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Director: Peter C. Patton

Comments about the content of this newsletter, or suggestions for changes may be directed to the editor, 235a Experimental Engineering, or call 612/376-4688.

looking backward

In 1980, we predicted that our Cyber systems and the NOS 1.3 operating system would meet our instructional and research computing needs until 1981. We did survive until 1981, but we saw significant changes in the demands being made on our systems by computer users.

Late in 1980, we realized that the Cyber 172 was being saturated during certain peak operating periods, interactive processing demands on the Cyber 74 were reducing the amount of central memory available for batch processing, and the MERITSS machine was suffering from a 45% increase in simultaneous users over 1979. We also saw demands for machines to handle such diverse tasks as compute-bound applications programs, text processing applications, and high-speed interactive graphics.

In response to these needs, we've made some changes since last spring. The following summarizes the changes and additions made in 1981.

On June 13, 1981, we upgraded the Cyber 720 (98K words central memory, 10 PPU's) to a Cyber 730 (2 central processors, 196K words central memory, 14 PPU's) in order to handle the increased non-instructional interactive processing load. The Cyber 730 provides 60% more computing power.

On June 20, 1981 we installed the Cyber 172 as the MERITSS machine (interactive instructional computing). The MERITSS machine now provides 40% more computing power.

On September 20, 1981, we removed interactive processing from the Cyber 74. All the interactive ports removed from the Cyber 74 were added to the Cyber 730. The permanent files on the Cyber 74 are in a "a shared permanent file family," so you can still access files on the Cyber 74 from either 74 batch jobs or 730 interactive terminal sessions: if you do interactive processing, select the family at log-in (C74); if you do batch processing, select the family on the USER statement in your job (C74).

Late in 1980, we realized that our Cyber 74 had begun to out-live its usefulness. It is the oldest of our machines, the most expensive to maintain, it cannot handle additional central memory, data transfer rates are slower than on our newer Cybers, and it has some computational inefficiencies because of its 6-bit character set. We also recognized a need for a faster, less costly batch FORTRAN machine, compatible with our present systems and computers. We needed to acquire a computer which would enable us to dispose of the Cyber 74 during the 1981-82 year.

We accepted the bid from Cray Research and our Cray-1 was installed in October. We expect that the cost of a job on the Cray should be 1/3 to 1/2 the cost of a job on the Cyber 74. The Cray is accessed through the Cyber 730; it accepts jobs written in Cray FORTRAN. We expect to offer Pascal, SPSS, other suitable applications packages, and FORTRAN program libraries soon.

Early in 1981, we purchased a VAX-11/780 (an 8-bit, full ASCII machine with 2.5M bytes of central memory) with the VMS (virtual) operating system. This machine, with 8 dial-up ports, was installed in Shepherd Labs and made public on August 10, 1981. The VAX will provide general processing and text processing facilities. The VAX runs the VMS operating system, offers FORTRAN, Pascal, and COBOL compilers; has SPSS, a popular statistical package and SCSS, an interactive version of SPSS; and has the SOS and EDT editor programs. We also offer EUNICE, a "UNIX under VMS" system, including the "C" language and UNIX utilities.

In addition to the Shepherd Lab's VAX, we purchased a second VAX-11/780 and installed it at our Lauderdale site in August, 1981. This VAX, with a UNIX system, will eventually be used for general computing services, communications research (culminating in a campus-wide network), and as a UNIX development machine.

Following all these changes, our configuration is:

Cyber 730	non-instructional interactive processing
Cyber 74	batch processing
Cray-1	compute-bound batch processing
Cyber 172	instructional processing (MERITSS)
VAX-11/780	general computing, text processing, high-speed interactive graphics
VAX-11/780	general purpose computing, communications research

In addition to the hardware changes made this year, we've expanded some of our service areas. You will find pages dedicated to two of these, non-traditional computing and microcomputers, in this issue. We will feature other services in later issues.

welcome back

With this issue, we welcome all of you to the pleasure of computing at the University.
This issue of the UCC Newsletter contains articles about all the new happenings since last spring; describes a few new services; and includes all the usual announcements and notes. You'll note from the articles herein that you're now stuck with choices. We have new systems and new products.
An article on page 116, "Choosing a Computer System For FORTRAN Jobs," should help if your jobs use FORTRAN.

If you run into problems over the year, please call -- the phone list on the back of this newsletter will point you toward the proper person.

Enjoy the new year!

microcomputing – think small

The microcomputer user represents one of the fastest growing segments of the University's computing community. In a continuing effort to provide the best possible service to the University of Minnesota, we at the University Computer Center render assistance to microcomputer users in the University community through consulting, teaching, evaluating hardware and software, creating and distributing software of general interest and utility to microcomputer users, distributing documentation and other microcomputer supplies, and maintaining the hardware associated with microcomputing.

Consulting involves advice and aid on subjects ranging from what equipment should be purchased to why a program doesn't work. Essentially, this means providing help for users, beginning at the time they first decide a microcomputer might be of some benefit to them. This service continues through all subsequent phases of microcomputer ownership and operation. This service, among others, is provided by the three full-time staff members of the microcomputer group, Dale V. Gear, Michael D. Collins and David A. Larsen. To provide for rapid problem solving, the group maintains a telephone help line -- dial DR MICRO (376-4276), 10-12 AM, 2-4 PM Monday through Friday -- for answering those questions which can be solved at a distance. These same hours are also available for personal consultation in the microcomputer office, 210 Experimental Engineering. Appointments are also accepted for hours other than those mentioned above.

As an additional aid to current and prospective microcomputer users, we also organize and teach short courses and University Extension Division courses. Topics of these courses include: introduction to microcomputing, UCSD Pascal and CP/M systems on micros, perspectives on microcomputing, programming techniques on micros, and text processing on micros. The UCC short courses are available free of charge throughout the year. Most of these are taught during the afternoon hours. Extension courses, taught at night, are available to anyone who pays the enrollment fee.

We also maintain an extensive file of technical information on many subjects and products which may be of interest to users. The Reference Room, 227 Experimental Engineering has a collection of microcomputer journals with a computerized bibliography of articles which have been found useful.

We make a continuing effort to study and evaluate new hardware as it becomes available. When a new machine is needed, we do the extensive research necessary to find an appropriate computer. Currently, a machine suitable for office word processing and simple bookkeeping is being added to the list of supported microcomputers.

An important aspect of the evaluation of the suitability of a particular item of hardware is price. When there is sufficient demand for an item, UCC's Engineering Services (UCC-ES) will negotiate contracts for quantity purchases at the best possible prices. These contracts may then be used by University departments to purchase equipment without the burden of "going out on bids." Maintenance service is also available from UCC-ES.

Another major form of user support is software. We believe that a computer is a tool. The kind of tool it is depends largely on the programs available for it. Without software, computers are absolutely useless. We provide software for micros in two ways, by evaluating and recommending programs available from commercial vendors, and by creating and distributing software ourselves. Assistance is available in evaluating outside vendor software. When there is sufficient demand for particular commercially available programs, an attempt is made to negotiate quantity prices on behalf of the University.

In order to enhance the portability of the programs developed at UCC as well as to keep costs at a minimum, all work on micros is done using the Pascal programming language. Some of the programs currently available include a communications program allowing all supported micros to talk to all other computers we operate, a text formatting program, and plotting and digitizing utilities developed especially for the Apple. Other software of general interest, some of which has been contributed by the user community, is also available.

