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GRAPHICS FOR BUSINESS

For those of you who have been buried in an avalanche of computer reports lately, relief is on the way. TELL-A-GRAF and DISSPLA, two graphics packages, are available on our VAX/VMS system. These packages are designed for non-programmers and make it relatively easy for anyone to compose graphic charts. You, too, can manipulate and display data without a four-year computer science degree.

Why computer graphics? Because they allow you to analyze data and transmit information quickly. A recent study sponsored by 3M at the Wharton School of Finance, University of Pennsylvania, concluded that in presentations that involve graphics: audiences prefer them two-to-one over non-graphic presentations; meetings are 28% shorter; people are more willing to make decisions; and presenters appear more interesting. Any organization that can benefit from such results should use graphics whenever possible.

Business applications for graphics include inventory and production monitoring, sales targeting, product and financial planning, and management presentations. It is estimated that the use of graphics in business is growing at the rate of 30-40% a year. More than a quarter of all computer graphics vendors have been in business for less than five years.

How do you begin? First, you must have an account on our VAX/VMS system. You can get one by calling 373-4548. After overcoming that hurdle, it is a good idea to have some data handy. Data can come from many sources, including standard reports or material you have developed. The easiest way to generate graphics right now is to enter the data yourself into the TELL-A-GRAF package with the INPUT DATA command. (In the near future, utility routines will make it possible to transfer data from the Cybers to the VAX.)

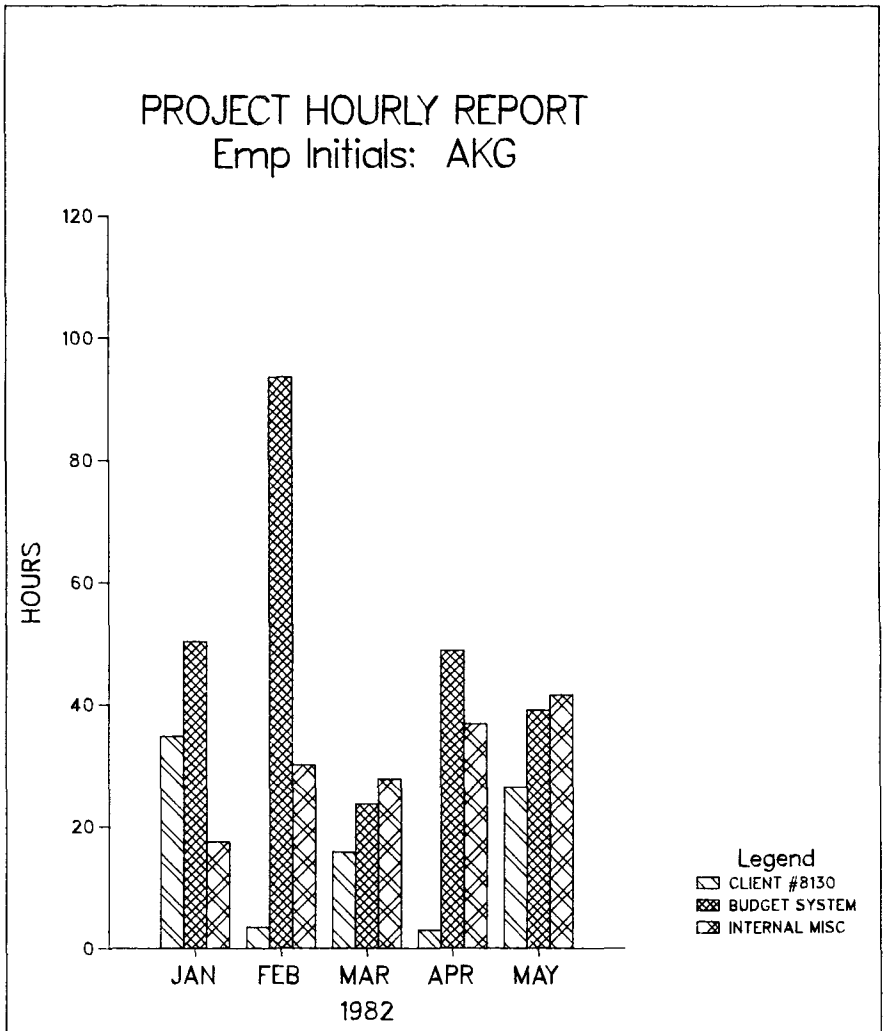

Figure 1

Here's one example of how you might use graphics. A supervisor wants to generate more profitable projects, but everyone who works under her is always extremely busy. Not wanting to overload everyone and work them to death, she decides to find out how they've been spending their time. Using information stored in a System 2000 data base, she discovers that most employees work on an average of three projects at one time. The

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CORRECTION

In the article "Pascal on the Cray" in the July *Newsletter*, the user interface was incorrect. It should be:

PASCAL[,INPUT=source, OUTPUT=listing,B=binary, LIST=on/off].

