a program would be very useful for training technical writing instructors at the JC or Vo-Tech level. Industry increasingly demands good tech writing skills of Vo-Tech grads. A graduate of your program would be well positioned to provide these skills to such students.

-- MORE --

**TECHNICAL DOCUMENTATION SERVICES, INC.**  
7008 Highway Seven, Minneapolis, MN 55426 • 926-3498

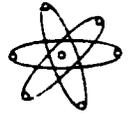
I hope this brief response has been helpful. If you would like any point elaborated, please let me know and I'll respond promptly. Best of luck with your proposal.

Sincerely,

A handwritten signature in cursive script that reads "Geoffrey Scott". The signature is written in black ink and is positioned above the typed name.

Geoffrey Scott  
Vice-President, TDS, Inc.

P.S. Erasmus Darwin's poetry is an excellent Plan A thesis topic. Since I've already written an article on it, does that mean I'm part way to a Master's?! Extra credit?



**STEM LINE PUBLISHING SERVICES, INC.**  
Medicine and the Sciences

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---

31 May 1985

Victoria Winkler Mikelonis, PhD  
Director of Technical Communication  
Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108

Dear Doctor Winkler:

I am very much impressed by the Rhetoric Department's proposal for an M.S. in technical communication and hope that the Graduate School approves it.

The proposed program has several strengths that should commend it, not only to technical communicators wishing to upgrade their skills, but also to persons with undergraduate or advanced science degrees seeking careers outside the laboratory. The requirement for a strong foundation in science, engineering, or mathematics is, I believe, vital; in my field—~~medicine~~—persons without such background are shut out of the highest-paying jobs. The provision for training in project management and in supervision, training, and evaluation of employees is also a significant strength, as it is essential for career advancement at the same time that it is generally ignored by the schools. The course in developing writing courses is also excellent, as many supervisory technical writers are called upon to train their technically oriented coworkers in this unfortunately rare skill. Indeed, as you know, *Technical Communication* recently devoted an entire issue to this subject. The other particular feature that impresses me is the training that will be offered in electronic publishing; I wish such a course were available in this area!

I would be delighted to help the Department with its program in any way I can, and look forward to being able to hire some of the graduates.

Sincerely,

*Judith Gunn Bronson*  
Judith Gunn Bronson, MS  
President

JGB:k



**TENNANT COMPANY**  
ESTABLISHED 1870

701 North Lilac Drive  
P O Box 1452  
Minneapolis, MN 55440  
(612) 540-1200 • TLX 290-451

22 May 1985

MAY 23 1985

Victoria Winkler Mikelonis  
Director of Technical Communication  
University of Minnesota  
Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108

Dear Victoria:

Thank you for including me in your Master's Program In Technical Communication review process. I would be glad to offer some comments about the proposed program.

First, to answer your questions, I would not only encourage appropriate staff members to enroll in the program but may be interested in enrolling in the program myself. Although I have worked professionally in the business and technical communications field for over eight years, the additional course work as well as the ability to focus on the topics suggested would certainly be a benefit. I also think an advanced degree, if appropriately designed, would be valuable in helping to meet the changing and broadening needs of business, industry, and government.

Secondly, I want to make a few suggestions about the proposal. These suggestions are based in a "real world" context; that is, what I feel should be included to ensure that the degree would indeed make the graduate a more valuable contributor to business.

- As of this draft, the focus is on the message, the document, the audience -- all of those things that are individual elements of the whole. You as program developers need to go to the other end of the spectrum, turn around, and view and address the broad applications as well. For example: I like your proposed new courses, but feel that some additional emphasis is necessary. Two more areas would be important: (1) project planning, development, and control, and (2) other managerial skills (budgeting, staffing, long-range planning, etc.).
- The first area is important because the graduate must be capable of running projects and making decisions. He or she would be a project manager rather than a project writer.

- The second area is important for people at the masters level because if that person will indeed be performing above the entry level, he or she should be able to to plan for documentation or communications issues that go beyond the scope of one project -- he or she should be able to look at whole systems' issues as well as functional interrelationships within organizations. A masters graduate must not only understand the managerial issues involved around project planning and control but also have the general management skills necessary for running a department.
- Another companion area to technical communications is records management. Because technical writers are the creators of many business records, some thought should be given to policy control issues that govern document creation, distribution, and retention. This is another whole speciality, but is a related area in many ways.

Finally, I am not sure I understand why you want to make a statement like that on page 4, "...but technical communication applies the information in looking at very specific problems in a limited number of situations." I do not feel that technical communications is, or should be, defined with such a narrow scope. I have found that my credibility for dealing with broad communications issues is far greater with a technical communications degree. Managers and other professionals often come to me for the in-depth analysis of various communications problems or applications while the person with the journalism degree is relegated to the house organ and other "newsy" projects.

I think we can do so much more to help redefine our profession so that we are not considered to be narrowly placed technical publications or engineering types who can only write about specific scientific or technical subjects. You asked if the program would meet the changing needs for technical communicators; it will if we are not too narrow in our definition and therefore our training. This is the main reason why I think we should broaden the program name to include the word business -- "Business and Technical Communication."

Again, thank you for asking me to review the proposal. A masters program is needed and would certainly be a benefit to the community. Please do not hesitate to contact me, Victoria, if you need any other information or support.

Sincerely,



Diane P. Nolden  
Senior Analyst  
Office Planning; Systems and Technologies

# Honeywell

June 10, 1985

Victoria Winkler Mikelonis  
Department of Rhetoric  
(Technical Communication Program)  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, Minnesota 55108

Dear Vicky:

I apologize for the delay in responding to your letter. May was an unusually busy month for me. I had a couple major, crash projects at work, and a daughter graduating from high school. But those are all finished or almost finished now so I can concentrate on other things.

I read your proposal with interest, partially because I believe the graduates of your current program are generally high caliber people.

I was pleased to see that the program will require some credits outside the Rhetoric department, presumably in a technical discipline. Whether we like it or not, the trend seems to be toward requiring more technical background, at least at Honeywell. For example, our Avionics Division prefers writers with engineering degrees and our Energy Products group in Residential Division has turned the technical writing task over to product specialists, many of whom have engineering backgrounds. Therefore, it seems to me that additional work in a technical discipline would enhance the candidate's marketability.

It is Honeywell policy to promote from within whenever possible; in most instances we would not hire from outside for a senior writer or manager position. Therefore, the holder of a master's degree would be competing against candidates with a bachelor's degree in technical communications or experience for entry level positions and against internal candidates for the advanced positions. In the former, the person with the master's might have an advantage; in the latter, the internal candidates generally would be preferred.

Our communications department is very small. With only six people plus a manager we handle all the public relations, advertising, sales promotion, and technical communications for the Residential Controls side of Residential Division. Because the advertising and public relations aspect is so visible and comprises the major portion of our annual budget, the department manager must have experience/training in these disciplines. The proposed technical communication master's program does not address this specific need.

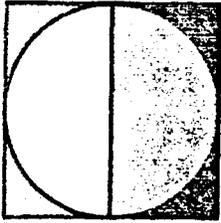
In addition, managers in our organization need to understand financial planning and budgeting, business planning, and human resource management. While the details tend to be department-specific, the manager who starts out with a broad understanding of these areas has a distinct advantage. It would be nice if these could be worked into your program.

The bottom line is that the candidate with a master's degree probably would have an edge in a company with a large, established technical communications department or in a technical communications firm. In my circumstance, I'd personally like to get additional background in audience analysis and message design, and in validation of instructional materials. I'm not sure, however, that the proposed master's in technical communication would be a significant advantage here.

Best regards,



Joyce E. Anderson  
Senior Technical Communications Specialist



century design

6425 OXFORD ST., MINNEAPOLIS, MN. 55426

TEL. 920-3601

JUL 10 1985

July 8, 1985

Victoria Winkler Mikelonis  
Director of Technical Communication  
University of Minnesota  
Department of Rhetoric  
302 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108

Dear Vicki:

Please forgive my tardiness in responding to your letter to Stu Cohen of May 17, 1985. Stu passed it on to me for review and comment and I am afraid the time really got away from me. I hope that the following comments are not too late to be of value to you.

1. I think the Master's Program in Technical Communication is a terrific idea. I only wish it had been available when right after I graduated; I would have been one of your first students.
2. We would be interested in hiring graduates from the program assuming that they had sufficient prior work experience. For us at Century Design, a proven track record in technical writing/communicating is essential.
3. I would (and have) encourage(d) members of my current staff to look into the program, especially the people currently enrolled in the Master's of Ag program.
4. As the program is currently written, I think it offers many fine educational opportunities. However, I have some concerns as to its transferability to real-world situations. For example:
  - a. As a supervisor, I spend considerable time in project development: assessing the scope, determining how many hours it should take, how much money it should cost, who is the most qualified writer for the job, etc. Therefore, I would recommend some type of case study course where various types of media presentations were analyzed and compared to their actual time/cost factors. Estimating how long it takes and what tools it takes to do a job are also essential skills for anyone interested in freelance writing.

V. W. Mikelonis  
July 8, 1985

Page 2

- b. If supervisory/managerial skills are to be developed, I would encourage more than one managerial skills course. A large part of my day is spent dealing with personnel problems. I think most managers would agree that handling personnel is a major and difficult part of the job. (And believe me, supervising writers is different from any other supervisory experience I have had in the past! Talk about creative temperments!!)
- c. A stated purpose of the program is to prepare people for managing and teaching writers; is any coursework being developed for writer assessment? Perhaps more emphasis needs to be placed on some writing basics - spelling, sentence structure, readability factors, etc. I refuse to hire people who spell poorly and I spend considerable time editing material for readability. Perhaps more editing practice would be helpful; I would also recommend exposure to the various reading grade level indicators, i.e. Fog index, Cloud index, etc.
- d. I also refuse to hire anyone who cannot type efficiently. Everything we do is on wordprocessing. And we use various models of wordprocessors and microcomputers. Keyboard skills are absolutely essential and no person should be allowed to graduate from either the bachelors or the masters program without an acceptable level of keyboard expertise.
- e. Technical communicating is changing dramatically from day to day. With all the new state-of-the-art tools for creating media, it is vital that technical communicators stay on top of the latest trends. I think a monthly seminar/lecture/presentation series should be developed to help keep the students aware of the latest technological advancements in media preparation.

Vicki, I am very pleased to see the University of Minnesota take this important step forward in technical communication education. I hope that my comments may be of some value to you and the other board members assessing the program.

Again, I apologize for the lateness of this reply. If I can be of any further assistance to you, please let me know.

Regards,



Bonnie Dannecker  
Writing Supervisor



UNIVERSITY OF MINNESOTA  
TWIN CITIES

APR 3 1986  
Division of Epidemiology  
School of Public Health  
Stadium Gate 27  
611 Beacon Street S.E.  
Minneapolis, Minnesota 55455  
(612) 376-4056

March 27, 1986

Kenneth C Zimmerman  
Associate Dean  
Graduate School  
University of Minnesota  
325 Johnston Hall  
Minneapolis, MN 55455

Dear Dean Zimmerman:

This is a follow-up on an earlier letter from the Graduate Faculty in Physiological Hygiene.

On August 13, 1985, the Graduate Faculty voted unanimously to disband the graduate program in Physiological Hygiene because

- a) all students wishing to pursue studies which involve cardiovascular disease prevention and behavioral interventions can now be adequately provided for in one of the concentrations in epidemiology--either cardiovascular disease epidemiology or behavioral epidemiology;
- b) all of the Graduate Faculty in Physiological Hygiene now have appointments in the Graduate Faculty in Epidemiology.

This letter assumes, in accordance with our recent conversation, that the remaining PhD students in Physiological Hygiene are "grandfathered" and will complete their studies using approved courses for Physiological Hygiene.

If you have any questions or need for further clarifications, please let me know.

Sincerely,

Ronald J Prineas, MB, BS, PhD  
Professor and Director of Graduate Studies

RJP:ah

pc: Graduate Faculty in Physiological Hygiene



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Chemical Engineering and Materials Science  
151 Amundson Hall  
421 Washington Avenue S.E.  
Minneapolis, Minnesota 55455  
(612) 373-2300

20 February 1986

GRADUATE SCHOOL

FEB 25 1986

OFFICE OF THE DEAN

Dean Robert Holt  
Graduate School  
University of Minnesota  
Minneapolis, MN 55455

Dear Dean Holt:

The purpose of this letter is to formally request a change in the degree title that we award from "Metallurgy and Materials Science" to "Materials Science and Engineering". The new title accurately describes our program and our direction whereas the old one does not.

Materials Science is the application of the principles of physics and chemistry to condensed matter systems. While it builds on, and complements, these principles, it goes further than is done in the pure science departments by addressing complex materials which have both scientific and engineering applications. Included in our department are thrust areas which focus on microelectronic materials, mechanical properties, corrosion, polymers, ceramics, and surfaces. Together, these areas give us a very strong program and modern approach to materials research. We would like our degree titles to reflect this approach and to represent our discipline more accurately.

We have polled our faculty on this issue and find unanimous approval of the change. Indeed, when asked to consider the change, we found that most faculty believed that it had long ago been approved and were eager to endorse this request.

It is our hope that approval will be given in time for the next edition of the Bulletin.

Sincerely yours,

John H. Weaver  
Director of Graduate Studies

William W. Gerberich  
Associate Head

H. Ted Davis  
Head



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Anatomy  
4-135 Jackson Hall  
321 Church Street S.E.  
Minneapolis, Minnesota 55455  
(612) 373-2790

31 January 1986

Dean Robert Holt  
The Graduate School  
Johnston Hall

Dear Dean Holt:

Please find appended the proposal for a **Ph.D. Program in Neuroscience** which we are submitting for consideration during the Winter Quarter by the appropriate Policy and Review Committees. As indicated in the document we are requesting implementation of the program for the 1987-88 academic year. The proposal is the product of extensive discussions held during meetings of the Graduate School's Committee on Neuroscience. As you recall, this committee broadly represents Neuroscience interests on our campus and includes representatives from the College of Liberal Arts, the College of Biological Sciences and the Health Sciences. Members of the committee include Professors Dwight Burkhardt (Psychology), Tim Ebner (Neurosurgery), Robert Elde (Anatomy), William Hermán (Genetics and Cell Biology), William Kennedy (Neurology), James Koerner (Biochemistry), Alice Larson (Veterinary Biology), Richard Phillips (Animal Science and Ecology and Behavioral Biology), Richard Poppele (Physiology) and George Wilcox (Pharmacology). Dean Kenneth Zimmerman provided substantial and expert ex officio counsel for the committee.

The committee unanimously and enthusiastically supports the appended proposal. During the development of the proposed program, individual members of the committee solicited opinions from many colleagues. We have distributed the draft of this proposal to 19 department heads and chairs whose faculty might be involved in the program. In addition, this proposal was discussed at the Council of Deans meeting on January 21. These consultative processes have aided in shaping the present proposal. I am pleased for the widespread support for a Ph.D. Program in Neuroscience that became apparent through this consultation. It is clear that implementation of the proposed Ph.D. Program in Neuroscience will significantly aid ongoing efforts to enhance other more specialized efforts in Neuroscience across our campuses.

Sincerely yours,

Robert P. Elde, Ph.D.  
Professor  
Chair, Neuroscience Committee, The Graduate School

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College University of Minnesota Code No. 2

I. General Information

A. Program Title Ph.D. Program in Neuroscience

8 27

B. Program Review Category:  Regular  
(check one)  Experimental (If Experimental, give Reporting Date:        /        /       )  
28 29 30 32 34

C. Proposed Implementation Date: 7 / 1 / 87  
36 38 40

D. Program Length: Total Cr/hr 54 Classroom 49 Laboratory 5(+36 thesis credits)  
42 45 46 49 50 53

E. Administrative Unit Immediately Responsible for Program: Graduate School

54 73

F. Describe the Program (in 50 words or less):

2 This program is designed to provide curricular and research training  
in Neuroscience. Neuroscience is a relatively new field of scientific  
inquiry, but has rapidly advanced to one of the most productive biomedical  
3 research disciplines. The proposed program capitalizes upon present  
Strength in Neuroscience at the University of Minnesota and provides a  
4 framework for future expansion.  
65 64 120 64 120 64 120

5 G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	First Year: <u>87-8</u> (Yr.)		Full Operation: <u>90-1</u> (Yr.)	
	Number (Headcount) Expected	Student Credit or Contact Hours	Headcount Capacity	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	10	250	40	1000
Other Students	30	300	30	300
Total	40	550	70	1300
b. Program Graduates/Completers	0		10	

A. Projected Costs of the Program:

II. Budget Data

	First Year <u>87-88</u>								Full Operation <u>90-91</u>							
	New				Re-assigned				New				Re-assigned			
	No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		
a. Faculty	0.25	\$ 15,000			\$		0.25	\$ 15,000			\$			\$		
b. Civil Service		\$ 10,000			\$			\$ 10,000			\$			\$		
c. Equipment, Supplies, etc.		\$ 37,000			\$			\$ 55,000			\$			\$		
Total Direct Costs (a+b+c)		\$ 62,000			\$			\$ 80,000			\$			\$		
d. One-time Costs		\$ 125,000			\$			\$ -			\$			\$		
e. Space Rental		\$ -			\$			\$ -			\$			\$		
f. Indirect Costs		\$ -			\$			\$ -			\$			\$		
g. Total Program Costs (a+b+c+d+e+f)		\$ 187,000			\$			\$ 80,000			\$			\$		

B. Expected Sources of Funds for Program:

	First Year: <u>87-88</u>						Full Operation: <u>90-91</u>					
	Dollar Amount		% of Annual Expend.	One Time Input		Dollar Amount		% of Annual Expend.	One Time Input			
a. Local	\$			\$		\$			\$			
b. State	\$ 41,540			\$ 83,750		\$ 53,600			\$			
c. Tuition	\$ 20,460			\$ 41,250		\$ 26,400			\$			
d. Federal	\$			\$		\$			\$			
e. Private	\$			\$		\$			\$			
f. Dedicated Fees	\$			\$		\$			\$			
g. Other (Specify)	\$			\$		\$			\$			
h. Total	\$		100%	\$		\$		100%	\$			

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions: None

D. System Verification:

V. Rance Murthy  
Authorized Institution or System Signature

Acting Vice President  
Title for Academic Affairs  
and Provost

3/27/86  
Date

UNIFORM PROGRAM INVENTORY  
AND PROPOSAL FORM

Section II

**Ph.D. Program in Neuroscience**

1. Summary Description of Program

Program Objectives. Establishment of this Program will accomplish the following objectives: 1) Recruit a critical mass of the brightest and most highly motivated, Neuroscience-oriented graduate students to each entering class. 2) Provide a three-quarter core course and laboratory experience which have been explicitly designed to afford a comprehensive foundation in Neuroscience. This course series will be co-ordinated with the other courses in content and in schedule in order for students to move logically and rapidly through curricular aspects of training. 3) Provide the basis for the selection of suitable elective courses in students' Ph.D. programs in Neuroscience. The requirements for advanced, elective courses and the publicity achieved by centralized listing in the Graduate School Bulletin will help to provide a student population for these courses. 4) Provide a vital and timely forum for new ideas and information in Neuroscience through seminars and visiting professorships. 5) Provide a selection of research training opportunities directed by a faculty distinguished in contemporary Neuroscience research. 6) Provide a formal program in Neuroscience that can be evaluated for its strengths and deficiencies by the periodic internal and external review process of the Graduate School. Such evaluation is necessary in order to increase the quality of Neuroscience at the University of Minnesota. 7) Further and foster productive collaboration among present and newly-recruited Neuroscientists at the University of Minnesota.