To make UCC developed software readily available to users at very low cost we sell our software through the Computer Store (211 Experimental Engineering). This provides a means of making quality programs available at a price slightly above duplication costs. This philosophy also applies to the documentation, diskettes, and other microcomputer supplies sold through the Computer Store. The University Computer Center strives to make all these items available at the lowest possible cost.

The microcomputers currently supported are the Terak (an LSI-11 processor based computer), and the well-known Apple II. We are now in the final stages of designating a new micro which will run CP/M (CP/M is a trademark of Digital Research Inc.) as an operating system. This will allow users to choose among a very large selection of software produced by hundreds of companies.

Dale Gear

non-traditional computing services

Many of you are already familiar with our Humanities Computing Services. Our staff assists with any computer-related research questions. We are expanding this service to include projects in fields that do not have a tradition of using computers in research. Hence, a new name: Non-traditional Computing Support Services. So if you have a project or an idea for one that doesn't seem to fit in an established category, please come see us. Our service includes advice on how to get started in computing and assistance with project design and implementation. (See the UCC Brief, Humanities Services.)

Our staff consists of Vicky A. Walsh, manager, Tom C. Rindflesch, graduate project assistant, and John P. Krystosek and Armand E. Prieditis, system software programmer trainees. I received my Ph.D. in Archaeology (classics) and have extensive computer experience. Tom Rindflesch is a doctoral candidate in Linguistics and is currently working on an English language parsing program. John Krystosek is a math major and is assigned to the New Testament analysis project. Armand Prieditis is a computer science major and is working on the TAGEDIT project. We are all available for consulting on humanities, text analysis, and other research projects.

grants

OK, but all this costs money. Right, but there are sources for computer-related costs. We have a grant program for University researchers, both faculty and graduate students, so when you apply for access to our computers, you can also apply for financial assistance. Our grants may not be enough for larger projects, but most funding agencies consider computing a valid expense request, so you should request funds for computing when you apply for research grants. For help in writing grant proposals and estimating computer costs, please contact me. I will help you calculate reasonable cost estimates, evaluate your proposal for correct computer terminology, and aid you in any way I can to develop a persuasive proposal. This service is available to all University researchers. If you need information I cannot provide, you will be put in contact with someone who can. See WRITEUP(COSTEST) for preliminary help in estimating computing costs. The first of a series of text processing cost estimates is now available as a UCC Brief, Terak-Cyber Text Processing Costs, in 140 Experimental Engineering.

hours

Starting fall quarter 1981, we will augment our Humanities Plus consulting. As before, phone consulting is scheduled MWF, 10:30 to 11:30 AM, 373-5780. In addition, consultants will be available in 140 Experimental Engineering, Monday-Friday, 1-2 PM, to answer questions on text processing and Humanities packages. For help at other times, please call me for an appointment.

projects

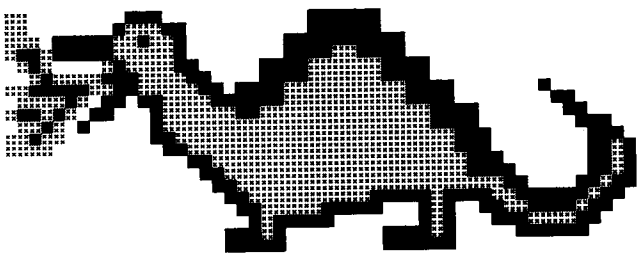
Many of you are already involved in computer-aided research projects. Faculty and students in French, English, classics, anthropology, art history, history, and many other departments are using the computer for text processing, text analysis, data base management, and simulation. In subsequent newsletters we will present active projects of general interest. If you know of a project you'd like to see highlighted here, or would like to have your project presented, let us know. We would also welcome your written contributions to the newsletter.

the CRAY

This fall, we will be the first university computer center to acquire a Cray "supercomputer." This computer is faster and bigger than anything we've had so far. Watch this newsletter for more details. Much of what you'll hear about the Cray emphasizes its "number crunching" capabilities, that is, its ability to quickly calculate complex equations on very large data sets. While this is very true, it should also be understood that the Cray can be an ideal tool for many humanities and related projects. Research projects involving very large bodies of text are prime candidates for processing on the Cray. Not only will processing time be much shorter, but larger sets of data can be handled at one time. Some projects that have not been attempted because of speed or size requirements may now be possible. Not only text, but other large data bases may be more easily handled.

Simulation is another area which can benefit greatly from use of the Cray. Simulating social systems, for example, can tax any computer, but the Cray should be able to handle even the most complex systems with ease.

Text analysis, simulation, and data bases are just three areas which can profit from supercomputer processing. Interested? We'll be glad to talk with you about your ideas for possible Cray projects. Call me at 373-5780, or call Tom Lanzatella at 376-5606.



text analysis

We have a number of programs which can serve as research tools for people interested in doing text analysis. GENCORD provides both a concordance and an index of either all the words in a text or selected words only. You can ask GENCORD to sort the concordance in a number of ways. GENCORD also provides a frequency count for all the letters and words in the text.

GENCORD is a good program to start with, but we also have programs that can refine some of the information which GENCORD provides. LTTRCNT (letter count) will separate the letters of a text into word-initial, word-medial, and word-final letters and then count the letters in these categories. Professor J. Lawrence Mitchell in the English department has a program called LARMIT which not only gives the overall frequency of words in a text but also shows how they cluster in distribution. This type of information has been found to be useful in work on contested authorship. GENCORD produces an index that is a research tool and is not always useful as a reader-oriented index. We have a number of programs (collectively called INDEX) that can help you construct a readable index.

Although not widely recognized as a research tool, our main editing program, XEDIT, can be effectively used for text analysis. There are many situations in which it is possible to use XEDIT to extract phrases from a text and then count the frequency of occurrence of those phrases. We would be happy to discuss your particular project with you to see if XEDIT could be useful.

We are currently developing two programs which will dramatically expand our text analysis capabilities. The first of these is TAGEDIT. The main feature of TAGEDIT is that it will allow you to associate up to ten "tags" with each word in a text. A tag is a label with which you can encode information about words in the text. You can then ask TAGEDIT to retrieve patterns of words from the text based on the tags you have supplied. TAGEDIT will count the number of occurrences of patterns it finds and give you a list of these patterns in any of a number of index and concordance formats. Language researchers will undoubtedly find TAGEDIT useful; however, others may also benefit from it. For example, it will be possible to tag a text on the basis of word content rather than grammatical category and then request patterns based on that content. If a number of texts were so tagged, it would be possible to find out quickly which ones dealt with a certain subject. TAGEDIT is scheduled to be available in the spring of 1982.

A second program under development is SYNTREC, which will be a parser for English. A complete parser is probably beyond our capabilities at this time. However, a parser which is meant to be a research tool for studies specializing in syntax appears to be possible. If the input to the parser includes part-of-speech labels on each word, then the parser can at least find all the noun phrases, verb phrases, prepositional phrases, and adverb phrases. With some additional information from the user, SYNTREC should also be able to locate all subordinate clauses (including relative clauses). TAGEDIT and SYNTREC will complement each other. TAGEDIT will allow you to add part-of-speech tags to each word in the text. Then, for English, SYNTREC will extract certain basic information automatically. You can then go back to TAGEDIT to conduct a more detailed analysis.