(The brackets are a Cray convention which indicate that anything within them is optional.) We apologize for any inconvenience this error may have caused.

Director: Peter C. Patton
Editor: Christine Mack Gordon

Comments about the content of this newsletter, or suggestions for changes may be directed to the editor, 235a Experimental Engineering, or call 612/376-9832.

following table represents one employee.

	Client 8103	Budget System	Internal Misc
Jan	34.8	50.3	7.5
Feb	3.5	93.5	30.1
Mar	15.8	23.7	27.8
Apr	3.0	48.8	36.8
May	26.5	39.0	41.5

The data was computed using a basic System 2000 command:

PRINT SUM HOURS-WORKED WHERE (EMP CODE EQ emp) AND (DATE SPANS beg. date*end date) AND (PROJECT CODE EQ project):

The supervisor then takes these figures into a TELL-A-GRAF session. Before any graphs can be drawn, TELL-A-GRAF requires a PROFILE file. Once you create it, the same file is used for all future sessions until it is deleted or renamed. This file, called TAGPRO.DAT, is created the first time you run TELL-A-GRAF on your account. The PROFILE prompts and replies look something like this (they are condensed here to save space). User replies are in lower case.

$ tellagraf
TELL-A-GRAF REQUIRES A PROFILE FILE
THIS PROMPTER WILL PRODUCE THAT FILE FOR YOU.
DO YOU WISH FULL PROMPTING? ANSWER YES OR NO
no
THE AVAILABLE DEVICE TYPES ARE:
[list of devices - choose the type of terminal you are on]
ENTER PRIMARY DEVICE NAME:
ramtek
[paragraphs describing default values and colors]
THE CHOICES FOR COLORS ARE 7 6 5 4 3 2 1 0
ENTER COLORS:
7
[lines describing drawing order]
THE CHOICES FOR DRAWING ORDER ARE 2 1 0.
ENTER DRAWING ORDER:
0
END OF PRIMARY DEVICE SPECIFICATION
ENTER SECONDARY DEVICE NAME:
mnplot [always use this name as secondary device name. It allows you to create a standard plot output file that can be used on a variety of output devices.]
[colors and drawing order specifications are then repeated]
END OF SECONDARY DEVICE SPECIFICATION
CHOICES FOR PAGE LAYOUT ARE:
[choices printed]
mrv [for medium resolution, aligning an 8-1/2 by 11 inch page vertically]
DO YOU WANT ECHO ON?
yes
THE CHOICES FOR ERROR REPORTING LEVEL ARE:
[choices printed]
ENTER CHOICE OF ERROR REPORTING LEVEL:
3
YOUR PROFILE FILE HAS BEEN CREATED:
SPECIFY FILES:
[enter carriage return]
GENERATE..ENTER:
[If you want to stop at this point, enter
quit.

Otherwise, continue with the specifications for your graph. Note that periods are required at the ends of commands.]

You can generate a simple bar graph by entering the following TELL-A-GRAF commands after the GENERATE..ENTER prompt:

```
GENERATE A MONTHLY CLUS-
TERED BAR.
X AXIS LABEL TEXT IS "1982"
Y AXIS LABEL TEXT IS
"HOURS"
TITLE TEXT IS "PROJECT
HOURLY REPORT" "Emp Initials:
AKG".
INPUT DATA.
"CLIENT #8130"
1 34.8 2 3.5 3 15.8 4 3.0 5
26.4
"BUDGET SYSTEM"
1 50.3 2 93.5 3 23.7 4 48.8 5
39.0
"INTERNAL MISC"
1 17.5 2 30.1 3 27.8 4 36.8 5
41.5
END OF DATA.
DISTRIBUTION 1, SHADE PAT-
TERN IS 3.
DISTRIBUTION 2, SHADE PAT-
TERN IS 5.
DISTRIBUTION 3, SHADE PAT-
TERN IS 9.
```

Now, after entering all this information, you can view the graph by entering the command:

```
go.
```

The data from the table was transformed into the above format. The DISTRIBUTION numbers correspond to the three sets of data listed— CLIENT #8130, BUDGET SYSTEM, and INTERNAL MISC. Shade patterns were selected from the patterns available. The distribution statements can be omitted and default shade patterns used. In the data listed as part of the program, notice the integers 1, 2, 3, 4, and 5 preceding the hourly amounts. These indicate the months of the year (January through May) that will be printed on the final graph. Any combination of integers 1-12 can be used to specify months, since this is a *monthly* clustered bar.