Admission Requirements. Applicants to the Ph.D. Program in Neuroscience shall have a Bachelor's degree or its foreign equivalent from a recognized college or university. Undergraduate coursework should include instruction in several of the following disciplines: mathematics, physics, chemistry, biology, psychology and neuroscience. Applicants will be required to take the Graduate Record Examination and an Advanced Test appropriate to their field of emphasis. Applications will be screened and ranked by an Admissions Committee which will be elected by the Neuroscience Graduate Faculty.

University Resources. It is proposed that the members of the present Graduate Faculty in Neuroscience (elected for the Ph.D. level minor), who are widely representative of Neuroscience interests across the campus, comprise the initial Graduate Faculty for the Ph.D. Program in Neuroscience. Upon approval of this proposal, this group will solicit applications for graduate faculty status in Neuroscience and will meet to act upon these applications in accordance with the membership criteria outlined in Section III.

Recurring program expenses are itemized below. These figures are based on an estimated total of 40 graduate students at full strength. The program will admit 10 new students per year and will compete for supporting stipends from the Graduate School.

	<u>First Year</u>	<u>Subsequent Years</u>
A) Director of Graduate Studies (DGS) compensation:	15,000	15,000
B) Seminar program & colloquium series at \$5,000/qtr.	15,000	15,000
C) Student recruitment:	7,000	5,000
D) Visiting professor(s): 3 mos salary & expenses	---	20,000
E) Annual symposium: Request based on 2-3 day meeting with 10-12 invited speakers.	10,000	10,000
F) Secretary: 1/2 time & fringe	10,000	10,000
G) Supplies & Equipment:	130,000	5,000
TOTALS	<u>\$187,000</u>	<u>\$ 80,000</u>

Extra-University Resources. Research Assistantships for most of the advanced graduate students will be obtained from research grants held by the students' advisors. In addition, one training grant application has already been submitted and others can be expected.

## 2. Need for the Program

At present, most major research universities have established formal programs in Neuroscience. It should be noted that the most recent survey by the Society for Neuroscience found an increase of 375% in the number of undergraduate Neuroscience courses offered at colleges and universities in the United States between 1978 and 1984. Thus, a rapidly increasing number of undergraduates are becoming familiar with Neuroscience as a discipline. Undergraduates inspired in these courses seek graduate programs in Neuroscience. Ph.D. Programs in Neuroscience are found at 39 institutions in North America, but not at the University of Minnesota. Therefore, many of the brightest undergraduates in the biological sciences desire to study Neuroscience, yet they fail to even apply for graduate studies at the University of Minnesota.

Graduate students at the University of Minnesota with an interest in Neuroscience are now matriculated within the traditional departmental programs. At present it is only possible for these students to minor in Neuroscience. Implementation of the proposed Ph.D. Program Neuroscience will increase our ability to 1) attract high quality graduate students who are interested in Neuroscience as a discipline; 2) recruit high quality faculty colleagues interested in the Neurosciences as a scholarly discipline; and 3) compete for and obtain Neuroscience-oriented training funds from Federal and private sources.

The lack of a Ph.D. Program in the Neurosciences at the University of Minnesota, then, is viewed as a serious drawback to Minnesota's opportunity to participate fully in one of the most exciting frontiers of present day science, despite the very substantial number of faculty and students here who clearly identify with Neuroscience. Failure to rectify this drawback within the next few years could result in the loss of both the high quality faculty

and students, and in Minnesota's defaulting in this area of scholarship. This proposal for the establishment of a Ph.D. Program in Neuroscience, is a necessary step toward overcoming the deficiencies cited above, and will capitalize on our present opportunity to build Neuroscience training and research.

### 3 & 4. Mission and Comparative Program Analysis

There exist no similar programs among the institutions of higher education in Minnesota. Several faculty in the Departments of Physiology and Pharmacology at the Mayo Clinic provide training in limited areas of Neuroscience, but no Ph.D. Programs in Neuroscience exist in the State of Minnesota.

Institutions of higher learning in neighboring states offer some aspects of formal training in Neuroscience. The University of Wisconsin, Madison has a strong tradition in Neuroscience research, and has an interdisciplinary, Ph.D. degree granting program in Neuroscience. The University of Iowa, Iowa City, does not offer an advanced degree in Neuroscience, although a Neural and Behavioral Sciences Committee coordinates interdisciplinary training that leads to a degree in a traditional, departmental program. Iowa State University, Ames, has neither a formal nor informal program in Neuroscience. There is no program in Neuroscience in the Dakotas.

### 5. Duplication

This program does not duplicate efforts in institutions within Minnesota.

### 6. Cost/Benefit

The proposed program will provide research training in Neuroscience. Neuroscience research has the potential to impact broadly on societal needs in areas ranging from the development of new therapeutic strategies for neurological and psychiatric diseases to enhancing the development of machine vision and robotics. Thus, the potential benefits are very high compared to the necessary costs.

### 7. Hypothesis to be Tested

This is not an experimental program.

Section III

January 31, 1986

Proposal for: Ph.D. Program in Neuroscience

Submitted by the: Neuroscience Committee

of the: Graduate School

The proposal has been reviewed and approved by:

\*\*\*\*\*

APPROVAL CERTIFICATION

ADDITIONAL APPROVALS

[Signature] 1/31/86  
Chair, Neuroscience  
Committee, Graduate School (Date)

[Signature] 3/17/86  
Dean, Graduate School (Date)

[Signature]  
Dean, College of Biological  
Sciences (Date)

1  
Vice President, Health  
Sciences (Date)

[Signature] 3/13/86  
Dean, College of Liberal  
Arts (Date)

[Signature] 3/27/86  
Vice President, Academic  
Affairs (Date)

[Signature] 3/13/86  
Dean, Medical School (Date)

Vice President, Agriculture,  
Forestry, & Home Economics (Date)

[Signature] 3/14/86  
Dean, Veterinary School (Date)

[Signature] 3/14/86  
Dean, College of Agriculture (Date)

Approval by Regents: \_\_\_\_\_  
(Date)

First Reading by PAC: \_\_\_\_\_  
(Date)

Second Reading by PAC: \_\_\_\_\_  
(Date)

Recommendation by the MHECR: \_\_\_\_\_  
\_\_\_\_\_  
(Date)

Confirmation by Regents: \_\_\_\_\_  
(Date)

Section III: The Proposal to establish a Ph.D. Program in Neuroscience.

A. Introduction Neuroscience is a relatively new field of scientific inquiry. The objects of the inquiry - the brain and nervous systems - are sufficiently complex and unique among biological systems as to require analytical approaches that cross the traditional boundaries of anatomy, behavioral biology, biochemistry, cell biology, genetics, pharmacology, physiology and psychology. In some instances neuroscientific inquiry also encompasses the disciplines of computer science, information processing, engineering, physics and mathematics.

Nationally and internationally the general field of Neuroscience has developed to the point where several cohesive subfields can be identified: Molecular Neuroscience, Cellular Neuroscience, Neural Systems and Behavioral Neuroscience. Formal programs and Departments of Neuroscience were established in some major universities more than a decade ago. The Society for Neuroscience with a membership in excess of 10,000 was established sixteen years ago and it continues to grow rapidly. The membership of the Society is principally drawn from neuroscientists in the United States, Canada and Mexico. The Society for Neuroscience has affiliated with the more recently established European, South American and Japanese Societies under the aegis of the International Brain Research Organization. These professional organizations sponsor meetings, publish journals, and employ professional staffs to carry out the functions normally associated with established, more traditional scientific societies. It should be noted that the Society for Neuroscience has grown so that its membership greatly exceeds that of several other important biomedical research societies: American Society of Biological Chemists (6,601); American Physiological Society (6,500); American Society for Cell Biology (5,600); Endocrine Society (4,992); American Association of Immunologists (4,659); American Society for Pharmacology and Experimental Therapeutics (3,700); American Association of Pathologists (2,500); and American Institute of Nutrition (2,270). Thus, Neuroscience is one of the largest and most rapidly expanding biomedical research disciplines but, as noted below, the University of Minnesota has yet to establish itself with a prominent, programatic emphasis in this field.

The University of Minnesota has 48 faculty as well as 22 postdoctoral fellows and graduate students who are identified members of the Society for Neuroscience. The local unit of the Society - the Voyageurs Chapter of the Society for Neuroscience - has an active membership list of 46 faculty and 51 postdoctoral fellows and graduate students. In addition, the local chapter maintains a recently updated mailing list through which an additional 119 interested individuals receive publicity for Neuroscience-oriented seminars sponsored by various departments at the University.

Neuroscience research is a diverse but lively enterprise at the University of Minnesota. Its diversity is exemplified by the summaries of investigative interests of the present graduate faculty affiliated with the Minor in Neuroscience (Appendix). The viability of Neuroscience research is illustrated by an informal survey in February 1985 in which it was found that some 35 Neuroscience-oriented faculty bring in nearly \$4,000,000 in annual direct costs to support their investigations (Appendix). The average grant income for individuals in this group, more than \$100,000 per annum, is very high when compared to other areas of biomedical research at the University of Minnesota.

Thus, Neuroscience is a discipline which is actively pursued at the University of Minnesota. In order to obtain a more objective analysis of the relative strength of the University of Minnesota in Neuroscience, this committee conducted a thorough survey of research activities in Neuroscience. The results of this study are found in several tabular summaries as an Appendix to this proposal. Briefly, it was found that this university (by virtue of its size, if not deliberate planning) has a large number of investigators whose research can be considered to fall within areas of Neuroscience. As can be seen, most of the major research areas in Neuroscience (Molecular Neuroscience, Cellular Neuroscience, Behavioral Neuroscience, Neural Systems and Clinical Neuroscience) are represented by 10 or more faculty members at the University of Minnesota. The two strongest clusters of Neuroscience research at the University of Minnesota appear to fall within the general categories of Molecular Neuroscience and Behavioral Neuroscience. These areas appear to be strong not only because there are significant numbers of investigators within the institution, but in addition, their research appears to be strong in terms of publications and federal grant support; that is, peer recognition. The data upon which this analysis is based is found in an Appendix.

Prior to the current academic year Neuroscience was not a formal academic discipline at the University of Minnesota. However, in the Fall Quarter of 1985 a new graduate level Minor in Neuroscience was implemented. This program was based upon a previous Program Proposal from this committee. Although this program has been in existence for a short period of time, students and faculty alike have demonstrated significant interest. More than 30 students have made inquiries concerning the requirements for the Minor in Neuroscience. More than 50 applications have been received for membership in the Graduate Faculty of this program. To date, 21 have been approved by the Program and the Graduate School and another 10 have been approved by the Program and await approval by the Graduate School. These individuals and their research interests are tabulated in an Appendix. It is now clear that present research and training activities in Neuroscience at the University of Minnesota can serve as a foundation for building new and enduring strength. This opportunity has two synergistic components: firstly, our present stage of development and visibility in Neuroscience is at a level such that we can recruit first-rate new faculty; and secondly, we are ready to offer a systematic, interdisciplinary program leading to the Ph.D. in Neuroscience that will attract the very best graduate students. The proposed program will offer Neuroscience training of a quality matched only by the most elite research universities.

## B. The Proposed Program

Program Objectives. The present proposal for a Ph.D. in Neuroscience is designed to capture the opportunities outlined above and in Section C (below). Establishment of this Program will accomplish the following objectives: 1) Recruit a critical mass of the brightest and most highly motivated, Neuroscience-oriented graduate students to each entering class. 2) Provide a three-quarter core course and laboratory experience which have been explicitly designed to afford a comprehensive foundation in Neuroscience. This course series will be co-ordinated with the other courses in content and in schedule in order for students to move logically and rapidly through curricular aspects of training. 3) Provide the basis for the selection of suitable elective courses in students' Ph.D. programs in Neuroscience. The requirements for

advanced, elective courses and the publicity achieved by centralized listing in the Graduate School Bulletin will help to provide a student population for these courses. 4) Provide a vital and timely forum for new ideas and information in Neuroscience through seminars and visiting professorships. 5) Provide a selection of research training opportunities directed by a faculty distinguished in contemporary Neuroscience research. 6) Provide a formal program in Neuroscience that can be evaluated for its strengths and deficiencies by the periodic internal and external review process of the Graduate School. Such evaluation is necessary in order to increase the quality of Neuroscience at the University of Minnesota. 7) Further and foster productive collaboration among present and newly-recruited Neuroscientists at the University of Minnesota.

Admission Requirements. Applicants to the Ph.D. Program in Neuroscience shall have a Bachelor's degree or its foreign equivalent from a recognized college or university. Undergraduate coursework should include instruction in several of the following disciplines: mathematics, physics, chemistry, biology, psychology and neuroscience. Applicants will be required to take the Graduate Record Examination and an Advanced Test appropriate to their field of emphasis. Applications will be screened and ranked by an Admissions Committee which will be elected by the Neuroscience Graduate Faculty.

Admission. An applicant will be admitted to graduate student status after selection by the Neuroscience Graduate Faculty and subsequent final approval by the Graduate School.

The Curriculum. The core of the Neuroscience curriculum will consist of a 3-quarter, introductory course (NSc 5-XX1, 5-XX2 & 5-XX3) and laboratory (NSc 5-XX4). Elective courses for the Major and an appropriate Minor field will be selected through consultation between the student and the advisor (sample programs for recognized subspecialties in Neuroscience can be found in an Appendix). The program will then be submitted to the Neuroscience Steering Committee for approval. Students with sufficient background and previous course experience equivalent to one or more courses within the curriculum may apply to the Neuroscience Steering Committee for waiver of appropriate requirements. It is expected that students will successfully complete the requirements for the degree in 16 quarters, or four academic years.

The outline of the proposed "Neuroscience Core Course" follows. The course will consist of 5 lectures per week for 3 quarters for a total of 15 credits. In addition, students will take the laboratory course for 5 credits.

NEUROSCIENCE CORE COURSE

CONTENT OF LECTURES ->	STRUCTURE	CHEMISTRY	FUNCTION	BEHAVIOR	DYSFUNCTION	TOTAL	SUBTOT
TEMPORAL SEQUENCE OF TOPICS							
OVERVIEW	1	1	1	1	1	5	
COMPONENTS							
Intracellular Apparatus							
Plasma Membrane	1	3				4	
Cytoskeleton	1	1				2	
Transport		2	1			3	
Growth and Development	2	2	1			5	
Neuronal Organization							
Membrane Potential		1	4			5	
Synaptic Transmission	2	5	3			10	
Axonal Conduction		1	2			3	
Excitation - Secretion		2	2			4	
Non-neural Cells							
Secretory	1	2	1		1	5	
Glial	1	1	1			3	
Myelin Sheath	1		1		1	3	
Circuits & Integration		1	1	1		3	
Adaptation		1	1	1		3	
Response to Injury		1	1			2	
SYSTEMS							60
SYSTEMS: SIMPLE							
Sensory Systems							
Chemical	2	1	1	1		5	
Somatic	2	2	2	1	1	8	
Orientation	1	1	3	1	1	7	
Audition	1		2	1	1	5	
Vision	2	1	2	2	1	8	
Other			1	1		2	
Motor Systems							
Autonomic & Enteric	2	2	1	1	1	7	
Reflex			2	1	1	4	
Locomotion	2	1	3	1	1	8	
Communication	1		1	2	1	5	
Hormonal Systems	2	2	1	1	1	7	
SYSTEMS: COMPLEX							
Rhythms		1	1	2		4	
Feeding & Drinking	1	1		2		4	
Mating	1			1		2	
Emotion	1	1		2	1	5	
Learning & Memory	1	1	1	2	1	6	
Population Adaptation				2		2	
							89
Total Lectures	29	38	41	27	14	149	
Numbers refer roughly to the number of lecture hours devoted to a given topic & content. However, actual allocation of time will be influenced by each content and topic. The overall coverage of this course will be comparative, not purely mammalian. Lectures will be given 5 times per week for 3 quarters or 2 semesters.							

The 5 credit laboratory course (NSc 5-XX4) will be affiliated with the core course, although because of its intensive nature, will be offered in the summer immediately preceding the fall quarter in which the student matriculates. This course will consist of four weeks (5 days/week; 8+ hours/day) of instruction and experience with the major experimental techniques and preparations used in contemporary Neuroscience research.

The elective courses for the Ph.D. in Neuroscience are to be selected from the following list. A student will be expected to select courses from the list totaling at least 16 credit hours.