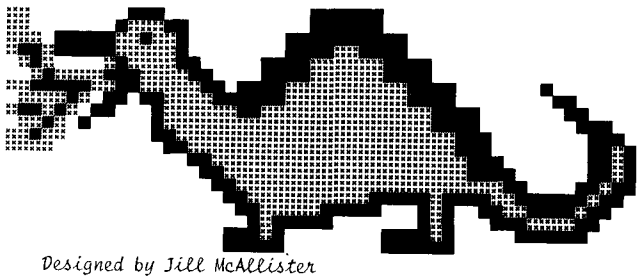
special tools

We have written two programs that are meant to supplement the text processing programs offered by UCC. These supplemental programs are designed to make it easier for you to write articles and dissertations by helping with two of the more tedious aspects of academic papers: footnotes and bibliographies.

FNOTE (footnote) will extract anything from a text as long as the material to be extracted is delimited by a special character. This means that as you are writing the first draft of your paper, the contents of the footnotes can be entered in the text of the paper, right after the footnote references. In later revisions, if you need to shuffle pages around, you do not have to retype pages of footnotes into their proper order. You only need to renumber them.

Once you have used FNOTE to extract the contents of the footnotes, MLSORT (multi-line sort) can be used to sort them into numeric order. MLSORT is especially useful for bibliographies. Even with an editing program like XEDIT or the Terak Editor, it is time consuming to get a bibliography into order. However, MLSORT allows you to type your bibliography into the computer in any convenient order. Once the bibliography is complete, MLSORT sorts it into the proper order. See Tom Rindflesch or Vicky Walsh for information on how to use these programs.

Vicky Walsh



Designed by Jill McAllister

text processing

In response to a growing number of requests for tools to create and modify textual material with the aid of a computer, we have defined an area of services called TEXT PROCESSING. As manager of our text processing services, it is my job to field your questions about how to use our hardware and software for your text processing tasks, to develop an introduction and training program for those services we offer currently, and to evaluate new products, with an eye to improving existing facilities. Our goal is to provide as comprehensive a service as possible, based on demand, current technology, and budget constraints.

With text processing, you can type text into the computer, correct errors or make changes to that text, and have the text printed on paper in practically any format you desire. These operations are called entry or input, editing, formatting, and printing or output. The great advantage of text processing over conventional methods of producing documents is that, with electronic editing and formatting, you never have to retype the entire document when you have made a change. You only enter changes to the original version into the computer, and the computer takes it from there, producing a new, reformatted version which incorporates all your changes. This method can be used to produce papers for class, journal articles, manuals, dissertations -- any kind of document you require.

We offer a wide variety of text processing services, including terminals for text entry, programs to help you edit and format the text, and printers to produce a paper copy of your text. We are presently reorganizing and significantly enhancing our text processing services. A new set of short courses will be offered to teach a new user all the steps necessary to be able to use our services. Several of these short courses will be introduced during fall quarter, and the entire series will be ready for winter quarter. The text processing courses are described on this page and in WRITEUP(CLASSES=TEXT).

To find out about terminals, printers, and programs available for text processing, see the document, WRITEUP(TEXT). Besides describing current facilities, this WRITEUP tells you what will be available in the immediate future, and what our long-range plans are for text processing services. It will be updated often as new features are added to our computers. To help make long-range plans, however, we must know what text processing facilities you require. Please read WRITEUP(TEXT) and then let us know if you have a text processing application that we have not recognized. In order to serve you effectively, we must be aware of your needs. If you have questions, call me at 376-2943.

theses

Our systems can already help you produce a thesis in a variety of ways. You can enter text directly via a microcomputer or interactive terminal. Once you have entered the text, each computer has one or more editors that let you make changes easily. Page (or screen) editors are available on Terak and Apple microcomputers and some terminals attached to the VAX. Line-oriented editors (editors that operate on one line at a time) can be used on all terminals that connect to the VAX or Cyber computers.

You can use the Prose formatting program on the Terak micro and all our large computers. Vicky Walsh has provided a Prose directive setup file -- accessed by FETCH(PRDIS) -- which will help you format your paper according to Graduate School requirements. We will soon offer more sophisticated programs that will provide more complex formatting options. The Graduate School will accept output from the Xerox 9700 electronic printer. Other letter-quality printers will be available in the future. For information on the Xerox 9700 service, see WRITEUP(SERVICE=X9700).

short courses

Text Processing: An Overview (new)
3:15-5pm, Oct 13 (Tu), MechE 221
Introduction to such aspects of text processing as text entry, editing, formatting, and printing. Describes how the different UCC computer systems are used for those processes, and what can and cannot realistically be done on each system.

XEDIT
2:15-4pm, Nov. 2-6 (MWF), NichH 45
Begins with an overview f the XEDIT text editor with discussions and illustrations of system structure and basic commands. More complex commands are introduced and explained with examples. Finally, new features of XEDIT are discussed and more sophisticated commands for windowing and formatting are introduced.

Text Editing On The VAX (new)
10:15-12n, Oct. 26-Nov. 6 (MWF), 113 ShepL
Three 1-hour labs (TTh), times arranged
Introduction to using a computer to create and edit documents. Students will learn to use the EDT text editor on UCC's new VAX/VMS system located in Shepherd Labs. Course format will consist of lectures and supervised lab work on a computer terminal. No previous computing experience is assumed.

Prose
3:15-5pm, Nov. 9-13 (MWF), FolH 105
Introduction to principles of using text-formatting programs, with an overview of the Prose text formatting program. Instruction and examples illustrate the use of Prose in producing simple document formats, and present progressively more complex format descriptions.

Text Processing On Micros (new)
3:15-5pm, Nov. 16-Dec. 7 (M), MechE 102
Describes text processing on the Terak and Apple micros. Explains editing and formatting operations and the Prose program. Explains how to use the communications feature to connect the micro to a mainframe computer, and for what applications such communication is appropriate.

Renee Holoien

product changes

business data products

The new school year brings several changes and updates to the business data products on our Cyber systems.

New versions of Sort/Merge, COBOL4, COBOL5, and Cyber Record Manager have been placed in the system. The products are at PSR release level 531. The previous products, level 518, are still available by using the PAST control statement. You may access:

```
PAST(SORTMRG)
PAST(COBOL)
PAST(COBOL5)
PAST(CRM)
```

If you use a PAST control statement, it should be the first statement in your job deck or terminal session. Each statement acquires many files in addition to the stated product. Also, if you should use a PAST compiler and then save the relocatable binary, you must also use the same PAST statement when you execute the binary in a subsequent job or terminal session. (In general you should save absolute binaries and not relocatable ones.)

The level 460 products which were PAST have now been changed to FETCH products. These products are being kept around because they are compatible with MNF and M77. This includes CDCIO, Control Data's old Record Manager. Our plans are to convert M77 so that it's compatible with the new Record Manager. At that time we will announce a phaseout of CDCIO. Don't panic, we have no plans to remove it now.

If you have any questions regarding these changes please call me.

COBOL4 phaseout

Don't panic yet! Back in October 1978, Control Data stopped supporting COBOL4. We said that we would continue to support COBOL4 as long as possible to allow a smooth and unhurried conversion to COBOL5. In the past year the stability and reliability of the COBOL5 compiler have improved tremendously, and it has become the primary teaching compiler here since it accepts the latest standard COBOL language.

Therefore, we are announcing the start of a 2 year phaseout of COBOL4. This should be ample time to convert COBOL4 programs to COBOL5. We would like to remove COBOL4 from the system in September, 1983. This will provide a total of 5 years of support overlap.

Control Data publishes a COBOL4 to COBOL5 conversion aids manual. It's available from our Computer Store. Ask for CDC publication number 19265021. Also, if you would be interested in attending a COBOL conversion seminar, call me. I will compile a list of names and, if there is enough interest, will offer a seminar.

