



## NOTE TO PF USERS

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### CATLSYS Change - New Utility Available

On November 1, CATLSYS versions were rotated. The current version became the PAST version and the FUTURE version became current. Documentation for these versions is now available via the indexed WRITEUP, CATLSYS.

Also, the WHO utility will be removed and replaced by PERMITS. PERMITS is a utility that produces a listing of all the Permit entries for all the files in a user's catalog; this list is similar to that obtained with CATLIST(L0=F). File size, mode, subsystem, etc. are also printed. Documentation for PERMITS is available either from WRITEUP, CONTROL=PERMITS, or WRITEUP, PERMITS.

T.J. Hoffmann, 376-5262

## SUPPORT LEVEL CHANGES

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### Support Level Changes

The FUTURE versions (PSR439, Level 13) of COBOL, SORT/MERGE, and the Record Manager utilities will become current beginning Winter Quarter (January, 1978). A specific date will be published in the December newsletter.

At that time, the current versions (PSR420, Level 12) will become the PAST versions.

Any questions regarding these changes should be directed to my attention.

J. Cosgrove, 376-1761

## LIBRARY CHANGES

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On November 1, the routine NORMAL was corrected to generate a continuous random number sequence each time it is called and to not store beyond the end of the user's array. (From September 13 to November 1, it restarted the same sequence each time it was called and stored into one word beyond the end of the user's array.)

A new routine, GNREAD, was added to replace the previous GENREAD routine. GNREAD reads multi-punched cards and operates correctly with Record Manager.

Routines CHECK and RANBIN were removed, as detailed in the October newsletter. Routines that do input/output from the libraries IMSL, FUNPACK, TEKLIB, GPM, SIMPLX, MEXPLOR, BESPAC, and ALMAP were added to the FTN4 and MNF libraries. (These will later be removed from their respective libraries so that these libraries will operate correctly under both FTN and MNF.)

M.J. Frisch, 376-1636

## KEYPUNCHES

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In response to user complaints on the availability of keypunches at Experimental Engineering, we have created a new keypunch area in 140 ExpEng. We plan to place 9 keypunches in this room and put other tab equipment in 130 ExpEng. We hope that this will satisfy user needs.

R.T. Franta, 376-3963

## EDUCOM

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We have received requests about software from various people and places. If you know where any programs exist to satisfy these requests, please call me or drop me a note. In this case, "where" means anywhere in the world!

1. Programs or subroutines that perform log sequential analysis or Markov analysis.  
Requested: University of Notre Dame
2. Programs dealing with optical lens design.  
Requested: EDUNET Central Office
3. Programs useful in engineering undergraduate courses, all engineering disciplines.  
Requested: California State Universities and Colleges

T.D. Hodge, 373-4599

## USERS MEETING

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The University Computer Center quarterly users meeting, refereed by Thea Hodge, was held on Wednesday, October 19th. The meeting started at 3 PM and we were eventually booted out of the room by a 6 PM class.

### Speakers in order were:

Peter C. Patton: system performance over the past summer, the problems with saturation, future plans and proposals. He mentioned possible new equipment and a possible new operating system (NOS).

Tom Lanzatella: recapped announcements on system changes (announcements appeared in greater detail in the October issue of this newsletter).

Larry Liddiard: new timesharing ports, performance of the new interpreter, acquisition of a used 512 printer, MNF changes.

Thea Hodge: consultants will again start collecting use statistics; process will be simpler than before.

Jerry Larson, John Sell: shuttle service, keypunch servicing and problems, tape cleaning and testing.

Mike Frisch: SPSS 7.0, new corrections to ISIS, a new version of BMDP, edition 6 of IMSL, SYMAP to be purchased.

Quentin Roggenbuck: ACCSTAT, what it shows; suggestion made that record show user credits.

Mike Skow: MERITSS status, EDUCOM access to MERITSS, hardwired terminals in labs and the need for such, changes in charging scheme, MECC acceptance testing.

Clive Schofield: MNF changes, MANTRAP.