#### ELECTIVE COURSES

##### Course Name, Number, Credit Hours and Course Director

Analysis of Behavior I, Psych 5-017, 4 credits, Thompson  
Behavioral Genetics, EBB 5-149, 4 credits, Merrell  
Behavioral Pharmacology, Psych 8-064, 3 credits, Pickens  
Biophysics of Nerve Cells, Phs1 8-114, 3 credits, Fohlmeister  
Cell Junction Structure and Physiology, Anat 8-170, 4 credits, Sheridan  
Cellular Regulation, GCB 5-950, 3 credits, Herman  
Central Regulation of Autonomic Function, Anat 8-222, 3 credits, Seybold  
Developmental Neurobiology, Anat 8-210, 3 credits, McLoon  
Experimental Comparative Veterinary Neurology, VB 8-136, 3 credits, Beitz,  
Fletcher  
Mathematical Neurophysiology, Phs1 8-115, 4 credits, Knox  
Muscle Contraction, MdBc 5-444, Phs1 5-444 or VB 5-444, 3 credits, Thomas,  
Popele, Louis  
Neuroanatomical Methods, Anat 8-141, 2 credits, Elde  
Neurobiology of Endocrine Regulation, Anat 8-223, 3 credits, Elde  
Neurobiology of Pain and Analgesia, Anat 8-221, 3 credits, Giesler  
Neuroethology, EBB 8-081, 3 credits, Phillips  
Neuropsychopharmacology, Phc1 8-208, 3 credits, Sparber, Wilcox  
Perception, Psych 5-031, 4 credits, Legge  
Physiology of Hearing, Oto 8-247 or Phs1 8-216, 3 credits, Ruggero  
Physiology of Visual Systems, Phs1 8-218, 3 credits, Purple

Properties of Receptor Systems, Phs1 8-217, 3 credits, Poppele

Psychopharmacology, Phc1 8-207, 1-3 credits, Sparber, Pickens, Meisch

Psychophysics and Audition, Psych 8-037, 3 credits, Veimeister

Readings in Neurobiology, Neurosurg 8-324, 1 credit (4 quarter sequence),  
Ebner

Selected Topics: Neurophysiology, Phs1 8-216, arranged credits, Poppele and  
staff

Seminar: Visual Perception, Psych 8-031, 3 credits, Legge

Sensory Neuropsychology, Psych 5-034, 4 credits, Burkhardt

Spinal Cord Physiology, Motor Control, Phs1 8-219, 3 credits, Soechting

Vision, Psych 8-035, 3 credits, Burkhardt

Other courses to be included in training program:

1. Statistics: As thesis work is expected to include statistical analysis of data where appropriate, a course in statistics such as PubH 5400 or equivalent is required.

2. Computer Language: Proficiency in at least one programming language is highly recommended.

Language Requirement:

Since English is the primary language for publication, the reading knowledge of one foreign language is no longer required. However, since the early literature in a foreign language should not be overlooked in acquiring an historical perspective in a scientific area, a reading knowledge of a foreign language relevant to the student's major field of interest is highly recommended.

Neuroscience Seminar and Symposium Program:

A crucial portion of each student's training and the enrichment of the program's faculty will be obtained through participation in the weekly Seminar Program, in which prominent visiting scholars present their research. In addition, the Annual Neuroscience Symposium will provide similar enrichment on important themes in Neuroscience Research. Neuroscience graduate students and faculty will be expected to attend all seminars and symposia.

Completion Requirements and Standards. All graduate students are expected to maintain at least a 3.0 grade point average (on a 4.0 base equals "A" grade). When poor performance is evident, the student's advisor will discuss this with the student and steps will be taken to rectify the problem.

The Preliminary Written Examination will be administered to all students in the fall quarter after completing the Neuroscience Core course. This examination will be designed to test a student's ability to criticize current research reports in light of his or her curricular training in Neuroscience. The examination will be evaluated by all members of the Neuroscience Steering Committee (Committee membership outlined below under "Governance of the Program").

The Preliminary Oral Examination will be administered according to Graduate School regulations, after successful completion of the Preliminary Written examination but before the end of the second year.

The heart of graduate training for the Ph.D. in Neuroscience will be extensive laboratory research under the supervision of a member or members of the Graduate Faculty in Neuroscience. This research will be guided so as to promote submission of manuscripts to prominent, peer reviewed journals. A thesis, based on this research shall be presented for defense for the Ph.D.

The coursework and the nature of dissertation research for students in the Neuroscience Ph.D. program is exemplified through sample programs and sample thesis titles in an Appendix.

### C. Educational and Social Need for the Program

It is estimated that 10 candidates will be admitted to the Ph.D. Program in Neuroscience in any given academic year. It is expected that after four years 40 doctoral students will be continuously affiliated with the program. In addition, it is expected that approximately 60 students at any point in time will be affiliated with the program as Ph.D. level Minors in Neuroscience.

At present, most major research universities have established formal programs in Neuroscience. It should be noted that the most recent survey by the Society for Neuroscience found an increase of 375% in the number of undergraduate Neuroscience courses offered at colleges and universities in the United States between 1978 and 1984. Thus, a rapidly increasing number of undergraduates are becoming familiar with Neuroscience as a discipline. Undergraduates inspired in these courses seek graduate programs in Neuroscience. Ph.D. Programs in Neuroscience are found at 39 institutions in North America, but not at the University of Minnesota. Therefore, many of the brightest undergraduates in the biological sciences desire to study Neuroscience, yet they fail to even apply for graduate studies at the University of Minnesota.

Graduate students at the University of Minnesota with an interest in Neuroscience are now matriculated within the traditional departmental programs. At present it is only possible for these students to minor in Neuroscience. Implementation of the proposed Ph.D. Program Neuroscience will increase our ability to 1) attract high quality graduate students who are interested in Neuroscience as a discipline; 2) recruit high quality faculty colleagues interested in the Neurosciences as a scholarly discipline; and 3) compete for and obtain Neuroscience-oriented training funds from Federal and private sources.

At the same time, it is not the purpose of the proposed Ph.D. Program in

Neuroscience to divert present or future students from existing graduate programs at the University of Minnesota. The intent of the present proposal is to attract students who would not otherwise attend the University of Minnesota because of their specific interest in Neuroscience as an academic, degree-granting discipline. The faculty in the Graduate Program in Neuroscience recognize and value the cross-disciplinary enrichment that is fostered by strong interactions with non-Neuroscience oriented faculty colleagues. In addition, the Graduate Faculty in Neuroscience intend to maintain and strengthen the graduate level Minor in Neuroscience so that students with a graduate level Major in other areas may be afforded formal training in Neuroscience.

The lack of a Ph.D. Program in the Neurosciences at the University of Minnesota, then, is viewed as a serious drawback to Minnesota's opportunity to participate fully in one of the most exciting frontiers of present day science, despite the very substantial number of faculty and students here who clearly identify with Neuroscience. Failure to rectify this drawback within the next few years could result in the loss of both the high quality faculty and students, and in Minnesota's defaulting in this area of scholarship. This proposal for the establishment of a Ph.D. Program in Neuroscience, is a necessary step toward overcoming the deficiencies cited above, and will capitalize on our present opportunity to build Neuroscience training and research.

#### D. Comparison with Similar Programs

There exist no similar programs among the institutions of higher education in Minnesota. Several faculty in the Departments of Physiology and Pharmacology at the Mayo Clinic provide training in limited areas of Neuroscience, but no Ph.D. Programs in Neuroscience exist in the State of Minnesota.

Institutions of higher learning in neighboring states offer some aspects of formal training in Neuroscience. The University of Wisconsin, Madison has a strong tradition in Neuroscience research, and has an interdisciplinary, Ph.D. degree granting program in Neuroscience. The University of Iowa, Iowa City, does not offer an advanced degree in Neuroscience, although a Neural and Behavioral Sciences Committee coordinates interdisciplinary training that leads to a degree in a traditional, departmental program. Iowa State University, Ames, has neither a formal nor informal program in Neuroscience. There is no program in Neuroscience in the Dakotas.

#### E. Quality Control

Qualifications of Graduate Faculty. The Graduate School Constitution states "Continuing active involvement and competency in one or more graduate programs, and the quality of such involvement, of members of the graduate faculty shall be the primary considerations in continued membership in graduate program faculties." Election to the Graduate Faculty in Neuroscience shall be granted to those faculty of the University of Minnesota who accept and fulfill the responsibilities outlined below:

- #They should be actively engaged in Neuroscience research. Evidence of such activity should include such things as recent grant support, financial support of graduate students or postdoctoral fellows, and recent publications in refereed journals.

- #They should be willing and able to act as advisers to degree candidates.
- #They should direct or provide a major contribution to at least one graduate-level course in the area of Neuroscience at least once every five years.
- #They should present one research seminar at the University of Minnesota at least once every five years.
- #They should be available for service on both standing and ad hoc Neuroscience program committees.

Periodically, but at no less than five year intervals, the Neuroscience Steering Committee should review the program-related activities of the Neuroscience graduate faculty. If individuals are identified that have not fulfilled the above obligations during the past five years, the Neuroscience Director of Graduate Studies should meet with such faculty to arrange for increased contributions to the Neuroscience program. Those faculty who have not fulfilled their responsibilities to the program, and who cannot increase their programmatic activities, should be requested to resign from this graduate faculty. If such faculty do not wish to resign, the DGS (in consultation with the Neuroscience Steering Committee) should present the case for review by the Dean of the Graduate School in accordance with established procedures.

Governance of the Program. Primary administrative responsibility for the conduct of program affairs will be vested in the Director of Graduate Studies (DGS). The DGS will be recommended to the Dean of the Graduate School by a majority vote of the program faculty and will serve for a period of three years. The DGS would not normally serve more than two consecutive terms. The DGS will be assisted by the Neuroscience Steering Committee, consisting of 6 program faculty serving staggered terms of two years each. These members will be appointed by the DGS after consultation with representatives of all subdisciplines in an attempt to represent all subdisciplines of Neuroscience. Substantial departures from existing program guidelines will be subject to majority approval of the program faculty.

Evaluation of the Program. The Ph.D. Program in Neuroscience will be evaluated by periodic internal and external review of Neuroscience as a self-standing discipline. Such reviews will be the primary means by which the program is evaluated. It is expected that the program faculty will take all steps within their power to remedy deficiencies identified by such review.

#### F. Implementation

Time Schedule. It is proposed that the Ph.D. Program in Neuroscience be initiated at the start of the 1987-88 academic year.

The Initial Faculty It is proposed that the members of the present Graduate Faculty in Neuroscience (elected for the Ph.D. level minor), who are widely representative of Neuroscience interests across the campus, comprise the initial Graduate Faculty for the Ph.D. Program in Neuroscience (list of present Graduate Faculty appended). Upon approval of this proposal, this group will solicit applications for graduate faculty status in Neuroscience and will meet to act upon these applications in accordance with the membership criteria established above.

University Resources. Recurring program expenses are itemized below. These figures are based on an estimated total of 40 graduate students at full

strength. The program will admit 10 new students per year and will compete for supporting stipends from the Graduate School.

	<u>First Year</u>	<u>Subsequent Years</u>
A) Director of Graduate Studies (DGS) compensation: The compensation could take varied forms. For example a faculty member on a B appointment could use the compensation for summer salary support. A faculty member with an "A" appointment could use up to \$5,000 of the compensation as salary augmentation.	15,000	15,000
B) Seminar program & colloquium series at \$5,000/qtr.	15,000	15,000
C) Student recruitment:	7,000	5,000
D) Visiting professor(s): 3 mos salary & expenses	---	20,000
E) Annual symposium: Request based on 2-3 day meeting with 10-12 invited speakers.	10,000	10,000
F) Secretary: 1/2 time & fringe	10,000	10,000
G) Supplies & Equipment: First year request includes an initial equipment budget of \$5,000 for word processing equipment, desks, filing cabinets and other office equipment necessary for the Director of Graduate Studies and secretary; and the equipment necessary to conduct the Core Laboratory Course. This equipment consists of 5 student workstations; each including a dissecting microscope, storage oscilloscope, stimulators, amplifiers, recording equipment, tissue chambers, animal frames and respirators. The laboratory will need the following single items: intracellular recording equipment, electrode puller, iontophoresis driver, stereotaxic apparatus, compound/fluorescence microscope, video camera and an HPLC with electrochemical detector. These items total approximately \$120,000.	130,000	5,000
TOTALS	<u>\$187,000</u>	<u>\$ 80,000</u>

Extra-University Resources. Research Assistantships for most of the advanced graduate students will be obtained from research grants held by the students' advisors. In addition, one training grant application has already been submitted and others can be expected.

Current Neuroscience Faculty

Alvin J. Beitz  
Vet Biology  
Putative neurotransmitters in brain & spinal cord

Dwight A. Burkhardt  
Psychology  
Retinal mechanisms of vision

Timothy J. Ebner  
Neurosurgery  
Neurophysiology of the Cerebellum

Robert P. Elde  
Anatomy  
Transmitter-coded pathways regulating autonomic, nociceptive & endocrine function

Glenn J. Giesler  
Anatomy  
Anatomical & physiology study of somatosensory systems

William S. Herman  
Genetics & Cell Biol  
Invertebrate neuroendocrinology

William R. Kennedy  
Neurology  
Disease affecting peripheral or autonomic nervous system.

James F. Koerner  
Biochem-med  
Pharmacology & ligand-receptor binding

Alice A. Larson  
Vet. Biology  
Sensory systems - chem. modulators - pain perception

Gordon E. Legge  
Psychology  
Physiological optics & perception

Richard E. Phillips  
Ecol & Behav Bio  
Neurobiology of behavior

Richard E. Poppele  
Physiology  
Role of sensory receptors in motor control

Richard L. Purple  
Physiology  
Electrophysiology of arterially perfused eyes

Donald C. Quick  
Anatomy  
Peripheral nervous system

Mario A. Ruggero  
Otolaryngology  
Mechanisms of hearing

Virginia S. Seybold  
Anatomy  
Histaminergic neurons & hypothalamic function

John R. Sheppard  
Dight Institute  
Molecular mech. of biological communication

John F. Soechting  
Physiology  
Motor control

Sheldon B. Sparber  
Pharmacology  
Effects of drugs, peptides & toxins

David Thomas  
Biochemistry  
Electron spin resonance study of muscle proteins in vitro

George L. Wilcox  
Pharmacology  
Neural transmission of sensation

Nominated for Faculty Status in Neuroscience

John H. Anderson  
Physiology  
Neurophysiology of eye movements and vestibular function

Franklin H. Barnwell  
Ecology & Behav Bio  
Multifrequency circadian systems in marine animals

David R. Brown  
Vet Biology  
Neuropharmacology of GI tract function

Paul C. Letourneau  
Anatomy  
Cell biology of nerve cell growth

Steve C. McLoon  
Anatomy  
Developmental neuroscience

Richard A. Meisch  
Psychiatry

David A. Nelson  
Otolaryngology  
Psychophysical studies of auditory analysis

Akira E. Takemori  
Pharmacology  
Opioid action; down regulation of muscurinic receptors

Travis Thompson  
Psychology  
Effects of drugs on behavior

Neal F. Viemeister  
Psychology  
Auditory information processing

## VI. THEMES AND TOPICS

### AREA CODES.

#### THEME A: DEVELOPMENT AND PLASTICITY

1. Process outgrowth, growth cones, and guidance mechanisms
2. Sprouting and sprouting mechanisms
3. Regeneration
4. Trophic agents
5. Trophic interactions
6. Synapse elimination and competition
7. Synaptogenesis
8. Specificity of synaptic connections
9. Morphogenesis and pattern formation
10. Neuronal death
11. Transmitter phenotypic plasticity
12. Neural plasticity in adult animals
13. Motor systems
14. Sensory systems
15. Limbic system
16. Visual system: retino-geniculo-cortical connections
17. Visual system: retinotectal connections
18. Development of invertebrates
19. Cell lineage and differentiation
20. Endocrine control of development
21. Biochemical and pharmacological correlates of development
22. Nutritional and prenatal factors
23. Development disorders
24. Aging
25. Autonomic nervous system
26. Neurotoxicity
27. Evolution of the CNS

#### THEME B: CELL BIOLOGY

28. Morphology of neurons and glia
29. Identified cells
30. Structure and function of the neuroendocrine cell
31. Staining and tracing techniques
32. Functions of glia
33. Membrane structure and function
34. Lipids and myelin
35. Proteins and nucleic acids
36. Cellular localization of receptors
37. Cell-surface macromolecules
38. Axoplasmic transport
39. Metabolic studies
40. Blood-brain barrier
41. Cellular aspects of disease
42. Molecular biology of gene expression

#### THEME C: EXCITABLE MEMBRANES, TRANSDUCTION AND SYNAPTIC TRANSMISSION

43. Synaptic structure and function
44. Presynaptic mechanisms
45. Postsynaptic mechanisms
46. Pharmacology of synaptic transmission

47. Receptor desensitization
48. Drug effects on receptors
49. Membrane biophysics
50. Action potentials and ion channels
51. Sensory transduction: photoreceptor transduction
52. Sensory transduction: photoreceptor signal processing
53. CNS neurons: vertebrates and invertebrates

#### THEME D: NEUROTRANSMITTERS, MODULATORS, AND RECEPTORS

54. Acetylcholine
55. Excitatory amino acids
56. Amino acids: GABA and benzodiazepines
57. Peptides: receptors
58. Peptides: anatomical localization
59. Peptides: biochemical characterization
60. Peptides: physiological effects
61. Peptides: biosynthesis and metabolism
62. Opiates, endorphins, and enkephalins: receptors
63. Opiates, endorphins, and enkephalins: anatomical localization
64. Opiates, endorphins, and enkephalins: biochemical characterization
65. Opiates, endorphins, and enkephalins: physiological effects
66. Catecholamines: receptors
67. Catecholamines: anatomical localization
68. Catecholamines: biochemical characterization
69. Catecholamines: physiological effects
70. Other biogenic amines
71. Transmitters in invertebrates
72. Transmitter cytochemistry and immunohistochemistry
73. Interactions between neurotransmitters
74. Coexistence of transmitters
75. Modulators
76. Metabolism of transmitters and modulators
77. Characterization of cholinergic receptors
78. Characterization of noncholinergic receptors
79. Regional localization of receptors and transmitters
80. Cyclic nucleotides
81. Alcohol and barbiturates
82. Transmitters and receptors in disease
83. Behavioral pharmacology
84. Uptake, storage, and secretion
85. Receptor modulation, up and down regulation
86. Chemical neuroanatomical methods

#### THEME E: ENDOCRINE AND AUTONOMIC REGULATION

87. Regulation of pituitary function
88. Pineal gland
89. Adrenal medulla
90. Endocrine control

- 91. Neural control of immune system
- 92. Cardiovascular regulation: morphological aspects
- 93. Cardiovascular regulation: functional aspects
- 94. Cardiovascular regulation: central transmitters
- 95. Cardiovascular regulation: hypertension and stress
- 96. Regulation of autonomic functions
- 97. Respiratory regulation
- 98. Peripheral autonomic nervous system
- 99. Hormonal control of behavior