S.A. Reisman, 376-1755

pretty pictures

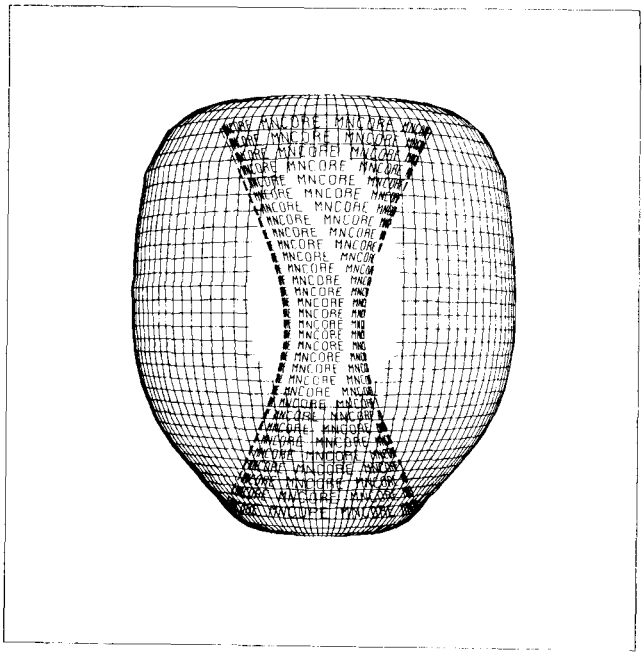
During fall quarter we will be introducing a new library of FORTRAN and Pascal compatible graphics routines. This library, which conforms to the SIGGRAPH (ACM Special Interest Group on Graphics) 1979 proposed Core Graphics Standard, supports 2-D and 3-D vector plotting, upper- and lower-case text, and color. It will be running on MERITSS, the Cybers, the Cray, and the VAX.

We've reviewed the way in which we've handled graphics over the last decade and have decided to make some changes to conform to current trends in graphics development. This means that we will have to change our picture storage method (metafile), currently a binary file named CALCOM, to one which conforms to the SIGGRAPH proposed metafile. This change should be transparent to most of you, but I want to hear from you if this causes you any serious problems.

During the transition period, we will continue to support PLOTPAC and PASPLOT as in the past. We will bring in this new package and its supporting software as FUTURE products.

For more information concerning these changes, attend the graphics short courses in October.

Kevin McMahon, 376-1849



choosing a computer sytem for fortran jobs

Before the large scale processor bids went out in February, we selected a group of seven FORTRAN benchmark programs to use as a standard test set to measure the processing power of various computer systems. Since benchmark sets are subjective, we used the statistics in Donald Knuth's article "Empirical Study of FORTRAN Programs," (Software Practice and Experience, Vol. 1,No. 2, 1971) to help select programs from the several hundred that we have used to test MNF and other FORTRAN compilers. The test programs and their test areas are:

MATRIX	tests the accuracy of constant dimension matrix inversion, multiplication, and subtraction.
RUNGE	tests short trip count do loops, and function evocation and setup times.
ELEMEN	tests the accuracy of the elementary functions, ABS, ALOG, ATAN, COS, EXP, SIN, and SQRT.
SORTE	tests IF and simple assignment statements.
TEST01	tests integer intrinsic and user supplied functions, and a do loop with four statements.
TEST05	tests a do loop that has an inner exchange do loop with a trip count of 2.
TEST10	tests the accuracy of matrix inversion using a variably dimensioned subroutine with non-contiguous passage over the matrix.

Before the test began we had expected that the Cyber 172 and VAX systems would have about the same relative power (approximately 1/3 of the Cyber 74) and that the Cray would be 9 times faster in scalar and 18 times faster in vector mode than the Cyber 74. The total test times for compiling, loading, and executing the test set gave us the following relative processor power (with the Cyber 74 normalized to 4):

Cray	single precision	43.2
Cyber 74	single precision	4
Cyber 730	single precision	2.16
Cyber 172	single precision	1.42
VAX	single precision	1.30
VAX	double precision	0.93
VAX	g_float	0.01

These are equivalent to the following ratios of execution times where the second named system is that many times faster than the first named system for our test set:

VAX double precision/Cray	46.5
VAX single precision/Cray	33.4
Cyber 172/Cray	30.6
Cyber 74/Cray	10.8
VAX double precision/Cyber 74	4.29
VAX single precision/Cyber 74	3.08
Cyber 172/Cyber 74	2.82
Cyber 730/Cyber 172	1.52
VAX double precision/Cyber 172	1.52
VAX single precision/Cyber 172	1.09

If we use our current rates, the following are the breakpoints that can help you decide which system to use for FORTRAN execution at the least cost.

Use the Cray if it executes faster than:
27.75 times the VAX time,
3.26 times the Cyber 74 at normal rates,
4.63 times the Cyber 74 at delay rates, and
9.25 times the Cyber 74 at NOFRILLS rates.

Use the Cyber 74 if it executes:
at normal rates, 18.5 times faster than the VAX,
at delay rates, 6.0 times faster than the VAX,
at NOFRILLS, 3.0 times faster than the VAX.

Else use the VAX.

Applying these breakpoints to our benchmark set, we would choose the Cray for economy rather than the Cyber 74 (even at NOFRILLS rate) since it runs 10.8 times faster. We would choose the Cray rather than the VAX (33.4 times faster than VAX single precision, 46.5 times faster than VAX double precision). We would choose the Cyber 74 at NOFRILLS rate over the VAX (3.08 times faster than VAX single precision, 4.29 times faster than VAX double precision).

For FORTRAN computations in general, the Cray is expected to be the most economical, followed by the Cyber 74 at the NOFRILLS rate, followed by the VAX.

strengths and weaknesses

The Strengths Of The Cray-1

The MATRIX and TEXT10 programs ran 18.5 and 21.2 times faster on the Cray than they did on the Cyber 74, showing that Cray's FORTRAN translator, CFT, does a good job of automatically translating matrix do loop statements into vector mode operations. If the elementary function test, ELEMEN, is transformed to run in vector mode, it runs 24.8 times faster than the Cyber 74; in scalar mode, it runs only 7.71 times faster than the Cyber 74. The Cray, in vector mode, runs 18 to 36 times faster than the Cyber 74. Cray FORTRAN will automatically change short, matrix, non-IF do loops into vector mode. For many other programs, if the user changes a few statements in an innermost do loop, execution, in vector mode, will be 2 to 4 times faster than the execution in scalar mode. Its half million word memory will allow programs with memory requirements four times larger than could be handled on the Cybers. Cray's REAL precision matches that of the Cybers while the exponent range is eight times larger.

The Weaknesses Of The Cray-1

In straight line scalar code such as that generated by the statements in SORTE, TEST01, and TEST05, the Cray is only 6.4 to 7 times faster than the Cyber 74 (we expected 9). This means that CFT needs to be improved in this area. Like the Cybers, the Cray is not as good as the VAX on simple replacement and IF statements. The higher transfer rate disk systems on the Cray are more expensive than the Cyber or VAX units for the same

number of storage bits. We expect that low cost, long term mass storage will usually be on the front end machines rather than the Cray.