Rich Franta: new keypunches in ExpEng, theft from RJE sites requiring new policies of reference manual supply.

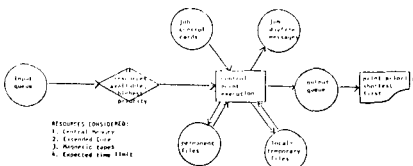
A discussion period followed. About 50 people attended this meeting. You are all cordially invited to meet with us again next quarter.

# INNER CYBER

## PART II: How Jobs Go Through The System

In order to have a good grasp of the total mechanism of job flow through the computer system, we will go backwards in time and describe the way that batch jobs were processed under MOMS, our previous operating system. The MOMS system did not have any interactive capabilities. As we stated in our previous article, batch jobs are entered through several different terminals (LOCAL BATCH, high speed EXPORT, and medium speed SUPIO), but ultimately every job is placed in the INPUT queue which resides on a large disk system.

The File Name Table (FNT), a Central Memory table that keeps track of every file that is currently active, has a special field signifying to which general queue (INPUT, OUTPUT, PUNCH, PLOT, LOCAL-TEMPORARY, ROLLOUT, TIMED EVENT) each file belongs. In addition to the FNT, the other essential mechanism you should understand about job flow is the Control Point idea incorporated in large scale CDC operating systems. For each job selected to advance through the system, a Control Point contains the computer resource usage, validations, status, operating registers exchange package, and buffer spaces for job control card and dayfile communication. Some of the 16 Control Points are permanently assigned to specific system jobs such as terminal entry (BATCHIO, EXPORT, SUPIO and TELEX) and magnetic tape control (MAGNET). Thus, a pictorial for batch job flow under MOMS would look like this:

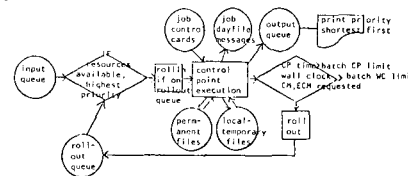


In a system such as MOMS, a job entered the INPUT queue, waited until the resources requested on the first card of the job control card deck were available and (if a Control Point was available and no other job in the INPUT queue had higher priority) was assigned to a Control Point until it had finished. Then the dayfile messages would be appended to the OUTPUT file, the Control Point and temporary file space released, and the OUTPUT file waited until it was the shortest one to be printed at whichever site the job was submitted. Under the MOMS operating system, a job requiring large system resources would usually have a long wait on the INPUT queue until those resources were available, but when it entered execution, it could freeze out most other jobs until it finished or until it was rolled out by operator intervention.

The concept of timesharing requires that no single user or group of users dominate the computer. For CDC machines, Greg Mansfield and other CDC personnel developed the MACE operating system which then evolved into KRONOS for large scale CDC systems. These systems permit any job in execution to be rolled out to a file so that other jobs can proceed; thus they fulfill the timesharing requirement.

In our own department, the doctoral thesis of a former staff member, Phil Houle, showed that to minimize total batch throughput job time in our MOMS system, it was best to give every batch job a short shot at the resources it needed and only if the job required more than the 90th percentile Central Processor time should it be put into a round robin queue for intermittent processing.

Since KRONOS allowed these ideas to be implemented, we changed to KRONOS in September of 1974. A further point of Phil's thesis was that keeping track of the CP and I/O boundness of the jobs on the round robin queue could allow better job scheduling. This is currently not done in KRONOS. A simplified pictorial for batch job flow under KRONOS looks like this:



Thus the job flow has the same basic flow as under MOMS with an added decision to rollout a batch job if it exceeds either a wall clock or Central Processor time limit for a batch job, or if more Central memory is requested. (Timesharing jobs have smaller wall clock and Central Processor time limits and also rollout if there is any terminal input/output interaction.) Currently on the Cyber 74, 50% of all jobs take less than 1 second and 90% take less than 10 seconds of CPU time, thus the current batch CP slice limit of 16 seconds means that 93% of all batch jobs will not go through the rollout mechanism but will act as they did under MOMS.