#### THEME F: SENSORY SYSTEMS

- 100. Somatic afferents: vertebrates and invertebrates
- 101. Transmitters in sensory systems
- 102. Spinal cord
- 103. Subcortical somatosensory pathways
- 104. Somatosensory cortex and thalamo-cortical relationships
- 105. Evoked potentials
- 106. Pain: afferent nociceptors
- 107. Pain: central pathways
- 108. Pain: modulation
- 109. Retina: intrinsic organization
- 110. Retina and retinofugal projections
- 111. Central processing in invertebrates: vision and audition
- 112. Subcortical visual pathways
- 113. Visual cortex: intrinsic organization of striate cortex
- 114. Visual cortex: cortico-cortical and cortico-subcortical relationships
- 115. Visual cortex: extrastriate visual areas
- 116. Subcortical auditory pathways
- 117. Auditory cortex
- 118. Auditory sensory organs
- 119. Chemical sensory systems

#### THEME G: MOTOR SYSTEMS AND SENSORIMOTOR INTEGRATION

- 120. Cortex
- 121. Cerebellum
- 122. Basal ganglia: anatomy and physiology
- 123. Basal ganglia: behavior and pharmacology
- 124. Vestibular system
- 125. Oculomotor system
- 126. Visuimotor integration
- 127. Sensorimotor integration
- 128. Spinal cord and brainstem
- 129. Reflex function
- 130. Control of posture and movement: limbs
- 131. Control of posture and movement: locomotion
- 132. Muscle afferents
- 133. Muscle
- 134. Disorders of motor systems; neural prostheses
- 135. Invertebrate motor function

#### THEME H: STRUCTURE AND FUNCTION OF THE CNS

- 136. Cortex and cortico-subcortical relationships
- 137. Subcortical organization
- 138. Limbic system and hypothalamus
- 139. Regional neuropharmacology
- 140. Comparative neuroanatomy
- 141. Brain metabolism
- 142. Evoked potentials and EEG
- 143. Epilepsy
- 144. Diseases of the nervous system
- 145. Evolution of the CNS

#### THEME I: NEURAL BASIS OF BEHAVIOR

- 146. Human neuropsychology
- 147. Human behavioral neurobiology
- 148. Interhemispheric relations
- 149. Learning and memory: anatomy
- 150. Learning and memory: physiology
- 151. Learning and memory: pharmacology
- 152. Motivation and emotion
- 153. Sleep
- 154. Biological rhythms
- 155. Neuroethology
- 156. Circuitry and pattern generation
- 157. Invertebrate learning and behavior
- 158. Angiotensin and drinking
- 159. Feeding and drinking: cues for need state
- 160. Feeding and drinking: central mechanisms
- 161. Feeding and drinking: neuropharmacology
- 162. Stress, hormones, and the autonomic nervous system
- 163. Monoamines and behavior
- 164. Neuropeptides and behavior
- 165. Effects of chronic drug administration and neuroendocrinology
- 166. Opiates
- 167. Alcohol and barbiturates
- 168. Other drugs of abuse
- 169. Psychotherapeutic drugs
- 170. Aging



UNIVERSITY OF MINNESOTA  
DULUTH

College of Science and Engineering

DEC 3 1985

Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

November 20, 1985

Kenneth C. Zimmerman, Associate Dean  
Graduate School  
325 Johnston Hall  
101 Pleasant Street S.E.  
University of Minnesota  
Minneapolis, Minnesota 55455

Dear Dean Zimmerman,

I enclose the revised copy of our proposal for a MS Degree in Computer Science. Please keep me informed about its progress. Thank you for all your help in its preparation and presentation to the Graduate School.

Sincerely yours,

Mark A. Luker  
Associate Professor

MAK:crs

Enclosure



UNIVERSITY OF MINNESOTA  
DULUTH

Office of Vice Chancellor

Academic Administration  
420 Darland Administration Building  
10 University Drive  
Duluth, Minnesota 55812-2496

November 21, 1985

TO: V. Rama Murthy, Acting Vice President  
for Academic Affairs

FROM: Donald K. Harriss, Vice Chancellor  
for Academic Administration  
*Donald K. Harriss*

RE: Proposal for a New Master of Science Degree Program

Enclosed is a proposal to establish a Master of Science in Computer Science degree program.

The proposal has the support of the Department of Mathematical Sciences, the College of Science and Engineering, and the Duluth campus administration.

We feel that both student demand and need for graduates exist, that it will be a program of high quality, that strong interaction with other programs will be generated, and that it will be a very valuable addition to the academic programs on the Duluth campus.

DKH:aw

Enclosure

cc: Chancellors Group  
Deans Committee  
Department of Mathematical Sciences



UNIVERSITY OF MINNESOTA  
DULUTH

*Office of the Dean*

College of Science and Engineering  
108 Mathematics-Geology Building  
Duluth, Minnesota 55812-9989

(218) 726-7201

MEMO: 12 September 85  
TO: For The Record  
FROM: George (Rip) Rapp, Jr., Dean *George Rapp Jr*  
RE: Support For The Proposal For A  
Master's Degree In Computer Science

The baccalaureate degree in computer science in the College of Science and Engineering is well established and highly regarded. The need for a master's degree program in computer science in northeastern Minnesota is well documented in this proposal. Student demand is there, the resources are available and committed, and a quality faculty is in place. I completely support this proposal and strongly urge administrative and Regents approval.

GRRjr:ah

UNIFORM PROGRAM  
INVENTORY AND  
PROPOSAL FORM

SECTION I  
Program Proposal Abstract and Cover Sheet  
(See Attached Instructions)

1 Unit, Campus or College University of MN, Duluth Code No. 2

I. General Information

A. Program Title MASTER OF SCIENCE IN COMPUTER SCIENCE

8 27

B. Program Review Category:  Regular  
(check one)  Experimental (If Experimental, give Reporting Date:      /      /     )  
28 29 30 32 34

C. Proposed Implementation Date: 9 / 1 / 86  
36 38 40

D. Program Length: Total Cr/hr      Classroom      Laboratory       
42 45 46 49 50 53

E. Administrative Unit Immediately Responsible for Program: Dept. of Mathematical Sciences

54 73

F. Describe the Program (in 50 words or less):

The Master of Science degree in Computer Science is a two-year program of  
advanced study designed to provide fundamental graduate training in the  
academic discipline and to prepare individuals in the use of its principles  
for problem solving in other fields or applications. Studies include  
advanced lecture and laboratory materials, with hands-on experience in both  
academic and industrial environments.

65 120 64 120

5 G. Expected student interest in the program during the first year of operation, and when the program reaches full operating level:

	First Year: 1986 (Yr.)		Full Operation: 1988 (Yr.)	
	Number (Headcount) Expected	Student Credit or Contact Hours	Headcount Capacity	Student Credit or Contact Hours
a. Enrollment				
Program Enrollees	8	192	20	488
Other Students	6	72	6	72
Total	14	264	26	560
b. Program Graduates/Completers	0		10	

A. Projected Costs of the Program: II. Budget Data

	First Year 1986								Full Operation 1988							
	New				Re-assigned				New				Re-assigned			
	No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		No. FTE	Annual Cost		
a. Faculty		\$		1*	\$ 14,000		\$		2**	\$ 54,000						
b. Civil Service		\$		0.2	\$ 4,000		\$		0.25	\$ 4,000						
c. Equipment, Supplies, etc.		\$			\$ 11,500		\$			\$ 14,500						
Total Direct Costs (a+b+c)		\$			\$ 29,500		\$			\$ 72,500						
d. One-time Costs		\$			\$ 75,000		\$			\$ 30,000						
e. Space Rental		\$			\$		\$			\$						
f. Indirect Costs		\$			\$		\$			\$						
g. Total Program Costs (a+b+c+d+e+f)		\$			\$ 104,500		\$			\$ 102,500						

\*Teaching assistant

\*\*One TA, one faculty member

(All funds are reassigned within the Department or the College of Science and Engineering.)

B. Expected Sources of Funds for Program:

	First Year: 1986-87						Full Operation: 1988-89					
	Dollar Amount	% of Annual Expend.	One Time Input	Dollar Amount	% of Annual Expend.	One Time Input						
a. Local	\$		\$	\$		\$						
b. State	\$ 22,184	75.2	\$ 50,000	\$ 54,144	75.2	\$						
c. Tuition	\$ 7,316	24.8	\$	\$ 17,856	24.8	\$						
d. Federal	\$		\$	\$		\$						
e. Private	\$		\$ 25,000	\$		\$ 30,500						
f. Dedicated Fees	\$		\$	\$		\$						
g. Other (Specify)	\$		\$	\$		\$						
h. Total	\$ 29,500	100%	\$ 75,000	\$ 72,000	100%	\$ 30,500						

C. If there are any formal arrangements with other institutions or agencies, (e.g. clinical sites, cooperation, joint programs) explain, giving names of institutions:

D. System Verification:

----- 8 ----- 15 ----- 22 -----

Authorized Institution or System Signature \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

----- 29 ----- 39 ----- 40 ----- 42 ----- 47 -----

SECTION II. - SUMMARY

## II. A.1. SUMMARY DESCRIPTION OF PROGRAM

This document proposes a Master of Science degree in Computer Science, to be offered by the Department of Mathematical Sciences, College of Science and Engineering, at the University of Minnesota, Duluth.

The two-year program is intended to provide a sound academic basis for theoretical research, as well as knowledge and experience for applications in this and other disciplines or areas. The research activities of present faculty members in the department, with the variety of state-of-the-art hardware and software now available at UMD, indicate the breadth and depth intended for the program. Ongoing research areas in the department include computer languages, operating systems, algorithms, numerical applications and modeling, graphics, networking, symbolic computation, artificial intelligence, encryption, formal languages, and computational geometry.

The proposed graduate program builds upon the undergraduate baccalaureate program in computer science offered at UMD since 1979.

## II. A.2. ORGANIZATION AND CONTENT OF THE CURRICULUM

The proposed program is intended to provide a firm foundation for both theoretical aspects and applications of the discipline. Students will use a variety of state-of-the-art systems, including VAX UNIX and VMS, Cyber NOS, and a large number of micro- and super-microcomputers at UMD. In addition, they will have access to

supercomputers and other special purpose equipment on the University network.

The curriculum of the Master of Science degree in Computer Science will comply with the recommendations for master's level programs in Computer Science of the Association for Computing Machinery (ACM). The program will also be governed by the standard, periodic processes of internal and external review by the University.

#### II. A.3. NUMBER OF EXPECTED ENROLLEES

During its initial year of operation (1986-87), approximately 8 graduate students would be enrolled in the program. When the program reaches full operation in 1988, approximately 20 graduate students will be enrolled, with 10 students per year expected to complete their M.S. degree.

#### II. B. PROPOSED PROGRAM'S COMPLIANCE WITH HECB GUIDELINES

##### II. B.1. MISSION

The introduction of a Master's program in Computer Science is compatible with UMD's mission to offer a comprehensive selection of undergraduate instructional programs and to provide graduate, professional, and continuing education programs. The establishment of such a program would better enable UMD to fulfill both its broad teaching, research, and service responsibilities and also its unique regional mission as the only institution in northeastern Minnesota that offers computer science at the master's level.

## II. B.2. EVIDENCE OF INSTITUTIONAL READINESS

The graduate program in computer science at UMD will be able to build upon existing resources. First, the Curriculum Committee of the Association for Computing Machinery recommends a minimum of eight FTE faculty members to provide adequate breadth where both a bachelor's and a master's program exist. Faculty numbers at UMD meet that recommendation (see Section III.E.1).

Second, the graduate program in computer science will make substantial use of the existing Computer Center, whose development is included in the summary of Section III.A. New acquisitions will supplement the existing facilities. Classroom and laboratory space already exists, and more will become available when the new engineering building reaches completion in September 1986.

Third, it should be emphasized that the proposed Master's degree represents a logical extension of the baccalaureate computer science program established at UMD in 1979. At that time, faculty members implemented an undergraduate research program with the kind of one-to-one student/faculty advisor relationship necessary for high quality research. The proposed master's program is a natural extension of this type of academic interaction.

Fourth, the presence of the Master's program in computer science will enhance and be enhanced through interaction with other departments. In particular, it is anticipated that there will be significant interaction between the Department of Computer Engineering (four Ph.D. faculty members) and the mathematicians and statisticians of the Department of Mathematical Sciences (nine Ph.D. faculty).

## II. B.3. COST OF THE PROGRAM (Does not include fringe benefits on salaries)

## 1. Implementation: 1986-87

a) Faculty:		
1 FTE Teaching Assistant		\$14,000
b) Civil Service:		
0.25 FTE Secretary		4,000
c) Equipment, Supplies, etc.		
Supplies and Expenses	\$ 5,000	
Maintenance Contracts	6,500	
TOTAL		11,500

Total Direct Costs 29,500

d) One-time Costs:		
Initial Equipment Purchase		
or donation	60,000	
Office and lab space conversion	10,000	
Software Purchase	5,000	
TOTAL		75,000

Total Program Costs 104,500

## 2. Full Operation: 1988-89

a) Faculty:		
1 FTE Faculty	\$40,000	
1 FTE Teaching Assistant	14,000	
TOTAL		54,000
b) Civil Service:		
0.25 FTE Secretary		4,000
c) Equipment, Supplies, etc.		
Supplies and Expenses	5,000	
Maintenance Contracts	9,500	
TOTAL		14,500

Total Direct Costs 72,500

d) One-time Costs:		
Additional Hardware Purchase		
or donation	20,000	
Software Purchase	10,000	
TOTAL		30,000

Total Program Costs 102,500

Remarks on program cost:

Initially, 8 full-time Computer Science Faculty will staff the

program. We anticipate the need to hire one additional tenure-track faculty member by 1988.

One new FTE teaching assistant will be funded by the College. Two additional FTE teaching assistants will be funded by conversion of funds for two current non-tenure-track faculty positions into teaching assistant positions. This will be accomplished by reorganization of the beginning programming courses (currently being taught substantially by non-tenure-track faculty) into a lecture-recitation format with faculty lecturing and being assisted by graduate students. This will also free up faculty time for the graduate program. Thus, the total support for teaching assistants is:

- 1 new FTE from College funds;
- 2 FTE by conversion of existing departmental funds.

It is anticipated that support for several additional graduate students will be available through 1) fellowships and tuition scholarships from the Graduate School, 2) research assistantships funded by external grants, and 3) fellowships funded externally.

We expect that several additional costs will be funded by other University sources in programs now being planned:

- Library book and journal acquisitions, funded through legislative requests.
- Acquisition of space for faculty and TA offices by addition of 4th floor on the Math-Geology building.

This addition is part of the University's 6-year capital request.

The remaining funds needed for the program will come from reallocation within the College of Science and Engineering.

#### II. B.4. GEOGRAPHIC AREA TO BE SERVED

Several other institutions in Minnesota offer master's programs in computer science. Of these, three are located in the southern half of the state (Minneapolis, Mankato, and St. Thomas), and one (Moorhead) is located at the extreme western portion of Minnesota. There are no master's level computer science degree programs in northeastern Minnesota. In fact, approximately one-third of the state is closer to UMD than to any other master's program in computer science.

One important function of the proposed program would be to offer access to students and professionals in the northeastern sector of the state. Furthermore, the program would offer a unique opportunity for cooperation with northeastern Minnesota's five community colleges: Mesabi (Virginia), Itasca (Grand Rapids), Hibbing (Hibbing), Rainy River (International Falls), and Vermilion (Ely). Faculty members at these institutions who require formal training to upgrade their credentials for teaching undergraduate computer science courses could make use of the proposed program at UMD (see Appendix: Letters of Support).

Although the program at UMD would provide a unique regional service, the program is expected to draw students from a much wider geographic area given the high demand for computer science personnel,

the shortfall in supply (see Section III.C.3), and the full breadth of theory and application planned for the program.

## II. B.5. JUSTIFICATION FOR IMPLEMENTATION OF THE PROGRAM

### II. B.5.a. STUDENT DEMAND

Employment opportunities in computer science are excellent; trained personnel are in great demand and command high starting salaries. According to "Science and Engineering Personnel: A National Overview," a survey published in December 1984 by the National Science Foundation, the fastest growing employment field between 1976 and 1983 was computer specialists. This has led to unprecedented demand nationwide for bachelor's and master's degrees in this area. Nationally, during the last decade, the number of computer science degrees granted increased dramatically, by 1,200 percent.

The Department of Mathematical Sciences at UMD surveyed students enrolled in undergraduate mathematics and computer science courses as one way to project student interest in a graduate computer science program at UMD. One hundred seventy-eight students answered the questionnaire between April 10-12, 1985. Of these, 134 indicated interest in pursuing a graduate degree at some point in their careers; 74 indicated interest in a computer science graduate degree; 74 indicated interest in graduate study at UMD; and 99 indicated highest interest in a graduate degree in theoretical or applied computer science. These responses indicate a high degree of potential student interest in a master's level program in computer science at UMD.

Aside from undergraduates interested in graduate work, a number of workers currently employed in computer science areas at UMD or in businesses in northeastern Minnesota would like to upgrade their skills and obtain an advanced degree in computer science. This interest has been documented in letters from Minnesota Power, Honeywell, Minnesota Educational Computing Corporation, UMD Computer Center, and others (see Appendix), and is an aspect of the program particularly appropriate to the service mission of UMD as a land-grant institution.

## II. B.5.b. EMPLOYMENT OPPORTUNITIES

One compelling reason for the introduction of a Master of Science in Computer Science program at UMD is the exceptionally high demand for qualified professionals to fill positions in Minnesota (and national) business and industry. A 1979 report by the Curriculum Committee of the Association for Computing Machinery (ACM) stated:

"Graduate enrollments in computer science, information systems, and other related programs have grown steadily since their inception in the early 1960s. Even though growth rates are substantial, estimates of demand for personnel with graduate degrees in such programs far exceed the supply. During the 1980s, the need for masters graduates is estimated to be approximately 34,000 annually. During this same period, production will only increase from about 3,000 to 4,000 annually."

A 1980 survey of businesses by the IT Advisory Council stated that Minnesota faced an approximate shortfall of 500 new C.S. graduates (Masters and PhDs) in 1981, and predicted that this figure might increase to 530 by 1990. Seventy percent of the business leaders polled felt that the single most important factor affecting

business growth in Minnesota was the availability of engineers, scientists, and technicians.

A more recent study (1982) by the Minnesota High Technology Council looked at Minnesota hiring patterns in high technology positions and projected that 41% of all hires in 1984 would be drawn from computer science and electrical engineering graduates; moreover, graduates of those disciplines are expected to account for 62% of all hires in 1991.

## II. B.5.c. DUPLICATION

Given the high market demand for master's level computer science graduates, and the current and projected shortage of such graduates, limited duplication of graduate programs within the state would not be wasteful.