The Strengths Of The VAX
The "virtual memory" of the VAX allows very large programs to run without being overlaid or segmented. For programs that do not need a large exponent range (limited to 10**38 on the VAX rather than the 10**308 on the Cybers) and which do large amounts of data movement rather than number crunching, the VAX will be more economical than either the Cray or the Cybers. We expect that COBOL programs and editing sessions will be more economical on the VAX; these packages should also benefit from the 8-bit ASCII character set of the VAX. The UNIX operating system, to be offered on the VAX at Lauderdale early next year, should also be a "plus" since it is reputed to be very "user friendly."

The Weaknesses Of The VAX
"Virtual memory" means having a dynamic working set of pages (each 512 bytes long) in memory representing the executing program. The VAX/VMS operating system will swap out the entire working set (working field length) of a particular program if it needs that space to bring in another working set that has been swapped out too long (similar to the automatic rollouts of the Cyber systems). VMS allocates more pages (field length) to the working set of a background batch job than it does to an interactive job. This means that large real memory space jobs that run interactively can generate many "soft page faults" (i.e., the page may be in memory but is not part of the working set). For example, in batch mode TEST10 executed in 1199 seconds and had 5373 soft page faults with a peak working set size of 499 pages. In interactive mode, it executed in 13950 seconds and had 34,666,273 soft page faults with a peak working set size of 150. Our VMS system hits you for 368 seconds of chargeable but non-useful processor time for every million soft page faults.

The VAX user should examine any run larger in scale than a previous run to ensure that unneeded page faults will not occur. For example, the page fault cost rose by a factor of 100 when we ran TEST10 in double rather than single precision, even though memory requirements only increased by a factor of 4.

VMS comes with a g_float option which allows REAL arithmetic with an exponent range of 10**308 and precision to match the Cyber systems. We only ran two test programs (MATRIX and SORTE) with this option since they took 100 times longer than they did with VAX double precision. We cannot recommend the g_float option for any user; if you require the safety of a large exponent range you must use the Cybers or the Cray. We also recommend at least double precision for large arithmetic computation, since the VAX single precision of 7 digits (24 bits) is not enough to ensure reliable answers without some cross-checking (i.e., usually running in double precision).

The Strengths Of The Cybers
The Cyber's REAL precision and exponent range are important for large scale arithmetic computation. (The IBM 360, 370, and 303X; the DEC 10, and 20; the Honeywell 6000; and the Burroughs machines all have much smaller exponent ranges and use single precision arithmetic.) The Cyber 730 is very competitive for data base management packages, and the peripheral processors of the Cybers have given very effective interactive computation without the large overhead seen in single central processor machines such as the VAX. One strength of the Cybers is the number of UCC-developed packages that will continue to run without any changes; changes may be required if you wish to use these packages on the VAX or Cray.

The Weaknesses Of The Cybers
The overlay or segmentation required for extremely large programs has slowed their development on the Cybers. (Large batch jobs can request 371,000 octal words on the Cyber 730 and 311,000 octal words on the Cyber 74. For interactive jobs on the Cyber 730, 71,000 octal is nominal, 111,000 octal is easily obtained, and 131,000 octal can be requested.)

The extra computations required to change the 6-bit Cyber characters to handle standard 8-bit ASCII bytes makes the machine less effective for character manipulation. For many programs, the Cybers will not be as economical as the VAX or Cray, but we hope to be able to review and lower Cyber rates once the Cray and VAX are in full service.

For descriptions of the Cray and VAX machines, and explanations of their associated operating systems, attend our introductory short courses this quarter. We will offer feature articles on these machines in later issues of this newsletter.

conclusions

We believe that the Cray will be the machine to use for large scale computation at the University. We believe that its proven cost effectiveness with FORTRAN will be extended to other languages and packages in the coming years. The VMS and UNIX operating systems of the VAX will combine friendly and effective editing and character manipulation to get easy to use FORTRAN execution for small programs and large "virtual memory" programs that are designed for contiguous data access. The Cyber systems will continue to do best with our long standing, and medium scale FORTRAN packages.

A writeup, BENCHMK, contains the results of our set of seven FORTRAN tests on various systems and the explanation and statement execution counts for each program in the test. This writeup is available on the system or will be mailed to anyone requesting it.

Lawrence Liddiard

micro labs

This month we are starting a new kind of service at UCC -- microcomputing laboratories. Two labs are scheduled to open in October. One lab, located in 304a Folwell Hall, will have seven single density, single disk Teraks, one single density, dual disk Terak, and a Decwriter II with modem (300 baud). The other lab, in 160 Architecture (the Architecture Library) will have three dual density, dual drive Teraks, and a dot matrix printer (Epson MX-100) with crude graphics capabilities. A telephone and 1200 baud modem are on order and should arrive before the end of the quarter.

You must purchase a University Microcomputing Use Card from our Computer Store before you can use the equipment in these labs. The price for the Use Card is $10 if you are required to use the lab for a classroom assignment, or $30 for all other uses. Some instructors have paid for these cards in advance and may distribute them during class periods.

Lab usage is expected to be light in the early part of the quarter and heavy at the end. Plan ahead and save yourself needless strife at the end of the quarter.

Policies and procedures governing the use of the microcomputing labs are available at the lab sites.

Joe Cornell, 376-1637

graphics terminals

The departments of Mechanical Engineering, Computer Science, Studio Arts, Electrical Engineering, Geography, Sociology, and Soil Science will offer courses this year that deal specifically with graphics. There are applications for graphics in virtually all fields of study at the University. Departments offering graphics courses often purchase equipment designed for their specific applications, but this frequently leads to University-wide duplication of effort and a failure to adequately meet a student's needs due to budget limitations.

At the end of spring quarter 1981, we asked for information about graphics requirements from all departments that had course accounts on our MERITSS system. From the responses to this request and conversations with people involved in computer graphics, we tried to gauge needs and to find common areas where it made the most economic sense for us to provide services. We decided to provide graphics terminals in the instructional labs.

We have a number of graphics software packages that can be used by Tektronix type terminals. Among them are ARTPLOT, CALCOMP, CNTOUR, DUAL, HTEKLIB, PASPLOT, PLOTPAC, PLOT3D, PLOT31, PLTSCL, SPSS, SURFACE, and TEKLIB. For the instructional labs, we decided that graphics terminals should support this software. They should also have interactive capabilities such as light pens or cursor control. They should offer resolution of at least 512 X 512 pixels. They should be good general-purpose interactive terminals (upper/lower case, 80 character lines, able to run at speeds up to 9600 baud, flexible setup options, good quality keyboard, and have bright, non-glare displays that do not tire the eyes). They should have a good repair history and reasonable maintenance contracts.

As soon as we can purchase these mythical beasts (we hope by the end of October), we plan to put two graphics terminals in the instructional lab in B2 Wilson Library. Two of the APPLEs now in Wilson will be given lines into the MERITSS system, along with software and hardware to let them emulate a Tektronix terminal. We will place two Tektronix 4013 terminals and five new graphics terminals in the lab in 308 MechE. Three of these five new terminals will be on loan from UCC and will be moved to a public research cluster when that cluster opens during winter quarter 1982. We are placing these graphics terminals in MechE temporarily because the graphics course load is expected to be especially heavy this fall. We plan to expand the Wilson and MechE graphics service sometime in the future. If the Diehl Hall Biomedical Learning Resources Library shows heavy use this fall, it will be considered as a site for adding graphics terminals.

Bill Sackett, 376-5602

new equipment, new problems

multi-file tapes

A serious problem was recently discovered in the NOS operating system multi-file tape software. When adding new file sections to an existing multi-file ANSI labeled tape, the NOS system will occasionally, randomly misposition the tape. This results in the new file section being written over one or more existing file sections. This problem has been reported to Control Data for correction.