In designing a multiprogramming operating system, three of the principles that always have to be kept in mind are interlock, deadlock, and thrashing.

Interlocks are hardware or software switches that allow only one process to proceed until finished, thus ensuring orderly use. Examples of interlocks are those on equipment such as magnetic tape transports (only one job can be in control of the tape) and disk controller channels. Another interlock is write permission on a file; multiple users can read a file, but when some job is writing on a file, other users must be locked out from writing in order that a unique new file be obtained.

Deadlock means that two or more of the currently executing jobs have allocated resources that could allow at least one job to proceed but divided among the two or more, mean that none of the jobs could proceed. In the MOMS operating system, no job in execution could request more Central Memory than it originally requested since, without the rollout ability of KRONOS, two jobs could be requesting more CM, thus resulting in deadlock. Other deadlock avoidance principles are used in assigning disk and magnetic tapes with the RESOURC card.

Thrashing occurs when the system uses enough of the computer resources so that very little work gets done for the users. We have stated that the CP time slice is currently set at 16 seconds which keeps 93% of all batch jobs out of the rollout mechanism. If it were to be set at 1/2 second, the percentage of rollouts would rise from 7% to 70% and very little real work would get done because of the thrashing that would occur when the overloaded disk channels could not swap jobs into Central Memory fast enough to achieve a reasonable Central Processor utilization.

## Part III: SYSTEM RESOURCES REQUIRED TO PROCESS JOBS.

L.A. Liddiard, 373-5239

# PUBLICATIONS

Computer Center users have two primary sources for information about documentation.

WRITEUP,INDEX which lists the names and a description of all the machine retrievable documents; this index is updated frequently, as often as the WRITEUPS themselves change.

WRITEUP,DOCLIST which lists the pre-printed documents available (with their sources); DOCLIST is updated quarterly.

The WRITEUP documents are easy for you to obtain; the cost is 3 cents a page for the printed copy. However, we have had a number of questions regarding pre-printed documentation (those publications listed in DOCLIST) and will attempt to clarify some things here.

We do not provide free copies of the standard reference manuals to any users. We supply reference copies of these manuals at the RJE sites and in the user rooms at Lauderdale and Experimental Engineering. We have also asked the Minnesota Book Center to stock these manuals in their reference sections. We cannot, of course, guarantee that the bookstore will carry all of these manuals. For your convenience we will list here all the standard manuals and the original sources for each. The prices listed are, of course, subject to change. Classroom instructors should please note that we do not ask the bookstores to stock classroom supplies. If you require one of these manuals for your students you will have to follow your normal procedures for ordering text books.