In any case, graduate programs in computer science in Minnesota appear to avoid duplication by emphasizing different focuses in their curricula. The program offered by the College of St. Thomas in St. Paul is titled Quantitative Methods and is directed toward business applications of computers. The programs at Mankato and Moorhead emphasize computer applications in education (although the Mankato program is part of the School of Business). North Dakota State University focuses on the mathematical applications of computers. The program offered at UMD would encourage breadth within the discipline and would include a strong emphasis towards theoretical and applied research. It would also include training in applications oriented towards the sciences and engineering to provide a master's degree that is either pre-doctoral or terminal.

Section III

\_\_\_\_\_  
(Date)

Proposal for: Master of Science in Computer Science  
Submitted by the: Department of Mathematical Sciences  
of the: College of Science and Engineering, University of Minnesota,  
Duluth

The proposal has been reviewed and approved by:

\*\*\*\*\*

APPROVAL CERTIFICATION

ADDITIONAL APPROVALS (as appropriate)

Keith R. Pierce August 29 1985  
(Department Chairperson) (Date)

Donald K. Harris 11/19 85  
(Vice Chancellor for Academic Administration) (Date)

Greg Rappje 29 Aug 85  
(Dean) (Date)

\_\_\_\_\_  
(Vice President, Academic Affairs) (Date)

\_\_\_\_\_  
(Dean, Graduate School) (Date)

Approval by Regents: \_\_\_\_\_  
(Date)

First Reading by PAC: \_\_\_\_\_  
(Date)

Second Reading by PAC: \_\_\_\_\_  
(Date)

Recommendation by the MHECB: \_\_\_\_\_

\_\_\_\_\_  
(Date)

Confirmation by Regents: \_\_\_\_\_  
(Date)

## III. THE PROPOSAL

## III. A. INTRODUCTION - (A description of the intellectual, social, and educational context of the proposed program and of the planning and development activities from which the proposal was generated.)

This document proposes the establishment of a Master of Science degree in Computer Science at the University of Minnesota, Duluth.

The proposed program is appropriate at this time for several reasons including the maturation and expansion of the discipline; the crucial unmet demand for computer science professionals in both the business world and academia; the educational, research, and service missions of UMD and the College of Science and Engineering; and for demographic reasons.

The computer science undergraduate program at UMD has been developed in orderly steps over the past twenty years. It originated in a sequence of three programming courses first taught in 1965 using an on-campus IBM 1620 computer system, and has been modified and expanded into a full B.S. program of over forty courses utilizing several computer systems. The major developments in this program are summarized chronologically below:

1965 - An IBM 1620 computer system is installed at UMD.

- A three-quarter computing sequence is offered. The main topics covered are machine structure, programming in assembly language and in FORTRAN, and an introduction to numerical analysis.

- 1968 - The IBM 1620 is replaced by an IBM 360/44.
  - The Association for Computing Machinery (ACM) publishes guidelines for degrees in computer science (Communications of the ACM, 11, March 1968).
- 1969 - The IBM 360 is replaced by a CDC 3200 system.
  - FORTRAN is offered as a separate, introductory course.
- 1970 - The three-quarter programming sequence is split according to subject matter into separate courses in numerical analysis, assembly language programming, and systems programming.
- 1972 - All mathematics majors are required to complete a common "core" curriculum which includes introductory FORTRAN.
- 1974 - The Academic Computer Center moves to new facilities and begins expansion to its present staff of 15 fulltime employees and numerous part-time, student positions.
- 1975 - Major revisions are made in the computer science curriculum to reflect the recommendations of the 1968 ACM guidelines. The systems programming course is replaced by one in data structures; a new course in comparative programming languages is offered; an intermediate-level COBOL programming course is added; the numerical analysis course is split into a two-course sequence.
  - The requirements for the BS in Mathematical Sciences are split into three options: applied mathematics, statistics, and computer science.
  - UMD obtains access to the University of Minnesota's MERITSS timesharing network.

- 1976 - Timesharing computing is introduced in all computing courses except COBOL.
- A new course in computer systems is added, then is split into two courses: Computer Architecture and Operating Systems.
  - PASCAL is adopted as the base language for the upper-division computer science courses.
- 1977 - A new intermediate level FORTRAN programming course is added to serve students in the computer science option.
- 1978 - The CDC 3200 computer system is replaced by a CDC Cyber 171.
- A new course in computer graphics is added.
- 1979 - The Association of Computing Machinery publishes revised curriculum guidelines (Communications of the ACM, volume 22, number 3, March 1979).
- 1972-79 - "Special Topics" courses are offered in many areas, including the use of mass storage, job-control languages, formal-language theory, and computability theory.
- 1979 - The current four-year baccalaureate degree program in computer science is established.
- 1980-84 - Many additional computer science courses are added to exceed the 1979 ACM curriculum guidelines.
- 1980-85 - Computer science faculty increases to eight tenure-track positions, plus additional lecturers.
- 1982 - An honors program is initiated to promote undergraduate research.
- 1983 - The CDC Cyber 171 is replaced by a Cyber 170-815 and UMD assumes responsibility for its own timesharing instructional computing.

1983 - Competitive admissions requirements are instituted to restrict enrollment in upper division courses to the full-program size of 60 students per year.

1984 - First students admitted to upper division program in computer engineering.

1985 - Full UNIX capability is added in all courses for majors.

- The Department of Mathematical Sciences begins to implement a split into separate departments of Computer Science and Mathematics.

Since 1975, the computer science program has become an integral part of both education and research in many disciplines at UMD. The introductory level course is now required of majors in nine programs, including business and other fields outside the physical sciences. Students (primarily from mathematics and the physical sciences) who have completed advanced courses in the program now form an important segment of the UMD and the Duluth-area research communities. Many graduates now hold positions in northeastern Minnesota computer installations.

Planning activities for the UMD computer science curriculum have been centered in the Department of Mathematical Sciences. All proposals were introduced at the departmental level, and were subsequently approved by College and University governing bodies. Planning has been simplified by the widespread national acceptance of the ACM guidelines for computer science curricula and the varied areas of research expertise represented within the department. The main objective of computer science curriculum development at UMD has been to provide a high quality, integrated curriculum of computer science and supporting mathematics courses, starting with the topics

identified by the ACM as most fundamental, and gradually expanding to the full recommended program.

The evolution of the UMD computer science program reflects parallel developments in the discipline of computer science, namely, a shift in emphasis from programming and programming techniques to the study of underlying mathematical structures, and the development of unifying, high-level descriptions of both algorithms and machines.

### III. B. THE PROPOSED PROGRAM

#### III. B.1. PROGRAM OBJECTIVES

The basic intent of the master's program in computer science is to develop the student's critical professional thinking and intuition. The program emphasizes the concepts, theory, and practice of computer science. Students will be equipped with a broad understanding of the field.

The proposed program is designed to prepare graduates to enter positions in business, industry, and government at a relatively high level of responsibility and expertise, or to pursue doctoral research. It is also designed to upgrade the skills and knowledge of persons with a bachelor's degree who are already engaged in positions in business, industry, and academia (see Appendix: Letters of Support).

Specifically, the proposed Master of Science degree in Computer Science will teach and require a mature grasp of the concepts, nature, and techniques associated with:

- 1) analysis of large or complex problems and the efficient design of an economical solution;

- 2) practical problems in the implementation of such designs;
- 3) organization and coordination of teams of experts;
- 4) written and oral communication skills;
- 5) research and scholarship in the technical literature; and
- 6) broad understanding of the present physical and algorithmic limits of computing, and their effects on potential applications.

The proposed program is also intended to upgrade skills of persons already employed in positions in computer science or related fields, a purpose entirely consonant with the service mission of UMD. Potential students would include:

- 1) computing professionals and managers in regional industry or at UMD;
- 2) university and community college faculty from a variety of disciplines; and
- 3) public school teachers.

### III. B.2. ADMISSION REQUIREMENTS

A bachelor's degree from a recognized institution in the United States or an equivalent credential from a foreign institution is required for admission consideration. An undergraduate degree in majors other than Computer Science that provide substantial background in Mathematics and basic core Computer Science qualifies an applicant for consideration in terms of prerequisite background. Applicants lacking a substantial part of the prerequisite background will be expected to complete the prerequisites prior to applying. Those lacking some of the prerequisites may be admitted with the

understanding that the remaining prerequisite work will be taken concurrently with the graduate program and prior to the award of the Master's degree.

The following list of UMD courses corresponds to those recommended by the Association for Computing Machinery as prerequisites for graduate education:

- Math 5555 - Discrete Math II
- CS 3521 - Introduction to Systems Software
- CS 3523 - Machine Organization
- CS 5526 - Data Structures I
- CS 5542 - Computer Architecture I
- CS 5543 - Operating Systems I
- CS 5544 - Comparative Programming Languages

Special Application Requirements—Scores from the General (Aptitude) and Subject (Advanced) Tests of the Graduate Record Examination are required. For undergraduate majors in computer science, the advanced test should be in computer science. These scores will be used in admissions decisions as well as for advisement.

Students whose native language is not English and who have not completed one year in residence as a full time student at a recognized institution of higher learning in the United States must submit their score on the Test of English as a Foreign Language (TOEFL). (The Graduate School requires a minimum TOEFL score of 450 for admission. The Department will also require a minimum score of 450 for admission, but will require 500 for the awarding of teaching assistantships.)

### III. B.3. DESCRIPTION OF THE CURRICULUM

The Master of Science degree in Computer Science is a two-year program of advanced study intended to provide fundamental graduate

training in the academic discipline and to prepare individuals in the use of its principles for problem solving in other fields or applications. Studies include advanced lecture and laboratory materials, with hands-on experience in both academic and industrial environments.

Ongoing research includes computer languages, operating systems, algorithms, numerical applications and modeling, graphics, networking, symbolic computation, artificial intelligence, encryption, formal languages, and computational geometry. Students will use a variety of state-of-the-art systems, including VAX UNIX and VMS, Cyber NOS, and a number of micro- and supermicro-computers at UMD, and will have access to supercomputers and other special purpose equipment on the University network.

a. DEGREE REQUIREMENTS

Total required hours: 49 (see comments below justifying this)

20 credits from the required sequences: CS 8001-2-3 (4 cr each) and CS 8010-11 (4 cr each).

8 credits from related areas, or 9 credits from a single related area for a minor.

1 credit CS 89XX of seminar.

Plan A additional requirements:

16 credits GRAD 8777 of thesis.

A minimum of 4 graduate credits in approved courses from CS or a related area to bring the total credits to 49.

Plan B additional requirements:

12 credits of graduate level CS courses

A minimum of 8 additional credits of approved graduate level courses in CS or related areas to bring the total credits to 49.

The Association of Computing Machinery [1] recommends that "the typical [master's level] program will consist of 30 to 36 semester hours," or equivalently, 45 to 54 quarter hours. We chose to require 49 quarter hours for the following reasons:

1. Anticipating an eventual request for accreditation of the program, we consider it unwise to require only the minimum recommended.
2. The ACM guidelines refer to 3-credit courses which include no credit for laboratory work. On the other hand, many current CS 5000-level courses are offered for 4 credits, 3 hours of which are for lecture and 1 hour of which is for laboratory work. Assuming that, of the 8 to 12 formal courses taken in a student's program (not including seminars and thesis credits), 4 of these courses have laboratory components worth 1 credit each, then the student actually has taken 45 quarter-lecture hours, meeting the minimum equivalent 30 semester hour limit.

Reference [1]: "Recommendations for Master's Level Programs in Computer Science: A Report of the ACM Curriculum Committee on Computer Science," *Communications of the ACM*, March, 1981, 115-123.

## b. COURSE DESCRIPTIONS

Listed below are the 5000-level courses available for the program. All but 8 of the 29 5000-level courses are currently in the curriculum.

- CS 5526 - DATA STRUCTURES I. (4 cr; prereq 3523, Math 3555)  
A study of data structures and their associated algorithms, emphasizing both implementation and complexity analysis. Review of lists, stacks, and queues. Storage of trees and graphs. Traversals. Data storage used for searching techniques, including binary search trees, B-trees, trees and hashing.
- CS 5528 - DATA STRUCTURES II. (4 cr; prereq 5526)  
Sorting, algorithms, file storage and access, and memory management.
- CS 5529 - SOFTWARE ENGINEERING. (4 cr; prereq 5526)  
Formal methods of software design and development. The quantification and measurement of design parameters. Organization and management of development projects.
- CS 5530 - NUMERICAL ANALYSIS. (4 cr; prereq 3510 or 3520 and Math 3380 or Math 3381 and Math 3699)  
Computer representation of numbers, unit roundoff, solution of nonlinear equations, polynomial interpolation, numerical integration and solution of differential equations.
- CS 5531 - NUMERICAL LINEAR ALGEBRA. (4 cr; prereq 3510 or 3520, and Math 5326 and Math 3670)  
Solution of systems of linear equations. Pivoting and scaling. Error propagation. Iterative refinement of solutions. Orthogonal functions and least squares approximation.
- CS 5532 - NUMERICAL METHODS IN PHYSICS. (4 cr; prereq 3510 or 3520, Math 3380 or Math 3381, Phys 3010)  
Numerical solutions to differential equations in physics with emphasis on hydrodynamics, heat, and mass transport problems.
- CS 5542 - COMPUTER ARCHITECTURE I. (4 cr; prereq 5526)  
Uniform description of digital devices using vector Boolean algebra. Elementary design considerations. Introduction to computer architecture; typical hardware devices and configurations.

- CS 5543 - OPERATING SYSTEMS I. (4 cr; prereq 5542)  
Efficient use of processors, memory, I/O devices, and files. Multiprogramming and multiprocessing. Scheduling, synchronization, reliability, and security problems. Job-control languages.
- CS 5544 - COMPARATIVE PROGRAMMING LANGUAGES. (4 cr; prereq 5526)  
A survey of significant features of existing programming languages with emphasis on the concepts underlying these languages, and the implicit relationship between language source codes and their run-time representations.
- CS 5550 - WORKSHOP. (1-5 cr) May be repeated for a max of 10 cr: no more than a total of 6 cr can be applied to a Graduate School program. Opportunities for teachers and other special-interest groups to concentrate on some topic of common interest and concern.
- CS 5701 - THEORY AND APPLICATION OF LINEAR PROGRAMMING ALGORITHMS. (4 cr; prereq Math 3320 and CS 3521)  
Basic solutions to linear systems; inequalities; convex polyhedral sets; linear programming formulation and optimality conditions; theoretical and computational aspects of simplex algorithm; postoptimal analysis; duality. Revised simplex and numerically stable methods, upper-bounded problems; commercially available LP systems; methods for large, sparse systems.
- CS 5704 - SYSTEM SIMULATION: LANGUAGES AND TECHNIQUES. (4 cr; prereq 3521 or Math 3562)  
Methodologies relevant to simulation including queuing theory, variable generation, design of experiments, data collection, statistical analysis of output. Simulation languages, both flow and event oriented, including GPSS, SIMULA, SIMSCRIPT. Application of job shops; operations research and modeling of computer and communications systems.
- CS 5711 - DATA COMMUNICATIONS AND COMPUTER NETWORKS. (4 cr; prereq 3521)  
Introduction to computer networking and associated software protocols. Study of ISO model and also ARPA protocols. Design of software used in computer networks.
- CS 5713 - CODING AND CRYPTOGRAPHY. (4 cr; prereq Math 3670)  
Public key encryption, factoring algorithms, algebraic coding theory.

- CS 5715 - MICROCOMPUTER SYSTEMS. (4 cr; prereq 3523)  
Microcomputer assembly languages, architecture, operating system issues, hardware devices, and configurations.
- CS 5725 - ALGORITHMS. (4 cr; prereq 5526)  
Survey and analysis of algorithms used in combinatorics, numerical calculations, systems programming, and artificial intelligence.
- CS 5730 - COMPUTATIONAL GEOMETRY. (4 cr; prereq 5526)  
Geometric data structures, Voronoi tessellations, and algorithms to compute polytope intersections, distance between polytopes, visibility, and shortest paths avoiding obstructions.
- CS 5735 - COMPUTER GRAPHICS I. (4 cr; prereq 3523 and Math 3320)  
A study of computer graphics hardware and software. Topics to include raster scan and vector displays, hardcopy devices, graphics packages, standards, display files, transformations, projections, and clipping.
- CS 5736 - COMPUTER GRAPHICS II. (4 cr; prereq 5735)  
A study of 3-D transformations and 3-D viewing; modeling and object hierarchy; scan conversion; 3-D modeling; hidden edge and surface removal; shading; use of color.
- CS 5742 - COMPUTER ARCHITECTURE II. (4 cr; prereq 5542)  
Alternatives to processing unit organization; bit slices, pipelining and parallel processors; stack machines; SIMD, MIMD; input/output; arithmetic, memory, peripherals.
- CS 5743 - OPERATING SYSTEMS II. (4 cr; prereq 5543)  
Concurrent processes and problems associated with them. Name management. Resource allocation including queuing, system balancing, job activation, and deactivation. Protection mechanisms and enforcement. Networking and distributed systems.
- CS 5744 - DATABASE MANAGEMENT SYSTEMS. (4 cr; prereq 5526)  
Introduction to database concepts; file organization; network, relational, hierarchical data models; queries and query languages; file security; normal forms.
- CS 5745 - DATABASE MANAGEMENT SYSTEMS DESIGN. (4 cr; prereq 5744)  
A study of the concepts and structures necessary to design and implement a data base management system.

- CS 5755 - THEORY OF PROGRAMMING LANGUAGES, TRANSLATION, AND COMPILING. (4 cr; prereq 5526)  
Finite-state grammars, lexical scanners, and implementation of symbol tables. Context-free languages and parsing techniques. Syntax-directed translation. Code generation and optimization. Intermediate languages.
- CS 5765 - AUTOMATA, COMPUTABILITY, AND FORMAL LANGUAGES. (4 cr; prereq Math 3555)  
Finite-state deterministic and nondeterministic machines, regular expressions, and closure. Formal grammars, pushdown automata, and grammar algorithms. Computability, Turing machines, and the halting problem.
- CS 5775 - ARTIFICIAL INTELLIGENCE I. (4 cr; prereq 5526)  
Data representation issues, search strategies, control, communication and perception questions in the artificial intelligence field. Some discussion of applications. Programming in LISP and discussion of other common languages used in artificial intelligence.
- CS 5776 - ARTIFICIAL INTELLIGENCE II. (4 cr; prereq 5775)  
Topics from among vision, expert systems, automated theorem proving, games, natural language processing.
- CS 5950 - INDEPENDENT STUDY. (1-4 cr) May be repeated for a max of 8 cr; no more than a total of 6 cr can be applied to a Graduate School program. Special projects not available in the standard curriculum.
- CS 5970 - SPECIAL TOPICS. (1-3 cr) May be repeated for a max of 6 cr. Directed reading and/or research in computer science.