Until Control Data corrects this problem, we suggest that you use an alternate method for file storage on magnetic tape. Users of multi-file tapes for archival storage should consider using the ARCHIVE utility. ARCHIVE is an excellent utility designed for file backup to tape. Information on ARCHIVE can be obtained with the control statement, WRITEUP(ARCHIVE). Users whose needs cannot be filled by ARCHIVE should consider storing their files in a single ANSI labeled tape file.

This software problem does not affect reading of multi-file tapes, nor does it affect typical tape usage where only a single ANSI labeled tape file is involved.

Chris Boylan, 376-5603

new printers

On September 7, 1981 the CDC 8090 computer and the associated high-speed input/output equipment in 131 Experimental Engineering was replaced by a PDP 11/40, a 600-card-per-minute reader, and two 600-line-per-minute printers. The card reader reads both Hollerith and binary cards. The printers both have upper- and lower-case ASCII character sets which are totally compatible with the previous printer at that site and with the CDC printers at the Lauderdale site. You cannot, however, choose which printer will print your job.

Some printer problems exist, however, including:

- One printer does not handle underlining and overprinting properly.
- One printer prints only 132 columns, not 136.
- One printer must be manually switched to handle 6 and 8 lines per inch printing formats.

We are working on solutions to these problems and will keep you posted when changes occur; watch SYSNOTES.

Jerry Larson, 373-7538

Our service vehicle, which makes hourly trips between the Lauderdale site and the campuses, now makes a stop at the VAX/VMS site in Shepherd Lab. The vehicle will stop three times each day: at 8:30 AM, 12:30 PM, and 3:30 PM.

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permanent files

On September 20th, all permanent files on the Cyber 74 computer became shared. Cyber 74 files are now accessible from both the Cyber 74 and the Cyber 730 computers. The auxiliary pack named SHA is also shared (as it was before that date). There is no longer any extra charge for files stored on shared devices. At the same time interactive access to the Cyber 74 was removed. All interactive access to the Cyber 74/730 complex is now via the Cyber 730 computer. At login time, you must select which family of permanent files you wish to use (C74 or C172). You may also have to use the MI= parameter when you submit jobs; see WRITEUP(FAMILY) for complete information.

For Safety's Sake

Permanent files are backed up to tape on the Cyber 74 and Cyber 730 computers, but only a couple of times per day. A long editing session can still be lost if a permanent file device fails at the wrong time of the day -- after you have done a lot of work but before permanent files have been backed up. We wish to offer two suggestions if you plan to spend a long period of time at a terminal creating or editing a file. First, if you are in for a long session, every half hour to an hour you should save (or replace) the permanent file you are working on. You will be safer in case the system dies for any reason, for example a power failure. If the system dies you may not be able to recover your last terminal session, and only the work saved since you last updated a permanent file will exist.

Second, if you have spent a lot of time creating or editing a file, save an extra copy of the file on pack SHA. This will protect you in case of a permanent file crash before the next incremental dump is done. Remember that in case your permanent file device on whichever family you are using has to be reloaded, your file will only be in the state it was as of the most recent permanent file dump. It is very unlikely that both your family device and pack SHA will have problems at the same time. So in case your family device had to be reloaded, you could replace it yourself with a copy from pack SHA. Of course, you will have to pay permanent file storage charges for the extra copy of your file on SHA, so you should purge the extra copy a day or two after you have completed making big changes. The cost of maintaining an extra copy of an indirect access permanent file for a couple of days is usually less than a dollar, and your time is probably worth this insurance investment.

K.C. Matthews, 376-9720

new & nifty

As we begin another school year, we want to let you know about our computer documentation and new publications.

We write, print, and distribute more than 170 publications, and we maintain more than 200 online documents. The printed documents are available in 140 Experimental Engineering or in the Computer Store (211 Experimental Engineering). On-line documents are obtained through the WRITEUP utility. A leaflet describing the use of this utility is available in 140 Experimental Engineering.

Our documents are designed to help users at all levels of experience and with all types of applications. We suggest that you stop by 140 Experimental Engineering and get a copy of our "Documentation Directory" before you pick up any other documents or manuals. The directory will steer you to the correct set of documents for your particular needs.

if you are an established user, you should note some improvements that have been made to our entry level documents. First, the "Cyber Instant" and the "Guide To Cyber Batch Computing" have been merged to form a new document: "Guide to Batch Computing." The new booklet has been redesigned to be more helpful, deals specifically with batch computing at UCC, and will be more convenient to carry. Pick one up in 140 Experimental Engineering.

We are distributing a new booklet this fall, "Introduction to Computing." This booklet is for new users with either little or no computer experience. It explains concepts and gives references to more detailed information. All computer terms are explained in the text and in the glossary. Look for copies in 140 Experimental Engineering.

Our other entry level document, "Guide To Interactive Computing," is also available in 140 Experimental Engineering. This booklet explains how to use our interactive computing system.

The UCC Brief, "Terak-Cyber Text Processing Costs," is new and should help those of you doing text processing with a Terak.

As you may know, we have acquired three new computers, two VAX 11/780s and one Cray-1. Documentation for these machines is being developed and will be announced when ready. The VAX at Shepherd Labs has preliminary documentation available through WRITEUP(SERVICE=SHEPVAX).

A final note: our publications are meant to be distributed and used, and we try to keep a supply sufficient to satisfy everyone's need. If, however, you need a large number of any UCC document, we want you to call Karen Johnson in the Publications Group (373-4668) to place a special order. By doing this, we can meet your needs and still keep the shelves full.

M.C. Boyd, 373-2522

price changes

In a continuing response to your requests for separate and unbundled pricing, we want to announce that the next pricing change will occur on January 1, 1982. The VAX and Cray rates will be re-evaluated at that time. We expect to drop the NOFRILLS rate (P1) from the Cyber systems because of the switch to the Cray for those number crunching jobs that benefited most from this rate. If VAX and Cray incomes rise as expected, we should be able to reduce Cyber normal and delay (P0) rates. We have, however, seen a 10% drop in income this year compared to last year and, if that trend continues into 1982, additional rate changes or cutbacks in service may be necessary during the last six months of the fiscal year. If you have any questions or comments about our current rate structure, please drop us a line.

TELENET

Users from across the country can now access the services of UCC interactively through the national Telenet packet network at speeds of up to 1200 baud. By dialing a local phone number in any of over 400 Telenet-served cities coast to coast, including Alaska and Hawaii, a user can connect directly to the Cyber 730 or the MERITSS 172 and make use of these systems and related services (such as the Cray machine), just as a local user can. A connect time surcharge of $8.50 per connect hour is the only extra fee associated with the service. For more information, call

Liz Stadther, 376-9823

A SIR 2.0 seminar will be given on December 16, 17, and 18, 1981 in Health Sciences Unit A. If you are interested in this seminar, write or call

Professor Gary Anderson
Box 1404
Evanston, Illinois 60204
312/475-8332

NEW RATE SHEETS

We have new rate sheets -- current rates as of September 1981. These include the rates for the VAX and the Cray. Pick up copies from the account clerks at UCC or call 373-4548 and ask for copies.

short courses

The University Computer Center offers short courses each quarter; we charge no fees, require no registration, and offer no credit for attendance. The fall quarter courses are listed below. For more information about course content, see the list from WRITEUP(CLASSES). If you have questions not answered by this schedule or by WRITEUP(CLASSES) call 373-4360.

Some of our courses are offered through Continuing Education & Extension. The Extension Division charges a small fee for these and requires registration.