ALGOL VERSION 3	(CDC 60322900D)	\$ 9.55
APL*CYBER	(CDC 19980400D)	\$ 4.75
APLUM	(U MASS, 1975)	\$ 3.75
BASIC 2.1	(CDC 19980300C)	\$ 7.60
BMDP	(UCLA, 1973)	\$10.00
COBOL VERSION 4	(CDC 60384100F)	\$17.70
COMPASS VERSION 3	(CDC 60360900F)	\$ 9.60
CYBER 74 VOLUME 1	(CDC 60347400M)	\$ 2.75
CYBER 74 VOLUME 2	(CDC 60347300J)	\$ 2.85
CYBER 74 VOLUME 3	(CDC 60347100E)	\$ 3.00
FTN VERSION 4	(CDC 60305601K)	\$13.50
FTN DEBUG	(CDC 60329400B)	\$ 3.00
GPSS	(CDC 84003900D)	\$ 5.20
IMSL LIB 3, ED 6	(IMSL, 1977)	\$20.00
KRONOS 2.1, VOL 1	(CDC 6040700D)	\$10.75
KRONOS 2.1, VOL 2	(CDC 60448200D)	\$ 7.80
KRONOS TIMESHARING	(CDC 60407600E)	\$ 4.25
LOADER	(CDC 60344200J)	\$ 4.50
MIMIC	(CDC 44610400E)	\$13.60
MNF	(UMINN, 1976)	\$ 6.75
MODIFY	(CDC 60281700G)	\$ 3.05
OMNITAB II, INTRO	(UMINN, 1974)	\$ 1.20
OMNITAB II	(NBS, 1972)	\$ 2.00
PASCAL	(S-V, 1976)	\$ 6.00
PERT/TIME	(CDC 60133600E)	\$ 5.95
RECORD MGR GUIDE	(CDC 60359600C)	\$13.05
RECORD MGR: COBOL	(CDC 60385300A)	\$ 3.50
RECORD MGR: FTN	(CDC 60385200B)	\$ 4.35
SIMSCRIPT	(CDC 60358500E)	\$ 9.60
SIMULA VERSION 1	(CDC 60234800F)	\$ 9.60
SNOBOL 4	(P-H, 1971)	\$ 7.95
SORT/MERGE 4	(CDC 60343900J)	\$ 4.95
SPSS EDITION 2	(MCG-H, 1975)	\$12.95
SPSS VERSION 6.5	(UMINN, 1975)	\$ 5.50
SYSTEM 2000	(MRI)	\$36.50
TEXT EDITOR	(CDC 60408200C)	\$ 2.40
UPDATE	(CDC 60342500G)	\$ 4.80
8-BIT SUBROUTINES	(CDC 60359400C)	\$ 6.20

Publishers are:

P-H = PRENTICE-HALL

S-V = SPRINGER-VERLAG

MCG-H = MCGRAW-HILL

IMSL = IMSL, INC.

NBS = NATIONAL BUREAU OF STANDARDS

UMASS = UNIVERSITY OF MASSACHUSETTS

UCLA = UCLA PRESS

CDC = CONTROL DATA CORPORATION

UMINN = UNIVERSITY COMPUTER CENTER

MRI = MRI SYSTEMS CORPORATION

Call the UCC Reference Room (612/373-7744) if you need the address of any publisher.

The UCC Reference Room also has limited supplies of these standard reference manuals. In the past, we have permitted users with research and production accounts to charge manuals as a supply cost on their user number. Because of a few bad charges, we will discontinue this practice in the future. We will sell reference manuals through journal vouchers only.

On November 1st, the UCC Reference Room made limited numbers of the most frequently used reference manuals available on a check-out basis. This service will be offered to students only (we will ask to see ID's) and the check-out period will be only three days. We hope this service will help alleviate the problem that we've had with reference manual thefts from the RJE sites and timesharing labs.

Which brings us to thefts. Because of the rapid disappearance of manuals from the open user areas, we've decided that we can no longer replace manuals as they disappear. We will replace manuals only once a year (over the summer period); if they are stolen after that, you have our sympathy and not much else.

In addition to the standard reference manuals, UCC prints a large number of free writeups designed to help users in various ways. These free publications are available in 140 ExpEng and in the Reference Room (235a ExpEng), or you may call 373-7744 and ask for copies. These publications are free; in return, we would like you to comment as freely as possible on their suitability so that we can steadily improve the product.

Classroom instructors should please note that we are most happy to make multiple copies of these publications available to their students. We do ask that you give us a little warning (about 10 days) before requesting classroom supplies, since we don't claim to be omniscient.

New Publications:

The long planned "Guide to Magnetic Tapes" is finally ready. This publication, a compilation of Bill Elliott's TAPEUSE, TAPES, BLOCKER, REBLOCK and EXAMINE writeups, will be available in the Book Center by the time you read this. As always, we invite your comments.

The MNF Reference Manual will soon be out-of-print; we do not plan to reprint it. The recommendation is that you use the FTN Version 4 Reference Manual (CDC) as a standard reference and then see the various WRITEUP documents on MNF for local information. We have printed WRITEUP,MNF and WRITEUP,MANTRAP; these are now available as free publications from the Reference Room. We will also be printing Appendices J, K, and O from the MNF Reference Manual as free publications.