Students will be required to take at least eight credits outside their major field, computer science. The majority of these credits are expected to be in Math, Computer Engineering, or Physics.

The following two sequences form the 8000-level "core" of the program:

- CS 8001-2-3 - COMPUTER SYSTEMS. (4 cr - 4 cr - 4 cr)  
 The analysis of large or complex problems, and the design of economic software solutions. The coordination of teams in their implementation. Software and management tools (includes a thorough introduction to the facilities and tools available at UMD, including UNIX). Principal components of computer systems including architecture, machine language, assembly language, implementation of data structures, assemblers, and linking loaders. The organization and coordination of system components including operating systems, filing systems, synchronization and security, virtual devices, communications, and networks.
- CS 8010-11 - LANGUAGES AND ALGORITHMS. (4 cr - 4 cr)  
 Theory and implementation of interpreters and compilers. Formal specification of syntax and semantics. Compiling tools. The design and mathematical analysis of computer algorithms. Classification of problems by complexity. Practical considerations and theoretical foundations.
- CS 8901 - SEMINAR: LANGUAGES AND SYSTEMS. (1-3 cr)
- CS 8902 - SEMINAR: NUMERIC COMPUTATION. (1-3 cr)
- CS 8903 - SEMINAR: NON-NUMERIC COMPUTATION. (1-3 cr)
- CS 8904 - SEMINAR: COMPUTER GRAPHICS AND GEOMETRIC APPLICATIONS. (1-3 cr)

Note - The amount of credit earned for a seminar is arranged with the faculty member. Consent of the instructor is required prior to registration. Seminars may be repeated for credit when topics change.

The following are sample programs and projects for the Master of Science degree in Computer Science:

Typical program - Plan A:

Year 1

Fall		
CS 8001	Computer Systems I	4 cr
	Elective in CS or related area	4 cr
Winter		
CS 8002	Computer Systems II	4 cr
	Elective - related area	4 cr
Spring		
CS 8003	Computer Systems III	4 cr
	Elective - related area	4 cr
		<u>24 cr</u>

Year 2

Fall		
GRAD 8777	Thesis	4 cr
CS 8010	Languages and Algorithms I	4 cr
	Seminar	1 cr
Winter		
GRAD 8777	Thesis	4 cr
CS 8011	Languages and Algorithms II	4 cr
Spring		
GRAD 8777	Thesis	8 cr
		<u>25 cr</u>

Sample thesis titles - Plan A:

Techniques for synchronizing distributed processes.

Algorithms to find distance to convex hull of a finite set of points.

Decomposition of polygonal regions into

- a. convex polygons
- b. convex quadrilaterals
- c. triangles

Hidden surface removal for high order surfaces.

Numerical modeling of groundwater flow.

Videotex protocols: telephone transmission of graphics.

Analytic or numerical singularities in partial differential equations.

Parallel processing in numerical linear algebra.

Signal processing algorithms.

Data compression in digital imaging.

Problems of deadlock in small and large distributed systems.

Performance evaluation on a (simulated) first generation digital computer.

Sound coding techniques: developments and applications.

Determination of test paths for software testing.

String compression algorithms.

Visual acceptability of image reconstruction.

Software development environments.

Rule-based interface for CAI authoring.

Rule-based human interface package.

Microcomputer/tablet recognition for characters.

## Typical program under Plan B: general emphasis

## Year 1

Fall		
CS 8001	Computer Systems I	4 cr
CS 5530	Numerical Analysis	4 cr
Winter		
CS 8002	Computer Systems II	4 cr
CS 5535	Computer Graphics I	4 cr
Spring		
CS 8003	Computer Systems III	4 cr
Elective - related area		4 cr
		<u>24 cr</u>

## Year 2

Fall		
CS 8010	Languages and Algorithms I	4 cr
Elective - related area		4 cr
Seminar		1 cr
Winter		
CS 8011	Languages and Algorithms II	4 cr
CS 5775	Artificial Intelligence I	4 cr
Spring		
CS 5743	Operating Systems II	4 cr
CS 5744	Database Management Systems	4 cr
		<u>25 cr</u>

## Typical program - Plan B: Computer Graphics emphasis

## Year 1

Fall		
CS 8001	Computer Systems I	4 cr
	Elective - related area	4 cr
Winter		
CS 8002	Computer Systems II	4 cr
	Elective - related area	4 cr
Spring		
CS 8003	Computer Systems III	4 cr
CS 5735	Computer Graphics I	4 cr
		<u>24 cr</u>

## Year 2

Fall		
CS 5736	Computer Graphics II	4 cr
CS 8010	Languages and Algorithms I	4 cr
Winter		
CS 5742	Computer Architecture II	4 cr
CS 8904	Seminar in Computer Graphics	1 cr
CS 8011	Languages and Algorithms II	4 cr
Spring		
CS 5730	Computational Geometry	4 cr
CS 5701	Linear Programming Algorithms	4 cr
		<u>25 cr</u>

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Typical program - Plan B: Computational emphasis

Year 1

Fall		
CS 8001	Computer Systems I	4 cr
CS 5701	Linear Programming Algorithms	4 cr
Winter		
CS 8002	Computer Systems II	4 cr
	Elective - related area	4 cr
Spring		
CS 8003	Computer Systems III	4 cr
CS 5530	Numerical Analysis	4 cr
		<u>24 cr</u>

Year 2

Fall		
CS 5531	Numerical Linear Algebra	4 cr
CS 8010	Languages and Algorithms I	4 cr
Winter		
CS 8011	Languages and Algorithms II	4 cr
CS 8902	Seminar in Numerical Analysis	1 cr
	Elective - related area	4 cr
Spring		
CS 5730	Computational Geometry	4 cr
CS 5742	Computer Architecture II	4 cr
		<u>25 cr</u>

Sample projects - Plan B:

Design and implementation of a menu-driven editor for beginning programming students.

Design robust, user-friendly operating system interface.

Implement 3-dimensional graphics packages on various computers.

Design a program to create and correct randomized multiple-choice exams.

Analysis, design, documentation, and implementation for a grading program.

Uses of sound or word coding schemes.

Design intercomputer message system.

Design standard relational database system to work on various computers.

Design specialized symbolic algebra package.

Design an EMYCIN-like expert system framework.

Design a syntax-driven menu interface.

Pseudorandom number generation.

Empirical computer performance evaluation.

Protocols in cryptography.

Monte Carlo simulations.

## III. B.4. GRADUATION REQUIREMENTS

Graduation requirements for a Master of Science degree in Computer Science will follow those of the Graduate School of the University of Minnesota.

The master's degree is offered under two plans: Plan A (involving a thesis) and Plan B (involving additional course work and special projects in place of a thesis). The completion of a master's program ordinarily requires six quarters in residence. Students who are planning to earn the degree under either Plan A or Plan B should, therefore, take into account this customary rate of progress as well as the graduate school requirement of four quarters in residence.

The maximum time allowed by the Graduate School for completion of the master's degree is seven years. The seven-year period begins with the oldest work included on the official degree program, including any transfer work applied. The graduate faculty in a specific program may set more stringent time requirements.

In addition to general Graduate School requirements, students must show proficiency in the use of computers by writing and executing a significant and adequately documented computer program. This can be done in connection with a thesis, Plan B project, graduate seminar, or independent study under supervision of a faculty adviser. All master's students must demonstrate competence in the basic material through a written final examination. Each student must present his/her thesis or project at a departmental colloquium. Plan A students must also successfully pass a final oral examination on the thesis.

## PLAN A: MASTER'S DEGREE WITH THESIS

In choosing a major and related field(s) or minor field of work, the student must present the minimum undergraduate preparation prescribed under Department Statements. (See Section III.B.2. Admission Requirements.) The student must complete a minimum of 49 credits of coursework with a minimum GPA of 2.80 in all courses taken in the program (see Section III.B.3.a, Degree Requirements). The thesis will account for 16 credit hours.

Ordinarily, the student is expected to devote a minimum of 700 hours to the preparation of the thesis, including courses on which the thesis is based (that is, approximately half of the candidate's time in the program). The following criteria will be used to judge the acceptability of a thesis:

1. It must be written in proper English using acceptable prose style.
2. It must demonstrate the candidate's ability to work independently.
3. It must display the candidate's power of independent thought, both in perceiving problems of computer science, and in making satisfactory progress toward their solution.
4. It must show the candidate's familiarity with the bibliography of his or her chosen special field of computer science through correct citation of authorities in that field.
5. It must demonstrate the candidate's skills in communicating his or her understanding of the special field, the problems perceived, and their solutions.

Candidates for the master's degree under Plan A must pass a final written examination on the basic material, and a final oral examination in defense of the thesis.

## PLAN B: MASTER'S DEGREE WITHOUT THESIS

The requirements for this plan follow Plan A in matters of admission, residence, and language requirements. As in Plan A, the student must pass a final written examination on the basic material. Plan B differs from Plan A in substituting for the thesis a heavier course requirement. For professional purposes, the master's degree program under Plan B is less focused on a single research topic and more appropriate for individuals who will profit by a broader range of knowledge in their fields. Whether taken for professional or personal purposes, the requirements for Plan B are meant to test interests and intellectual abilities for a different purpose, but not on a different level, from that of Plan A.

Under Plan B, students must complete a minimum of 49 quarter credits of coursework with a minimum GPA of 2.80 in all courses taken in the program (see Section II.B.3.a, Degree Requirements).

Candidates are expected to complete at least one project requiring a minimum of 120 hours of effort. This project will usually be satisfied by the candidate developing a significant software package. Such a project will be judged for acceptability based on the following criteria:

1. It must be written in correct English using acceptable style of prose.
2. It must demonstrate via external documentation the candidates understanding of the specialty field that the software involves; the specifications required of the software; an awareness of, and appreciation for, the end-user's needs.

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3. It must demonstrate the candidate's understanding of state-of-the-art in software development methodology.
4. It must demonstrate the candidate's ability to write a clear, correct, maintainable piece of software that correctly meets the initial design specification.

Candidates for the master's degree under Plan B must pass a final written examination on the basic material.

III. C. EDUCATIONAL AND SOCIAL NEED FOR THE PROGRAM

III. C.1. PROPOSED NUMBER OF STUDENTS TO BE SERVED BY THE PROGRAM

The proposed program is designed to admit 8 students the first year, and 10 students each successive year.

III. C.2. STUDENT INTEREST DATA

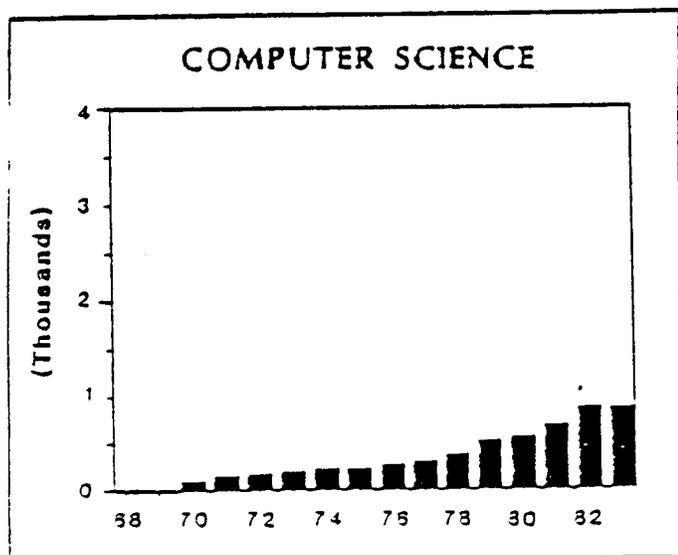
a. National

According to a 1984 NSF survey, the proportion of college-bound seniors who intend to major in a science/engineering field rose steadily from 36% in 1981 to about 40% in 1983. This increase is largely attributable to the rise in the proportion of students intending to choose computer science as their undergraduate field: from about 6% in 1981 to more than 10% in 1983. The proportions who intended to major in other fields remained relatively stable.

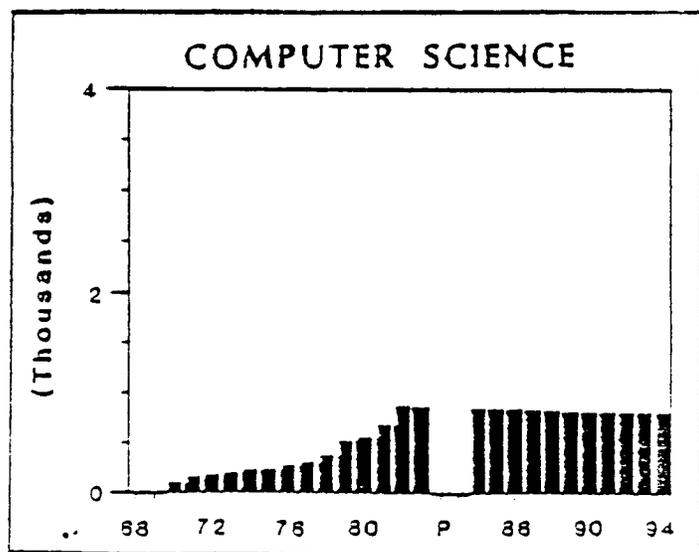
b. Institute of Technology (Twin Cities Campus)

IT's Master Facilities Plan: 1984-1994 (1985) documents increased actual and projected growth in the number of computer science undergraduates and graduates enrolled.

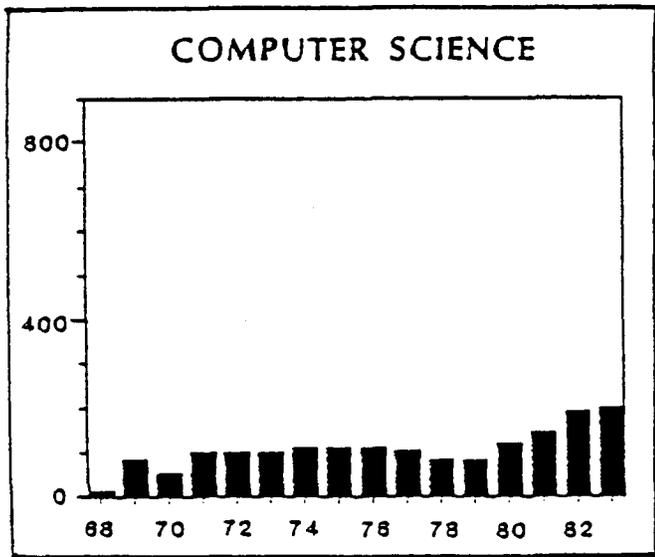
Undergraduate Majors  
1968-1983



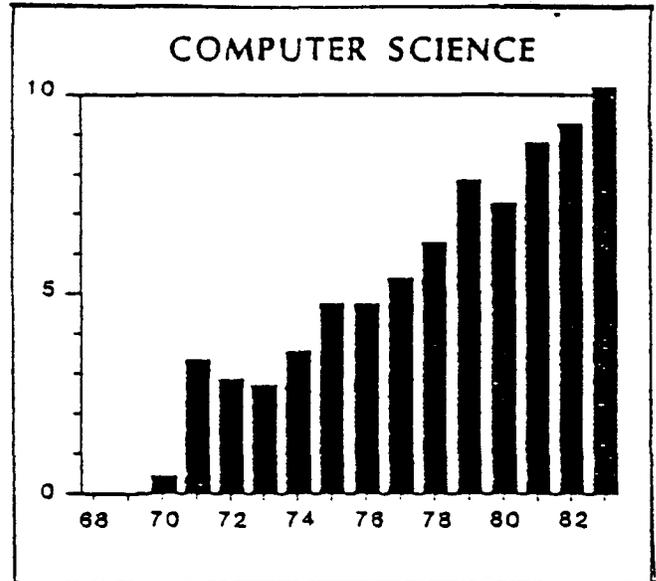
Undergraduate Majors  
1968-1994



Graduate Enrollment  
1968-1983



Total Degrees (BS, BA, MS, PhD)  
per FTE Faculty  
1968-1983



The Master Facilities Plan for IT states that Department of Computer Science enrollment has increased every year since its founding in 1971. The Department plans an increase in graduate enrollment of about 15% by 1994. One major goal of the department by 1994 is to produce "quality graduates" for 60% of Minnesota's needs. But even under optimal conditions, IT cannot meet 100% of Minnesota's hiring needs for qualified computer scientists.

c. UMD

As demonstrated by results of a survey of 178 computer science students at UMD taken during April 1985, 74 students indicated specific interest in pursuing a graduate degree in computer science at UMD. Since employment opportunities are excellent, with shortfalls predicted in numbers of trained personnel, high student demand may be expected to continue.

The letters in the Appendix indicate strong interest in the program from other sectors:

1. computing professionals and managers in regional industry:

Robert J. Marchetti, Senior Vice President, Minnesota Power:  
"Minnesota Power has approximately 20 professionals involved in the design, implementation, and support of highly sophisticated software systems, and is continually attempting to provide better software tools and utilities to its computer user constituency... someone is required to advance that software technology. It is in this capacity that these 20 professionals would benefit from such a program."

Thomas R. Varilek, Director, Information Systems, Minnesota Power:  
"What has been lacking in this region of the country is a graduate level curriculum in computer science. A number of employees at Minnesota Power, including myself, have had an interest in pursuing an advanced computer science degree, but have been frustrated by the inconvenience of travel to the Twin Cities. Approximately twenty professionals could benefit from this program and most would in all likelihood take advantage of the educational opportunities."

Nancy Giddings, Section Chief, Software Technology Research, Honeywell:  
"There certainly is a solid marketplace for individuals who complete a research-oriented graduate program... It is very likely that some of our senior people may be interested in visiting your campus via seminars/colloquia."

2. computing professionals at UMD:

John E. Skelton, Director, UMD Computer Center:  
"...several of the computer center staff have indicated that they would be interested in pursuing the degree... There would also be an interest in using the proposed course offerings for personnel to retrain or upgrade their skills... I think that the availability of a number of graduate students to help in both consulting and special projects would be most welcome and improve the quality of the services we offer."

3. university faculty at UMD from disciplines as widely divergent as accounting and music:

Fawzi G. Dimian, Professor of Accounting, UMD:  
"We have a number of students who are majoring in accounting and computer science. This combination is of great interest to us and the accounting profession. We believe a master degree in Computer Science is highly desirable. We strongly support this degree program at UMD."