*^Computing: What Is It?
3:15-5pm, Oct. 1-9 (TWThF), SciCB 125

$^Computing: What Is It?
6:15-8pm, Sept. 29-Oct. 15 (TTh), NichH 45

^Introduction to UCC
3:15-5pm, Oct. 16 (F), Arch 40

* Introduction to VAX
3:15-5pm, Nov. 23-Dec.9 (MW), Arch 30

Introduction to the CRAY 1B
3:15-5pm, Nov 30-Dec 4 (MWF), FolH 105

Microcomputing
3:15-5pm, Oct. 20-Nov. 17 (Tu), Arch 30

$UCSD and CP/M Systems on Micros
6:15-8pm, Nov. 2,4 (MW), AkerH 215

$Programming Techniques on Micros
6:15-8pm, Nov. 16,18 (MW), AkerH 215

*$Personal Computers: A Perspective
6:15-8pm, Oct. 19,21 (MW), AkerH 215

^Text Processing: An Overview
3:15-5pm, Oct 13 (Tu), MechE 221

^XEDIT
2:15-4pm, Nov. 2-6 (MWF),NichH 45

Prose
3:15-5pm, Nov. 9-13 (MWF), FolH 105

* Text Editing on the VAX
10:15-12n, Oct. 26-Nov. 6 (MWF), 113 ShepL
3 1-hour labs (TTh), times arranged

Text Processing on Micros
3:15-5pm, Nov. 16-Dec. 7 (M), MechE 102

^Batch Introduction
2:15-4pm, Nov. 10 (Tu), MechE 221

^Interactive System Commands
3:15-5pm, Nov. 3-12 (TuTh), FordH 115

^NOS (system configuration)
3:15-5pm, Oct. 20 (Tu), Arch 40

NOS (files/jobs)
3:15-5pm, Oct. 21-22 (WTh), Arch 40

NOS (permanent files)
3:15-5pm, Oct. 23 (F), Arch 40

NOS (program execution)
3:15-5pm, Oct. 27 (Tu), Arch 40

NOS (intro to tapes)
3:15-5pm, Oct. 28 (W), Arch 40

NOS (misc statements)
3:15-5pm, Oct. 29 (Th), Arch 40

NOS (control language)
3:15-5pm, Oct. 30 (F), Arch 40

SPSS (basics)
3:15-4:30pm, Oct. 26 (M), MinMet 116

SPSS (data manipulation)
3:15-4:30pm, Oct. 27 (T), MinMet 116

SPSS (SPSS files)
3:15-4:30pm, Oct. 28 (W), MinMet 116

SPSS (On-Line)
3:15-4:30pm, Oct. 30 (F), MinMet 116

BMDP
3:15-4:30pm, Nov. 2-6 (MWF), Arch 30

SCSS
3:15-4:30pm, Nov. 16-25 (MWF), Arch 60

Comparative DBMS
3:15-5pm, Nov 5 (Th), Arch 30

Intro to System 2000
3:15-5pm, Nov 9-25 (MWF), Arch 15

SIR
3:15-5pm, Nov. 30-Dec 9 (MWF-MTW), Arch 60

Graphics I.(overview)
3:15-5pm, Oct. 19-20 (MT), Arch 45

Graphics II.(TELL-A-GRAF)
3:15-5pm, Oct. 26-29 (MTTh), Arch 45

Graphics III.(DISSPLA)
3:15-5pm, Nov. 2-10 (MTTh), Arch 45

Graphics V.(user update)
3:15-5pm, Nov. 12-13 (ThF), Arch 45

Graphics IV.(CORE 79)
3:15-5pm, Nov. 16-20 (MTThF), Arch 45

Intro to Record Manager
3:15-5pm, Oct 26 (M), Arch 60

RM (basic access methods)
3:15-5pm, Oct 28-30 (WF), Arch 60

RM (adv. access methods)
3:15-5pm, Nov. 2-6 (MWF), Arch 60

SORTMRG
3:15-5pm, Nov. 9-13 (MWF), Arch 30

FORM
3:15-5pm, Nov. 16-20 (MWF), Arch 30

Introduction to Programming
3:15-5pm, Nov 17-Dec 8 (TWTh), AkerH 309

$Programming: It's All In How You Do It
6:15-8pm, Oct. 26-Nov. 18 (MW), AkerH 211

Pascal for Programmers
3:15-5pm, Oct. 19-Nov. 11 (MW), Arch 10

Beginning FORTRAN
3:15-5pm, Nov 2-20 (MWF), MinMet 116

Beginning COBOL
3:15-5pm, Nov 3-Dec 1 (TTh), Arch 60

* indicates change from first publication.
^ indicates prerequisite for other courses.
$ indicates Continuing Education and Extension.

statistics

***PRODUCTION USAGE SUMMARIES: Cyber 74/730

	August, 1981	August, 1980	% Change
System resource units (SRU)	1,280,184 (1,790,362)	1,402,306 (1,815,705)	- 8.7 (- 1.4)
Batch jobs & MIRJE sessions	92,696 (104,941)	100,846 (111,766)	- 8.1 (- 6.1)
Total central processor (CP hours)*	135/154 (156/281)	146/250 (184/350)	(-15.2 /+22.0)
Pages printed, charged from UCC	676,337 (808,494)	849,232 (989,220)	-20.4 (-18.3)
MIRJE terminal hours	17,152 (19,946)	18,096 (20,568)	- 5.2 (- 3.0)
Number of terminal sessions	44,410	40,342	+10.1
Average file storage (char)	3,298.2 million	3,121.8 million	+ 5.7
Mean time between failures	105.9/35.3 hours	105.5/262.2	+ 1.3 /-86.5
Available during scheduled hours	98.7/98.8 percent	99.0/ 99.8 percent	- 0.3 /- 1.0

(totals in parentheses include staff development, accounting, and maintenance runs)
*The Cyber 730 is approximately 1.52 times faster than the Cyber 172 used in 1980.

DOWNTIME SUMMARY: September, 1981 (Column 1, Cyber 74 : Column 2, Cyber 730)

	0800-1800 M-F		other		total	
Total possible scheduled uptime hours	210.0	210.0	309.0	309.0	519.0	519.0
Total downtime hours (see Schedule A)	0.4	2.7	0.2	0.8	0.6	3.5
Total uptime hours	209.6	207.3	308.8	308.2	518.4	515.5
Uptime (percent)	99.8	98.7	99.9	99.7	99.9	99.3
Average downtime per occurrence (min)	8.7	40.5	13.0	11.5	9.7	26.0
Mean time between failures (hours)	52.5	52.5	154.5	77.3	64.9	64.9
Subsystem failures						
SUPIO	9	-	3	-	12	-
TELEX	1	8	1	4	2	12
EXPORT	3	-	0	-	3	-

Schedule A: downtime hours

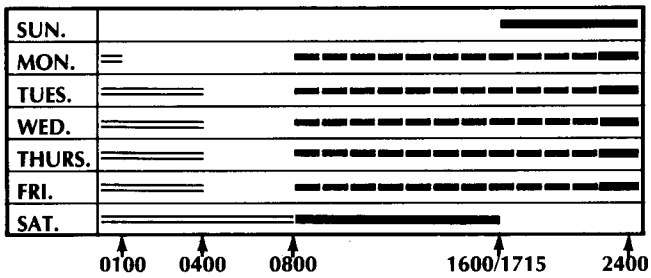
	Number		Total hours		Average minutes	
(1) Preventive maintenance over-runs	0	0	0.0	0.0	0.0	0.0
(2) Software related problems	0	0	0.0	0.0	0.0	0.0
(3) Hardware related problems	0	5	0.0	3.0	0.0	36.0
(4) Indeterminate problems	2	1	0.3	0.4	8.0	22.0
(5) External Problems	2	2	0.4	0.1	11.5	3.0