A. Koepke, 373-7744

# THE SUGGESTION BOX

ON SEPTEMBER 17 I WAS SUBMITTING JOBS TO THE CYBER TO ACQUIRE CERTAIN WRITEUPS. FIRST, I SUBMITTED A CARD THAT READ WRITEUP, INDEX, AND RECEIVED THE INDEX. NEXT, I CHOSE THOSE WRITEUPS THAT I FELT I WOULD NEED. SINCE THERE WERE MANY THAT I NEEDED, I CHOSE TO PLACE THEM ON ONE CARD AS SUCH: WRITEUP, NAME, NAME, NAME, .... . FOR SOME STRANGE REASON, CERTAIN WRITEUPS LISTED ON THE INDEX WERE NOT TO BE FOUND AS EVIDENCED BY THE ENCLOSED DAYFILES. ....FOUR WRITEUPS WERE UNABLE TO BE FOUND, AND I ONLY ASKED FOR 18. IN THE FUTURE COULD THE CYBER NOTE WHERE THESE "MISSING" WRITEUPS ARE? ALSO, IS IT POSSIBLE FOR THE CYBER TO LOOK FOR THE NEXT WRITEUP IN A LIST, WHEN THE PRIOR ONE IS NOT ABLE TO BE LOCATED?

S.A.S.:26SEP77

During the period when you were trying to obtain WRITEUP files, the system was experiencing a problem with the disk pack which contains the WRITEUP file information. This problem went unreported until about 2 hours after you had your trouble. After the error was reported to us, the situation was corrected in a few minutes and all WRITEUP files were available. your final suggestion on "missing" files is under consideration.

R. Franta

WHY ARE THE CARD READERS ALWAYS IN SUCH POOR SHAPE? WHY NOT SLOW THEM DOWN; IT IS FRUSTRATING TO SEE ONE OF THEM EAT HALF OF YOUR DAMN DECK. I RECENTLY LOST ABOUT 200 CARDS OUT OF A 400 PLUS DECK IN 2 OR 3 RUNS. THE FAST READER IN THE EXP ENG STUDENT ROOM JUST WRECKED TWO DAYS OF WORK WHEN IT ROUGHED UP MY DECK. I'M HOSTILE.

E.S.:030CT77

The Univac 1004 RJE card readers are generally not in poor shape. However, the 1004 was designed to be used by trained operators in a relatively clean environment having a limited temperature and humidity range. Additionally, Univac specifies that, in order to avoid card jams, your cards are to be properly stored in that same environment. Very few of our 1004s are located in such facilities. That is the reason for many card jams. Compounding this are problems caused by abuse (perhaps by users who are reacting to jams) dirty, damaged, or warped cards, and attempts by users to adjust the reader. It is unfortunate that you lost 200 cards. Due to a mechanical failure, the reader was out of order and should have been so labeled. Apparently this problem was not reported -- we noticed it the next day and repaired it.

D. Parkes

CONGRATULATIONS ON THE NEW USERS GUIDES AND REFERENCE HANDBOOKS. THEY APPEAR TO ME TO BE WELL CONCEIVED, ORGANIZED, AND WRITTEN.

I.A.M.:190CT77

Thank you.

I TAKE MY PEN IN HAND TO WRITE YOU A NOTE TO TELL YOU HOW MUCH I LIKE THE NEW MNF. THE NEW CROSS REFERENCE IS EASIER TO READ AND MUCH BETTER THAN THE OLD ONE. MSUIO IS AS SMALL AS THE RUN23 I/O

PACKAGE AND HAS ALL THE ADVANTAGES OF RECORD MANAGER COMPATIBILITY. THE SYMBOLIC DUMP IS A GREAT IMPROVEMENT OVER OCTAL. I USE THE NEW MNF AND LIKE IT.

D.E.:170CT77

Two in a row -- again, we thank you.