Robert E. Williams, Department of Music, and Chairperson, UMD Subcommittee on Computing, President, IBM-PC Users Group:

"It is my conviction that a Masters degree in computer science is needed in the Duluth area to benefit all of northern Minnesota. There are numerous firms looking for personnel and for assistance in computer problems in this area. It would be beneficial for both the community and the university to have a masters in computer science here."

4. university faculty at the University of Wisconsin, Superior:

Francis G. Florey, Coordinator, Mathematical Sciences, UWS:

"We see [the proposed program at UMD] as one which would allow our own graduates to obtain locally an advanced degree in computer science. We may also have faculty and staff at UWS who would take advantage of this program as it would be much more convenient than traveling to Minneapolis or Madison."

Paul Williams, Associate Professor, Mathematical Science, UWS:

"Persons... with training in other areas who have been retrained in computer science have the need to continue that training... At present I would have to go at least 150 miles to take a course."

5. public school teachers:

Dennis R. Chretien, Minnesota Educational Computing Corporation, Northeast Minnesota Instructional Coordinator:

"I spend most of my time dealing with elementary and secondary school teachers... These teachers could make use of some of your graduate level courses for retraining or to upgrade their skills... Imagine the effect on your [undergraduate] program of having incoming students with a solid background in structured design and programming, competent in problem analysis and program planning. These students can only result from high school classes taught by properly trained teachers."

## III. C.3. GEOGRAPHIC AREA THE PROGRAM IS DESIGNED TO SERVE

In a 1975 publication, Computer Manpower - Supply and Demand By States, John W. Hamblen compiled a table estimating need versus production at the master's degree level for computer science:

<u>State</u>	<u>Need</u>	<u>Production</u>
Illinois	2152	149
Iowa	581	36
Minnesota	786	34
North Dakota	171	5
South Dakota	137	0
Wisconsin	717	8

On the average, only 5% of the needed personnel were being produced at the master's level a decade ago, and in Minnesota the figure was only 4.3%.

According to Peterson's Guide to Graduate Programs in the United States (1985), the number of master's level computer science graduates still falls far below the demand:

<u>Institution</u>	<u>Number of Fulltime Students Enrolled in CS MS Program (1983-84)</u>	<u>Number of Degrees Awarded (1983)</u>
Mankato State U.	60	9
Moorhead State U.	15	1
North Dakota State U.	61	11
University of Minnesota	130	25
TOTALS:	<u>266</u>	<u>46</u>

The Institute of Technology's current resources should allow the graduation of approximately 1,000 bachelor's degree and 275 advanced degree students each year throughout the 1980s. About 60% of these graduates will stay in Minnesota to work, according to IT Placement

Office data. One hundred companies surveyed in 1980 by the IT Advisory Council appeared to need approximately 1,200 B.S. graduates per year, which is expected to increase by about 13% annually through 1990 and continue to escalate in the years beyond. Thus, the proposed program at UMD would not only serve a unique regional function for northeastern Minnesota, but could also reasonably be expected to draw students from other parts of Minnesota as well as from neighboring states.

### III. C.4. A QUANTITATIVE DISCUSSION OF EMPLOYMENT PROSPECTS FOR GRADUATES

Steady growth in the demand for qualified computer professionals shows every indication of continuing throughout the 1980s and beyond. Widely reported figures prepared by the U.S. Bureau of Labor Statistics indicate that total employment of computer-related personnel is expected to grow by 47.1% between 1980 and 1990, from 1,455,000 to 2,140,000.

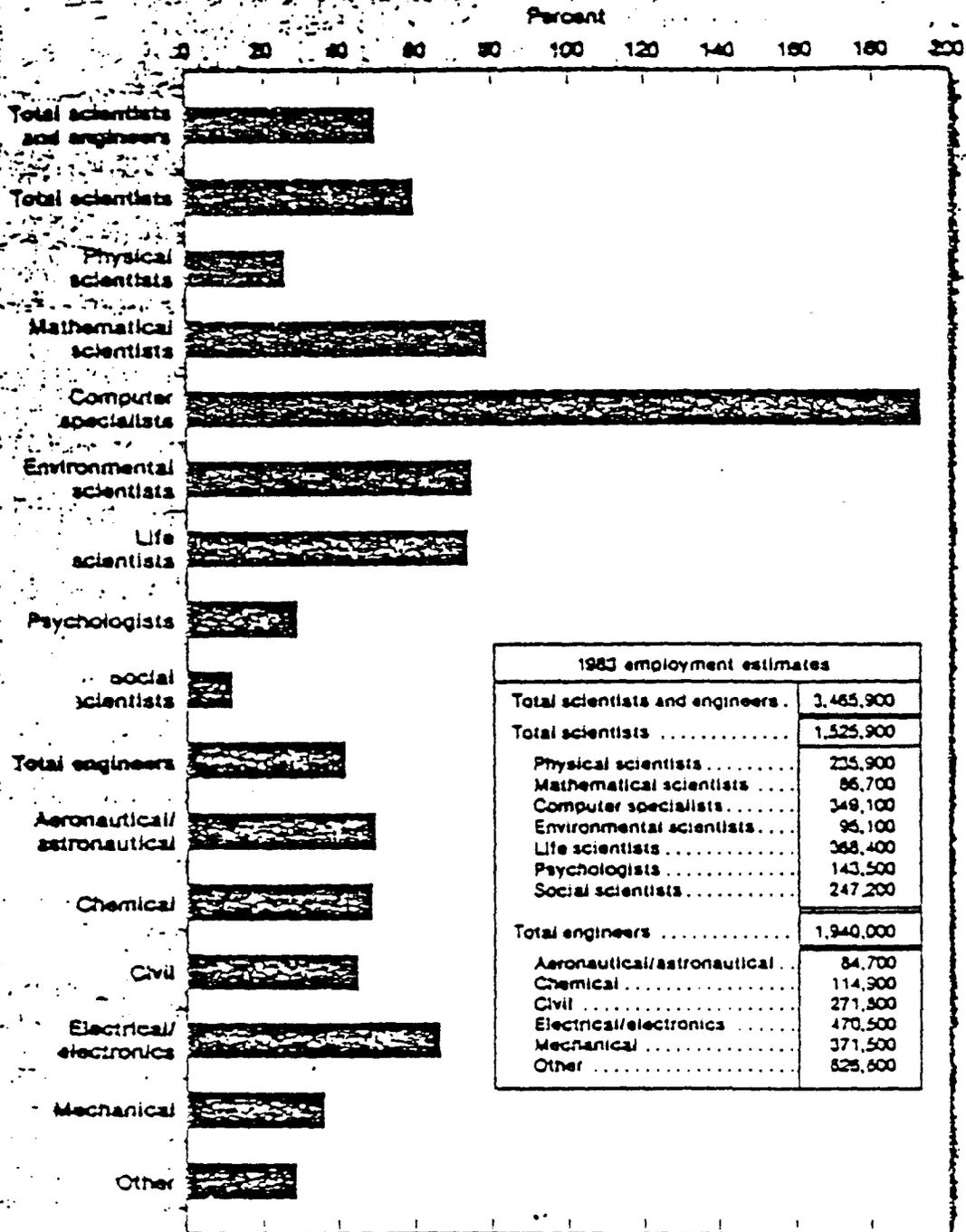
NSF recently completed a study of the science, engineering, and technician (SET) labor market over the 1982-87 period. Projections indicate probable shortages of computer specialists. Over the next five years, the study projects growth at an annual rate of 5%-6% for employment of computer specialists. By 1987, the projected supply shortfall ranges from 15%-30%. Such shortages translate into a possible need for 115,000 to 140,000 additional personnel in that year.

Another study, "Labor Markets for New Science and Engineering Graduates in Private Industry," performed for the National Science Foundation, is representative of the present employment situation.

The study reports the results of a telephone survey of 255 employers that hire computer professionals through campus recruiting. For 1980 and 1981, over 40% of these firms reported shortages of applicants with bachelor's or master's degrees in computer science, systems analysis, and computer and electrical engineering. Employers reported that they were able to fill less than 50% of their available computer science positions.

The National Science Foundation reported in 1984 that computer specialists were in the science field with highest growth of employment rate, 16% between 1973 and 1983. Chart 1 shows the high growth of employment for computer specialists between 1976 and 1983. Computer specialists, the fastest growing group, accounted for about two fifths of the total employment increase among scientists. Conversely, computer specialists showed the lowest recorded rate of unemployment in science/engineering fields: 1.6%.

Chart 1. Change in employment of scientists and engineers by field: 1973-83



SOURCE: National Science Foundation, appendix table B-1

High demand and low supply is reflected in high starting salaries. A 1983 salary survey in Opportunities in Computer Science reported that a student graduating in 1983 with a B.S. in computer science could expect to receive at least \$20,000 in his/her first year of employment. With a master's degree, the estimate was around \$26,000.

Employment prospects for computer science graduates in Minnesota parallel the high national demands. The Report of the 1982 Minnesota High Technology Council Survey, Jobs in Technology: Minnesota's Critical Human Resource Needs for the Coming Decade, published in February 1983, indicates strong demand for computer science personnel.

Table 1 (MHTC Survey Table 8) shows computer science as the third heaviest demand category for overall Minnesota hires during 1980-81 and as the heaviest demand category for hires by companies of medium size.

Table 1.

### DISCIPLINE DISTRIBUTION OF TECHNICAL-PROFESSIONAL HIRES: IN MINNESOTA FOR THE TWO YEAR PERIOD, 1980-1981

Discipline	% Hires Company Size 11-250 Employees	% Hires Company Size 250-500 Employees	% Hires Company Size 500 - Employees	% Hires All Companies
Biology	2%	5%	1%	2%
Chem. Eng.	1%	6%	5%	5%
Chemistry	1%	1%	4%	3%
Civil Eng.	10%	5%	3%	3%
Computer Sci.	15%	27%	11%	17%
Electronic/Electrical Eng.	15%	5%	27%	24%
Mathematics	2%	1%	2%	2%
Mfg./Ind. Eng.	3%	3%	4%	4%
Mech. Eng.	17%	9%	22%	20%
Metallurgical Science	5%	15%	3%	4%
Metallurgy/Metals Sci.	1%	1%	1%	1%
Physics	3%	1%	1%	2%
Architecture/Landscape Arch.	9%	.	.	1%
Other	13%	15%	11%	12%

Table 2 (MHTC Survey Table 11) compares hiring from 1980-81 with projected hiring needs for 1991. An appreciable increase in demand is shown for electronic/electrical engineers and for computer scientists.

Table 2.

## DISCIPLINE DISTRIBUTION TRENDS

Discipline	Discipline Employment Distribution 1981	Discipline Hirings 1980-81	Discipline Distribution of Anticipated Hiring Needs in 1991		
			Companies with 11-500 Employees	Companies with 500 or More Employees	All Companies
Biology	1%	2%	1%	.	1%
Chem. Eng.	2%	5%	.	1%	1%
Chemistry	3%	3%	3%	3%	3%
Civil Eng.	5%	3%	3%	1%	2%
Computer Sci.	25%	17%	52%	20%	27%
Electronic/Electrical Eng.	23%	24%	15%	40%	35%
Mathematics	1%	2%	1%	1%	1%
Mech. Ind. Eng.	8%	4%	6%	6%	6%
Mech. Eng.	14%	20%	12%	17%	16%
Medical Sciences	5%	4%	2%	1%	1%
Metallurgy/Matls. Sci.	1%	1%	1%	1%	1%
Physics	1%	2%	1%	2%	2%
Architecture/Landscape Arch.	1%	1%	1%	1%	1%
Other	9%	12%	2%	6%	3%

Table 3 (MHTC Survey Table B-1) projects selected high demand job categories to 1991. Employment opportunities for computer science personnel are predicted to remain excellent. Conversely, acute shortages in trained personnel will persist, perhaps inhibiting the growth of Minnesota's vital high tech industries. There is a documented need for more programs to train computer scientists at the bachelor's and master's degree levels.

Table 3.

### STATE-WIDE PROJECTED NEEDS: CONSERVATIVE ESTIMATE

Growth By 1991  
Selected Job Categories

Demand Job Categories	State-wide Staff Levels Yr.-End 1981	Average Annual Compound Growth Rates: Conservative	Projected Staff Levels Yr.-End 1991	Average Growth per Year (10 Yr.)
<b>TECHNICAL/PROFESSIONAL</b>				
Chemistry	1,350	3.9%	1,979	63/Yr.
Civil Engineering	920	2.3%	1,158	24/Yr.
Computer Science	5,513	5.0%	12,129	651/Yr.
Electronic/Electrical Engineering	4,561	6.2%	8,506	385/Yr.
Manufacturing/Industrial Engineering	2,476	3.8%	3,595	112/Yr.
Mechanical Engineering	3,076	5.0%	5,010	193/Yr.
Medical Sciences	4,534	2.4%	6,191	131/Yr.
<b>PARAPROFESSIONAL/TECHNICIAN</b>				
Computer Programmers	1,575	10.2%	4,424	275/Yr.
Drafters	3,305	4.4%	5,084	178/Yr.
Printed Circuit Designers	254	9.0%	601	35/Yr.
Technician-Computer	1,225	5.3%	2,053	83/Yr.
Technician-Electronic	2,793	6.1%	5,049	225/Yr.
Technician-Field Service	2,096	3.6%	2,985	89/Yr.
Technician-Mechanical	3,368	4.2%	5,100	273/Yr.

## III. C.5. EDUCATIONAL, RESEARCH, CULTURAL AND SOCIAL BENEFITS

A Master of Science degree program in computer science would be consonant with UMD's mission to provide graduate, professional, and continuing education programs as well as promote significant research and service activities. A master's level program at UMD would not only provide access to residents of northeastern Minnesota, but would also afford an educational opportunity to other qualified Minnesotans who cannot be accommodated in other programs within the state.

Furthermore, such a program would have far-reaching and beneficial social, economic, and research ramifications. In the 1980 IT Advisory Council Survey, 70% of Minnesota manufacturing company presidents and chief executives reported their belief that the vitality and growth of Minnesota's major industries are directly related to the availability of scientists and engineers.

The shortfall in available technical personnel in Minnesota is occurring in a state that is among the six major technology - oriented states in the U.S. Collectively, Minnesota's technology - based companies employ more than 30% of its workforce.

There is a strong relationship between gross state product and technology. In 1979, 39% of the GSP was generated by technology - intensive companies, according to the Minnesota Department of Economic Development.

Moreover, Minnesota has a tradition of nurturing successful technology-based ventures. Four out of five such new companies or units succeed each year, whereas nationally four out of five fail. Their success is often dependent on the availability of trained personnel.

The presence of a major research university has proven to be a necessary (though probably not sufficient) condition for attracting high tech industries and for supporting research and development. The 1977 Census of Manufacturers lists Minnesota as one of the top four state producers of electronic computing equipment, but warns that Minnesota's ability to retain its 11% share of the U.S. market will depend upon its ability to target research, development, and production effectively.

Leaders of the Minnesota High Technology Council, made up of 113 Minnesota companies, recommended that the 1984 Legislature approve \$61.7 million in capital spending and \$16 million for special technical education programs. Charles M. Denny, former MHTC chairperson and chief executive of Magnetic Controls Co. warned that augmentation of university computer science and engineering programs is necessary if companies are to remain in Minnesota rather than redirect their research and development base to other states where graduates are available.

Education cannot be divorced from economic growth. The technical workforce in America is shrinking compared with those in Japan and Germany, countries which have three to four times more electrical engineering and computer science graduates on a per capita basis than does the U.S. (Technology Review 85:49-57, October, 1982). The pressing need for expanded technical programs and for trained personnel that led to the establishment of UMD's College of Science and Engineering and to the three new engineering degree programs at UMD now applies with equal force to computer science graduates at the bachelor's and master's levels.

III. D. COMPARISON WITH SIMILAR PROGRAMS

Graduate programs in computer science within Minnesota (or at NDSU) appear to avoid direct duplication since the programs have different focuses.

U. of Minnesota (IT): Like UMD's, this program is oriented toward research. However, IT's program is an integral part of their doctoral program. Our programs would complement each other, rather than compete.

St. Thomas: Quantitative Methods - program is directed toward business applications of computers.

Mankato: Program emphasizes computer applications in education (part of Mankato's School of Business).

Moorhead: Program also emphasizes computer applications in education.

North Dakota State U: Program focuses on mathematical applications of computers.

Furthermore, it should be pointed out that UMD's program would be the only graduate program in computer science in the northeastern one-third of Minnesota. Finally, current and projected market demand for trained personnel is so high that limited duplication of programs might be argued as beneficial rather than harmful to the state and region.

III. E. QUALITY CONTROL

III. E.1. FACULTY QUALIFICATIONS

Resumes for eight fulltime faculty members are here appended:

(Curriculum vitae are on file in Physical Sciences Policy and Review Council folder, 1985-86.)

## III. E.2. PROCEDURES BY WHICH THE PROGRAM WILL BE GOVERNED

The program will be governed according to the usual procedures for a graduate program in the College of Science and Engineering. Accordingly, all significant curriculum changes are to be developed and approved in the Department and must then be approved by the College Curriculum Committee, the Duluth Graduate Faculty Committee, and by the deans of the College and the Graduate School.

## III. E.3. EXTERNAL ACCREDITING AND CERTIFICATION AGENCIES

Requirements for accreditation are in the process of being formulated by the Association for Computing Machinery, which has previously published guidelines for such programs (Recommendations for Master's Level Programs in Computer Science, Communications of the ACM 3, March 1981). These guidelines have been accepted widely, and now represent the de facto standards for master's level programs in computer science. The proposed program has been designed to conform to these guidelines.

III. E.4. PLAN FOR SYSTEMATIC REVIEW AND EVALUATION OF THE PROGRAM

The program will be reviewed periodically as part of the standard internal and external review of the Department of Mathematical Sciences, UMD, and the Graduate School of the University of Minnesota.

III. F. IMPLEMENTATION

III. F.1. TIME SCHEDULE

The program will be initiated September 1, 1986 (subject to approval by the University of Minnesota Board of Regents and the Minnesota Higher Education Coordinating Board). By 1988, the program is expected to be in full operation.