***PRODUCTION USAGE SUMMARIES: Cyber 172 (MERITSS)

	August, 1981	August, 1980	% Change
Number of jobs run	139,094	103,332	34.6
Central processor hours	218	110	98.2
MERITSS terminal hours	17,188	13,012	32.1
Number of terminal sessions	29,602	25,866	14.4
Maximum number of simultaneous users	108	76	42.1
Average file storage (char)	444.8 million	416.5 million	6.8
Mean time between failures	250.4 hours	69.0 hours	262.9
Available during scheduled hours	99.9 percent	99.6 percent	0.3

operations

CYBER 74+730 OPERATING HOURS



Lauderdale, ExpEng, NORMAL rate
Lauderdale, ExpEng, DELAY rate
Lauderdale only, DELAY rate

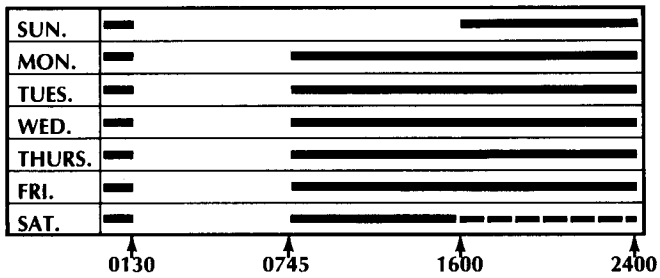
See WRITEUP(HOURS) for schedule of batch job pickup/delivery service.

TWIN CITIES CAMPUS PUBLIC REMOTE JOB ENTRY SITES

SITE	ID	SUPERVISOR	PHONE
		East Bank	
ElectE 38	4V	V. Zahhos	373-5346
EltHN 640	4W	D. Anderson	373-5827
ExpEng 130	3L	I/O Coordinator	373-4596
ExpEng 130	4B	I/O Coordinator	373-4596
ExpEng 130	4N	I/O Coordinator	373-4596
FrontH	4E	D. Schumacher	373-2740
MasCan 39	4C	L. Croatt	373-7714
KoltH S191	4Z		
MinMet 321	41	N. Kacker	373-2302
2 OMWL	29	J. Bayer	373-3840
Physics 69	44		
TerrH W106	4I	B. Hackett	373-6621
D388 Mayo	24	L. Croatt	373-7714
Zoology 314	4J	E. Cushing	373-2232
		West Bank	
SocSci 167	4X	D. Lund	373-3608
SocSci 1009	4K	M. Mongiat	373-0168
		St. Paul	
BioSci 257A	47	M. Simmons	373-1961
ClaOff 125G	48	C. Bingham	373-0988
McN H	42	G. Wahlert	373-0939
NorH 24	4G	J. Colten	373-0990
NorH 24	40	J. Colten	373-0990
		Lauderdale	
User's Room	3F	Secretary	373-4912

Keypunches provided at each site.

MERITSS (CYBER 172) OPERATING HOURS



Up, not attended
Up, attended

See WRITEUP(LAB HOUR) for a schedule of open hours in the student computer laboratories.

TWIN CITIES INSTRUCTIONAL COMPUTER LABORATORIES

SITE	SUPERVISOR	PHONE	EQUIPMENT
	East Bank		
Arch 160	K. Johnson	3-2203	Terak(3)
CentH	R. Rickgarn	3-2289	Teleray(2)
ComH	C. Youngdale	3-2453	TTY33(1)
DiehlH 270	N. Sauro	6-7005	CRT(2) TTY33(2) TTY43(3) Teleray(1) Decwriter III(1)
EltH 121, 125	D. Anderson	3-5827	TTY33(6) Hazeltine(3) Teleray(2)
FolH 304a	J. Cornell	6-1637	Terak(8) Decwriter(1)
FrontH	T. Shobe	3-2740	TTY43(1) Teleray(1)
LindH	T. Chan	3-7580	CDC713(6) Decwriter(5) Decwriter III(1) Teleray(1) TTY43(16)
MechE 308	E. Riley	3-0340	TTY33(1) Teleray(4) Decwriter(7) Decwriter III(1)
SanfH	J. Hicks	3-3434	Tektronix(2) VT-100(5) TTY33(1)
TerrH	B. Hackett	3-3567	TTY33(1)
VincentH 4	W. Stenberg	3-2586	TTY33(1) CDC713(2) Decwriter III(1) Decwriter(7) Teleray(2)
WaLib 204	R. Estelle D. Donnelly	3-2538 3-2538	TTY43(10)
	West Bank		
BlegH 140	D. Lund	3-3608	TTY43(16) Teleray(1)
MdbH	B. Baker	3-9818	TTY33(1)
SocSci 167	D. Lund	3-3608	
OMWL 2	D. Lund	3-3608	VT-100(2) TTY43(9) Graphics(2)
	St. Paul		
ClaOff 125	C. Bingham	3-0988	TTY33(5) Hazeltine(2) Decwriter III(1) Decwriter(5)
BaH	N. Lee	3-1393	TTY33(1) Teleray(1) Decwriter(2)

phone numbers

Budgets 373-2521
Computer-Aided Instruction 376-2975
Computer Hours (recorded message) 373-4927
Computer Store 373-4877
Consulting
  HELP-line 376-5592
    9 AM—5 PM, Monday—Friday
  Business Data Products 376-1761
    1-3 PM, Monday—Friday
  Statistics Packages 376-5062
    1-2 PM, Monday—Friday
  Data Bases 376-1761
    1-3 PM, Monday—Friday
  Microcomputers 376-4276
    10-12 AM and 2-4 PM, Monday—Friday
  Humanities 373-5780
    10:30-11:30 AM, Monday, Wednesday, Friday
Contract Programming 376-1764
Data Base Applications 376-1764
Educational Services 376-3963
EDUNET Liaison 373-7745
Equipment Purchase 376-8153
Experimental Engineering I/O 373-4596
Field Engineering 376-7584
Graphics Software 376-1849
HELP-line 376-5592
  9 AM—5 PM, Monday—Friday
HOURS-line (recorded message) 373-4927
Image Processing 376-2895
Information, Experimental Engineering 373-4360
Information, Lauderdale 373-4912
Information Systems 376-1764
Instructional Labs 376-3963
Job Status, ExpEng (recorded message) 373-4994
Lauderdale Computer Room 373-4940
Lauderdale Operations Manager 373-4920
Lauderdale Services 373-4995
Lauderdale Services Manager 373-7538
Lauderdale Users' Room 373-4921
MECC Liaison 373-4573
Microcomputers 376-4276
Newsletter Subscription 376-4668
Permanent File Restoration 376-5605
Professional Services Division (PSD) 376-1764
Project Assistance 376-1764
Program Librarian 376-1636
Programming Languages 376-7290
Reference Room 373-7744
Remote Batch (RJE) Services 376-3963
Short Courses 373-4360
Shuttle Bus Service 376-3068
System Status (recorded message) 373-4927
Tape Librarian: see Lauderdale Services
Text Processing Services 376-2943
User Accounts 373-4548
User Services 376-3963

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227 Experimental Engineering
University of Minnesota
208 Union Street SE
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