TURNAROUND TIME HAS BEEN UNUSUALLY GOOD, ESPECIALLY AROUND MIDDAY. I SUGGEST COMPLIMENTING THE OPERATORS FOR PROVIDING SUCH OUTSTANDING SERVICE.

G.R.M.:12AUG77

We've been saving them up -- again, thank you.

WHY IS IT THAT JOBS OF LENGTH LESS THAN 2000 ARE DIVERTED FROM ELECTRICAL ENGINEERING (4V) AND WHY DO THEY TAKE SO LONG TO BE PRINTED AT EXP ENG.

S.U.:14SEP77

At 8 AM on September 19th, new values were implemented into autodivert at sites where this feature is used (see UCC newsletter, 1977, page 86). Generally, the limits were raised in an attempt to hold down the number of user files diverted and the inconvenience caused by this, since most files diverted were usually just slightly larger than the limit. These higher limits have reduced the number of divers from roughly 50%. The limits at site 4V are 2000 from 8 AM to 6 PM Monday-Friday and 5000 for all other hours. If files of smaller sizes are being diverted during these time periods, please send me examples so that any problems can be corrected. Diverted files are given a lower priority in the print queue than are jobs originating at the ExpEng site. This is primarily an attempt to not inconvenience the ExpEng users by making them wait while diverted files are printed since turnaround at that site is so critical to its users. This priority scheme will not be changed in the near future. However, this should not cause you any problems if you keep the size of your jobs below the limits for your site.

G. Jensen

PRODUCTION USAGE SUMMARIES

	September, 1977	September, 1976
CDC Cyber 74		
Number of Batch jobs and MIRJE sessions	62,953 ( 70,156)	55,735 ( 62,762)
Total Central processor hours inc. DELAY	158 ( 196)	143 ( 180)
DELAY queue processor hours	47 ( 51)	-
MIRJE terminal hours	6,492 ( 8,214)	-
Mass storage transfers (KPR)	221,328 ( 294,223)	179,541 ( 219,536)
Magnetic tape transfers (KPR)	5,852 ( 7,886)	5,489 ( 7,654)
Pages printed and charged	587,927 ( 673,898)	598,992 ( 692,506)
Cards punched	393,245 ( 429,374)	526,616 ( 545,582)
Microfilm frames produced	25,324 ( 253,048)	6,991 ( 194,286)
Status plotting production (feet)	9,714	6,546
Tapes mounted	8,610	8,224
Average file storage (2210M available)	1,084.0 million char	798.9 million char
Mean time between failures	18.0 hours	13.9 hours
Available during scheduled hours	96.9 percent	98.2 percent
SUPIO uptime during available hours	97.2 percent	-
(totals in parentheses include staff development, accounting, and maintenance runs)		
CDC 6400 (23 Aug through 30 Sept)		
Number of jobs run	91,851	87,722
Central processor hours	74	107
MERITSS terminal hours	11,222	10,310
Number of terminal sessions	29,250	21,311
Maximum number of simultaneous users	75	65
Average file storage	221.2 million char	213.1 million char
Mean time between failures	83.1 hours	64.9 hours
Available during scheduled hours	99.1 percent	99.2 percent

CYBER 74 DOWNTIME SUMMARY : October, 1977

	Monday-Friday 0800-1800	other	total
Total possible scheduled uptime hours	210.	311.	521.
Total downtime hours (see Schedule A)	0.7	3.2	3.9
Total uptime hours	209.3	307.8	517.1
Uptime percentage	99.7 percent	99.0 percent	99.3 percent
Average downtime per occurrence	7.3 minutes	24.1 minutes	16.9 minutes
Mean time between failures	34.9 hours	38.4 hours	36.9 hours
Subsystem failures			
SUPIO	18	11	29
TELEX	2	1	3
EXPORT	1	3	4

schedule A: downtime hours

	Number	Total hours	Average minutes
(1) Preventive maintenance over-runs	0	0.0	0.0
(2) Software related problems	1	0.1	4.0
(3) Hardware related problems	7	3.0	25.4
(4) Indeterminate software/hardware problems	5	0.8	10.0
(5) External Problems	1	0.1	5.0