III. F.2. UNIVERSITY RESOURCES REQUIRED FOR IMPLEMENTATION AND FOR FULL OPERATION

1. Implementation: 1986-87

a) Faculty:		
1 FTE Teaching Assistant		\$14,000
b) Civil Service:		
0.25 FTE Secretary		4,000
c) Equipment, Supplies, etc.		
Supplies and Expenses	\$ 5,000	
Maintenance Contracts	6,500	
TOTAL		11,500

Total Direct Costs 29,500

d) One-time Costs:		
Initial Equipment Purchase		
or donation	60,000	
Office and lab space conversion	10,000	
Software Purchase	5,000	
TOTAL		75,000

Total Program Costs 104,500

2. Full Operation: 1988-89

a) Faculty:		
1 FTE Faculty	\$40,000	
1 FTE Teaching Assistant	14,000	
TOTAL		54,000
b) Civil Service:		
0.25 FTE Secretary		4,000
c) Equipment, Supplies, etc.		
Supplies and Expenses	5,000	
Maintenance Contracts	9,500	
TOTAL		14,500

Total Direct Costs 72,500

d) One-time Costs:		
Additional Hardware Purchase		
or donation	20,000	
Software Purchase	10,000	
TOTAL		30,000

Total Program Costs 102,500

Appendix: Letters of Support

Robert J. Marchetti  
Senior Vice President  
Power Supply and Engineering  
Minnesota Power

Thomas R. Varilek, Director  
Information Systems  
Minnesota Power

Thomas K. Chambers  
Lead Systems Development Engineer  
Minnesota Power

Daniel J. Beddow  
Engineer Programmer  
Minnesota Power

Nancy Giddings, Section Chief  
Software Technology Research  
Honeywell

John E. Skelton, Director  
UMD Computer Center

Robert E. Williams, Chairperson  
UMD Subcommittee on Computing  
President, IBM-PC Users Group

Fawzi G. Dimian  
Professor of Accounting  
UMD

Francis G. Florey, Coordinator  
Mathematical Sciences  
UWS

Paul Williams, Associate Professor  
Mathematical Sciences  
UWS

Dennis R. Chretien  
MECC Northeast Instructional Coordinator



minnesota power / 30 west superior street / duluth, minnesota 55802 / telephone 218-722-2641

Robert J. Marchetti - senior vice president, power supply and engineering

May 21, 1985

Mr. Mark Luker, Associate Professor  
University of Minnesota/Duluth  
College of Science and Engineering  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

Dear Mr. Luker:

I am pleased to learn that UMD is planning to offer a Master of Science degree in computer science. The availability of quality graduate education is of extreme importance to the future of northeastern Minnesota.

This program would benefit Minnesota Power in two ways. First by advancing the education of currently employed personnel, and secondly by providing qualified candidates for future employment by this Company and other high-technology-oriented organizations.

Minnesota Power has approximately 20 professionals involved in the design, implementation, and support of highly sophisticated software systems, and is continually attempting to provide better software tools and utilities to its computer user constituency. Although software technology is advancing to the extent that extreme computer competence is no longer necessary for the majority of the user community, someone is required to advance that software technology. It is in this capacity that these 20 professionals would benefit from such a program.

Your program, once established, could provide a pool of interns with advanced skills in computer science to assist the user community and thus gain valuable experience, prior to permanent hire. This effort also provides an opportunity for your faculty to interact with industry in consulting and research.

Mr. Mark Luker  
Page Two  
May 21, 1985

Finally, if this region of the state is to succeed in attracting new business, it will be necessary to expand in areas which support those business interests. Expansion of computer- and high-technology-oriented education programs becomes essential, when attempting to attract high technology firms.

Sincerely,

*Bob Marchetti*

R. J. Marchetti

RJM:am

cc: A. J. Sandbulte  
G. B. Ostroski/T. R. Varilek  
J. F. Johnson



© Minnesota Power 30 West Superior Street Duluth, Minnesota 55802 Telephone 218-722-2641

Thomas R. Varilek - director, information systems

May 28, 1985

Mr. Mark Luker  
Associate Professor  
University of Minnesota/Duluth  
College of Science and Engineering  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, Minnesota 55812-2496

Dear Mr. Luker:

We have had extremely good work experience with individuals educated in the UMD computer science program. Individuals hired at Minnesota Power, following graduation from UMD, have occupied positions in engineering applications, scientific application research, and systems programming, among others. These have been typically highly motivated individuals, requiring minimal supervision, and have performed beyond normal expectations.

What has been lacking in this region of the country is a graduate level curriculum in computer science. A number of employees at Minnesota Power, including myself, have had an interest in pursuing an advanced computer science degree, but have been frustrated by the inconvenience of travel to the Twin Cities. Approximately 20 professionals could benefit from this program and most would in all likelihood take advantage of the educational opportunity.

Please count us in support of the Master of Science degree in computer science. I am certain that other organizations in the area will be as interested as we are.

Sincerely yours,

Thomas R. Varilek  
Director, Information Systems



Minnesota Power 30 West Superior Street Duluth, Minnesota 55802 Telephone 218-722-2641

April 25, 1985

Professor Mark Luker  
Department of Mathematical Sciences  
320 Mathematics - Geology Building  
10 University Drive  
Duluth, MN 55812-2496

Dear Prof. Luker:

This letter is in response to your request for comments on the proposed Master of Science Degree in Computer Science at UMD (dated March 29, 1985). For the most part this response reflects my own feelings, although it is representative of our Real Time Applications section which is staffed by nine programmers.

I, as well as some of my associates, am interested in obtaining a masters degree in Computer Science at UMD. Masters levels courses would be valuable for both upgrading current skills as well as retraining with new skills. Assuming that the masters degree would have a strong mathematical basis like the undergraduate degree, it would be particularly beneficial to our real time applications work. Graduate students in computer science could serve a useful purpose in our operation although I doubt that jobs in the Duluth area can be salary competitive, particularly at the masters degree level.

The undergraduate degree in Computer Science at UMD is indeed a quality program. The excellent graduates that we have hired at Minnesota Power can attest to that. I would expect that the masters degree program would follow suit.

Since you are soliciting support from programmers already working in the area, I would recommend that courses for your proposed degree be scheduled so as to accommodate us. Courses offered in early morning, late afternoon, or evening would work well with our schedules.

The best to you in your pursuit of developing a Master of Science Degree in Computer Science. Please do not hesitate to call on me or my associates for further support.

Sincerely,

Thomas K. Chambers  
Lead Systems Development Engineer



Minnesota Power 30 West Superior Street Duluth, Minnesota 55802 Telephone 218-722-2641

May 1, 1985

Mr. Mark Luker  
Associate Professor  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, MN 55812-2496

Dear Mr. Luker:

Tom Chambers, an associate of mine, brought to my attention the possibility of UMD offering a Masters degree in computer science. I would be interested in such a degree. I am a recent graduate with a Math and computer science degree from UMD. I feel a Masters degree would greatly benefit me personally and other programmers in the area. The availability of courses at the graduate level would help strengthen my current job skills.

Because of my recent enrollment as a undergraduate at UMD, I feel that UMD would offer an excellent Master of Science degree in computer science. The quality of education I received from the Math department became apparent upon my employment at Minnesota Power. My course work prepared and gave me valuable skills that allowed me to jump into my current job and give immediate support to our system. I attribute the quality education I received to the staff of the UMD Math department. The instruction I received was top quality both in and out of the classroom.

Sincerely yours,

Daniel J. Seddow  
Engineer Programmer

DJB:drp

# Honeywell

25 July 1985

Mr. Mark Luker, Associate Professor  
University of Minnesota/Duluth  
College of Science and Engineering  
Department of Mathematical Sciences  
320 Mathematics-Geology Building  
10 University Drive  
Duluth, MN 55812-2496

Dear Mr. Luker:

I would like to express my support and interest in the proposed computer sciences masters program. There certainly is a solid marketplace for individuals who complete a research-oriented graduate program.

Thank you for the opportunity to express our opinions on the curriculum, etc. It is very likely that some of our senior people may be interested in visiting your campus via seminars/colloquia.

Good luck with your efforts.

Sincerely,

*N. Giddings*  
Nancy Giddings  
Section Chief, Software Technology Research

NMG:mac

cc: Rod Larson



UNIVERSITY OF MINNESOTA  
DULUTH

UMD Computer Center  
Duluth, Minnesota 55812  
Telephone (218) 726-7587

April 11, 1985

Dr. Mark Luker, Associate Professor  
Department of Mathematical Sciences  
University of Minnesota, Duluth

Dear Mark,

Both personally and speaking for the UMD Computer Center, I most enthusiastically support the offering of a Master of Science degree in Computer Science at UMD. In my view it is most needed and would be a very popular offering. It would also fit in well with the various technological initiatives recently established at UMD.

Regarding the points mentioned in your letter, several of the computer center staff have indicated that they would be interested in pursuing the degree under the Regent's Scholarship program. There would also be an interest in using the proposed course offerings for personnel to retrain or upgrade their skills. I would certainly support these uses of the curriculum by being very liberal with time and job requirements. I think that the availability of a number of graduate students to help in both consulting and special projects would be most welcome and improve the quality of the services we offer.

I also agree with your assessment that the UMD program would be a quality program for the same reasons that you state in your letter. I continue to feel that the undergraduate computer science program at UMD is the highest quality program in the state and see no reason that the orientation would change for a graduate program. I also assure you that the UMD Computer Center would make every effort to provide the types of computing equipment that would be necessary to maintain this status.

Please let me know if I can be of any assistance in your efforts or furnish any additional information.

Sincerely,

John E. Skelton  
Director



UNIVERSITY OF MINNESOTA  
DULUTH

School of Fine Arts

Department of Music  
231 Humanities Building  
Duluth, Minnesota 55812  
(218) 726-8208

May 6, 1985

Dr. Mark Luker  
Associate Professor  
Department of Mathematical Sciences  
University of Minnesota  
Duluth, MN 55812

Dear Dr. Luker,

Thank you for sending me some information regarding the proposal to offer a Master of Science degree in computer science at the UMD campus. I have noted the steady and important growth in the number and variety of courses on our campus in the area of mathematics and computer science. UMD can be proud of the strong undergraduate program which we now have. I personally have seen a number of your graduates go on to excellent positions in business and government.

It is my conviction that a Masters degree in computer science is needed in the Duluth area to benefit all of northern Minnesota. There are numerous firms looking for personnel and for assistance in computer problems in this area. It would be beneficial for both the community and the university of have a masters in computer science here.

Sincerely,

Dr. Robert E. Williams  
UMD Subcommittee on Computing, chairman  
IBM-PC Users Group, president



UNIVERSITY OF MINNESOTA  
DULUTH

Department of Accounting  
125 School of Business and Economics Building  
Duluth, Minnesota 55812

April 19, 1985

Dr. Mark A. Luker  
Associate Professor  
Department of Mathematica Sciences  
320 Mathematics - Geology Building  
University of Minnesota, Duluth

Dear Mark:

Thank you for your letter of March 28, 1984. I read with great interest your proposal to offer a Master of Science degree in Computer Science.

We have a number of students who are majoring in accounting and computer science. This combination is of a great interest to us and the accounting profession. We believe a Master degree in Computer Science is highly desirable. We strongly support this degree program at UMD. Duluth and Northeastern Minnesota will provide enough students and you will have a high demand for a Master degree. In addition the highly regarded existing program in Computer Science you provide, will add significantly to the recognition of the Master program and will attract highly qualified faculty and students.

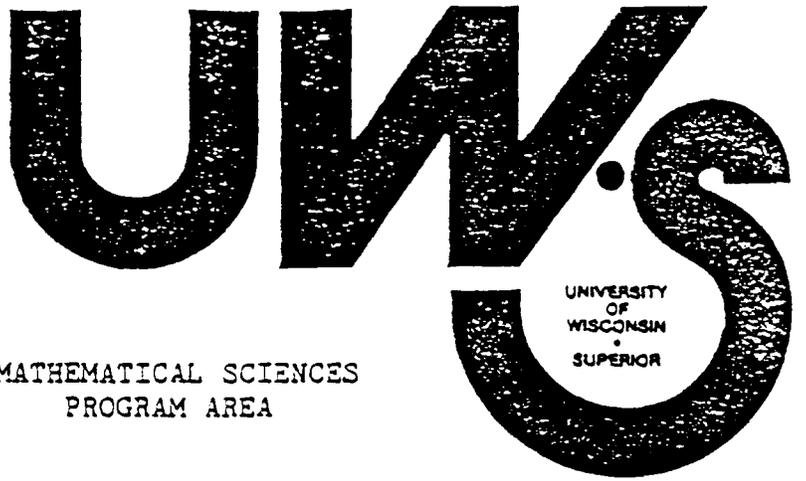
We are confident it will be a quality program and you have our full support.

Sincerely,

A handwritten signature in cursive script that reads "Fawzi G. Dimian".

Fawzi G. Dimian, Ph.D.  
Professor of Accounting

FGD/d



August 5, 1985

Dr. Mark Luker  
Chairman, Computer Science Department  
University of Minnesota-Duluth  
Duluth, MN 55812

Dear Mark:

It is my understanding that UMD is in the process of applying for a new degree program which will lead to a Master's Degree in Computer Science. Please accept this letter as encouragement and support for this program.

We see this program as one which would allow our own graduates to obtain locally an advanced degree in computer science. We may also have faculty and staff at UWS who would take advantage of this program as it would be much more convenient than travelling to Minneapolis or Madison.

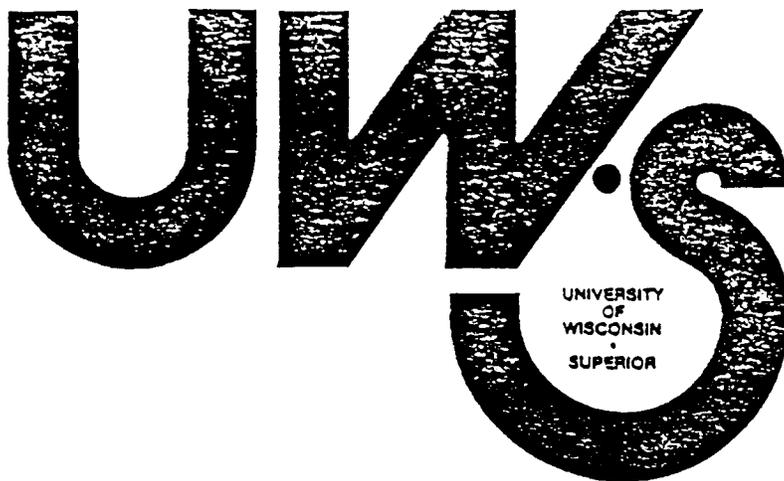
As you know, mathematical sciences faculties at UMD and UWS have had many mutually beneficial contacts over the last several years. I hope that these contacts will continue as you expand your programs in the field of computer science.

Sincerely,

*Francis G. Florey*

Francis G. Florey, Ph.D.  
Coordinator, Mathematical Sciences

bj



MATHEMATICAL SCIENCES

August 5, 1985

Dr. Mark Luker  
Computer Science  
University of Minnesota-Duluth  
Duluth, MN 55812

Dear Mark,

It was with a lot of interest that I heard of your efforts and those of your department to begin a masters program in computer science at U.M.D. There are several reasons for that interest.

The first is a bit selfish. Persons such as myself with training in other areas who have been retrained in computer science have the need to continue that training. I cannot help but think what our classes will be like in six to eight years when elementary students now who are learning about computers and computer programming reach the college age. What they learn may not be all that great but in any case they will offer a challenge. Area secondary school teachers would find a masters program in computer science very helpful.

Computer science is very dynamic. New uses for the computer are being found and new areas of study in computer science are developing. It will be necessary to keep abreast of these developments. At present I would have to go at least 150 miles to take a course.

At UW-Superior we have two programs in computers: The computer science option to a mathematics major in the Division of Sciences and the information science major in the Division of Business and Economics. All of the graduates from these programs could profit from a masters program in computer science. At least half of our computer science graduates this year were planning to pursue a graduate degree. Future job opportunities will require more sophisticated training.

A masters program in computer science at U.M.D. would certainly improve the image of the area and would probably help to bring high-tech into the region. Best wishes for your efforts in the development of this program and I hope it succeeds.

Sincerely,

*Paul Williams, Assoc. Prof.*



Minnesota educational computing corporation

NORTHEAST MINNESOTA INSTRUCTIONAL COORDINATOR  
Mesabi Community College, Virginia, Minnesota 55792 (218) 749-7730

April 9, 1985

TO: Mark A. Luker

FROM: Dennis R. Christian  
MECC Northeast Instructional Coordinator

RE: M.S. Degree Program in Computer Science.

Thank you for inviting my opinions concerning UMD's proposal to offer a Master of Science degree in computer science. I am not sure, however, that I am the proper person to make recommendations concerning such a proposal. I do believe that there is a need for an advanced degree program in computer science in this area, and UMD's plan should be ideal for meeting the need for qualified computer scientists. But my job is to provide educational computing services and training to area school districts, and as a result, I spend most of my time dealing with elementary and secondary school teachers. So, in addressing your questions, I will be speaking from the standpoint of someone interested in educational computing rather than computer science, per se.

The individuals with whom I deal on a daily basis are interested in obtaining advanced degrees, and UMD would be considered an ideal institution from which to obtain them. Their interest would extend more to a master's degree in educational computing as opposed to one in computer science, and your proposal, as it is, is not likely to meet their needs.

These teachers could make use of some of your graduate level courses for retraining or to upgrade their skills however. Courses from your list which might be appropriate would include CS 1001, Computer Basics, and CS 1010 Microcomputers and Their Applications. In addition, most school computer science teachers would probably be interested in most of your other courses, but especially CS 1501, Programming and Algorithms, CS 3500, Programming and Algorithms II, and CS 3509, Software Engineering.

There is a possibility that the state may impose licensing requirements for computer teachers which may require the acquisition of a master's degree in computer science. In my opinion, such a degree for teachers should be substantially different from an "unstudied" computer science degree. I believe

that familiarity and experience with programming languages, system architecture, and so on is necessary beyond that which would be used in a high school setting, but more important, would be additional courses covering methods of teaching computer science. Imagine the effect on your program of having incoming students with a solid background in structured design and programming, competent in problem analysis and program planning. These students can only result from high school classes taught by properly trained teachers.

I would urge you to continue with your plans to institute a Master of Science degree in computer science, but at the same time, involve the Department of Education and include a Master of Science degree in Educational Computing as part of your proposal. (I would be interested in that one myself)

I hope that these comments are useful to you, even if they are not what you expected. If you have any questions or responses, please contact me anytime. Once again, thank you for your interest in my views.