SUBMISSION SITE USAGE SUMMARY: TELEX EXCLUDED : October, 1977

submitted from	total jobs	%	pages printed	%	cards read	%
Lauderdale	2,550	3.7	280,904	24.9	1,116,255	11.6
ExpEng	6,904	10.0	219,445	19.4	1,992,620	20.7
West Bank	7,658	11.1	81,923	7.3	1,000,362	10.4
6400	1,303	1.9				
SUPIO	50,705	73.4	547,585	48.5	5,515,875	57.3
TOTALS	69,120		1,129,863		9,625,112	



UCC FALL QUARTER 1977 SHORT COURSE SCHEDULE

FORM IS: COURSE, DAYS, TIME, DATES, LOCATION, INSTRUCTOR.

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INTRODUCTION TO UCC - MPLS : TH, 2:15-4PM, 29 SEPT, MINMET 116, RTF
                        LISP : MWF, 3:15-5PM, 3-21 OCT, AERO 21, JH
KRONOS CONTROL CARDS : TTH, 2:15-4PM, 4-27 OCT, AERO 321, RTF
INTRODUCTION TO UCC - STP : W, 2:15-4PM, 5 OCT, CLAOFF B45, RTF      *
    BEGINNING COMPASS : MWF, 2:15-4PM, 10-21 OCT, MECH E 102, KCM
INTRODUCTION TO SYSTEM 2000 : MWF, 2:15-4PM, 10-21 OCT, AERO 321, JC
    GRAPHING PACKAGES : TWTH, 7:30-9:30, 18-20 OCT, LAUD CONF RM, KM
    FALL OPEN USERS MEETING : W, 3:15-5PM, 19 OCTOBER, 193 EXP. ENG.  *
        PASCAL : MWF, 3:15-5PM, 24 OCT - 11 NOV, AERO 321, JPS
        SPSS : M, 2:15-3:30, 24 OCT, MECHE 18, SPY
        SPSS : T, 2:15-3:30, 25 OCT, Z 313, SPY
        SPSS : W, 2:15-3:30, 26 OCT, MECHE 18, SPY
        SPSS : TH, 2:15-3:30, 27 OCT, AERO 209, SPY
        SPSS : F, 2:15-3:30, 28 OCT, MECHE 18, SPY
        COBOL : MWF, 2:15-4PM, 24 OCT - 11 NOV, FORH 40, JC
    DUMP AND LOAD MAP READING : TH, 2:15-4PM, 27 OCT, AERO 321, RTF
    SYSTEM 2000/REPORT WRITER : MWF, 2:15-4PM, 31 OCT - 4 NOV, MRRC 211, SPN
INTRODUCTION TO TIMESHARING : TTH, 2:15-4PM, 1-3 NOV, LINDH 54, RTF
    BEGINNING FORTRAN : TTH, 2:15-4PM, 8 NOV - 1 DEC, FORH 40, RTF
    ART PACKAGES : TWTH, 2:15-4PM, 8-10 NOV, LINDH 54, KM
    SYSTEM 2000/PLI : MWF, 2:15-4PM, 14-18 NOV, FORH 40, JC
        XEDIT : MWF, 2:15-4PM, 14-18 NOV, AERO 321, BW      *
RECORD MANAGER - SORT/MERGE : MWF, 2:15-4PM, 28 NOV - 2 DEC, FORH 40, JC  *
    ADVANCED SYSTEM 2000 : MWF, 2:15-4PM, 28 NOV - 2 DEC, MRRC 211, SPN
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RETURN TO:

UNIVERSITY COMPUTER CENTER  
 227 EXPERIMENTAL ENGINEERING  
 UNIVERSITY OF MINNESOTA  
 208 UNION STREET SE  
 MINNEAPOLIS, MINNESOTA 55455

UNIVERSITY ARCHIVES  
 11 WALTER LIBRARY  
 UNIV. OF MINNESOTA  
 EAST BANK CAMPUS