The graph you see will look like Figure 1. (To view your output, you must use a terminal retrofitted for graphics.) You have created a basic graph, but it still may not provide the information you need. How does the total number of hours compare across months, for example? To create a different type of graph with the same data and commands, enter:

```
save. [To save into TAG-
SAV.DAT]
GENERATE LEVEL..ENTER:
quit.
$ rename tagsav.dat myfile.dat
$ tellagraf
SPECIFY FILES
myfile.dat
GENERATE LEVEL..ENTER:
generate a monthly stacked bar.
GENERATING A MONTHLY
STACKED VERTICAL BAR
CHART.
go.
```

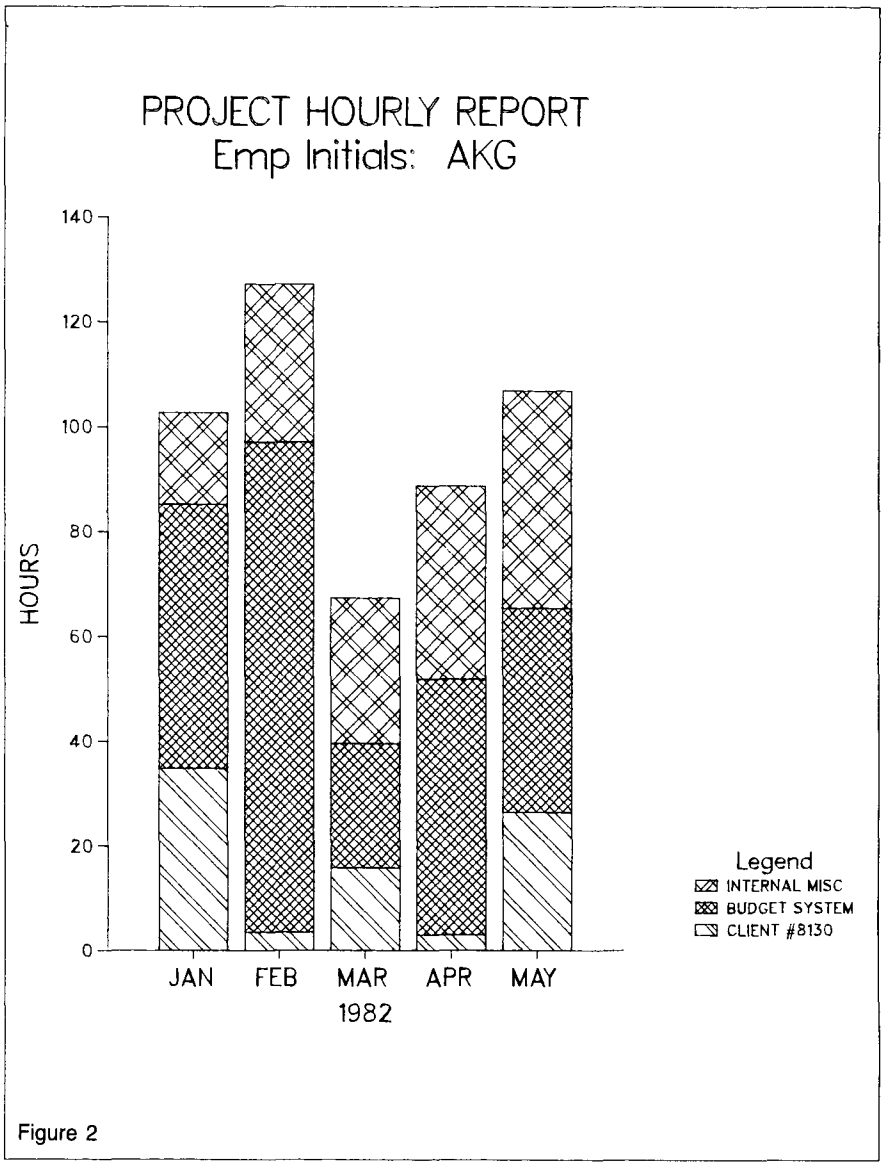

Figure 2

Figure 2 represents the output from this set of commands. You can send any graph that looks printable to a hard copy output device by issuing the SEND command instead of GO. The graph will be written to MNPLOT on a file called PLOT.PLT.

To alter a graph with new commands in the same session, use the CONTINUE command.

The stacked bar shown in Figure 2 indicates a sharp drop in monthly hours for March. When the supervisor investigates the data base further, she discovers that this employee worked on additional projects during that month. A pie chart can illustrate this data.

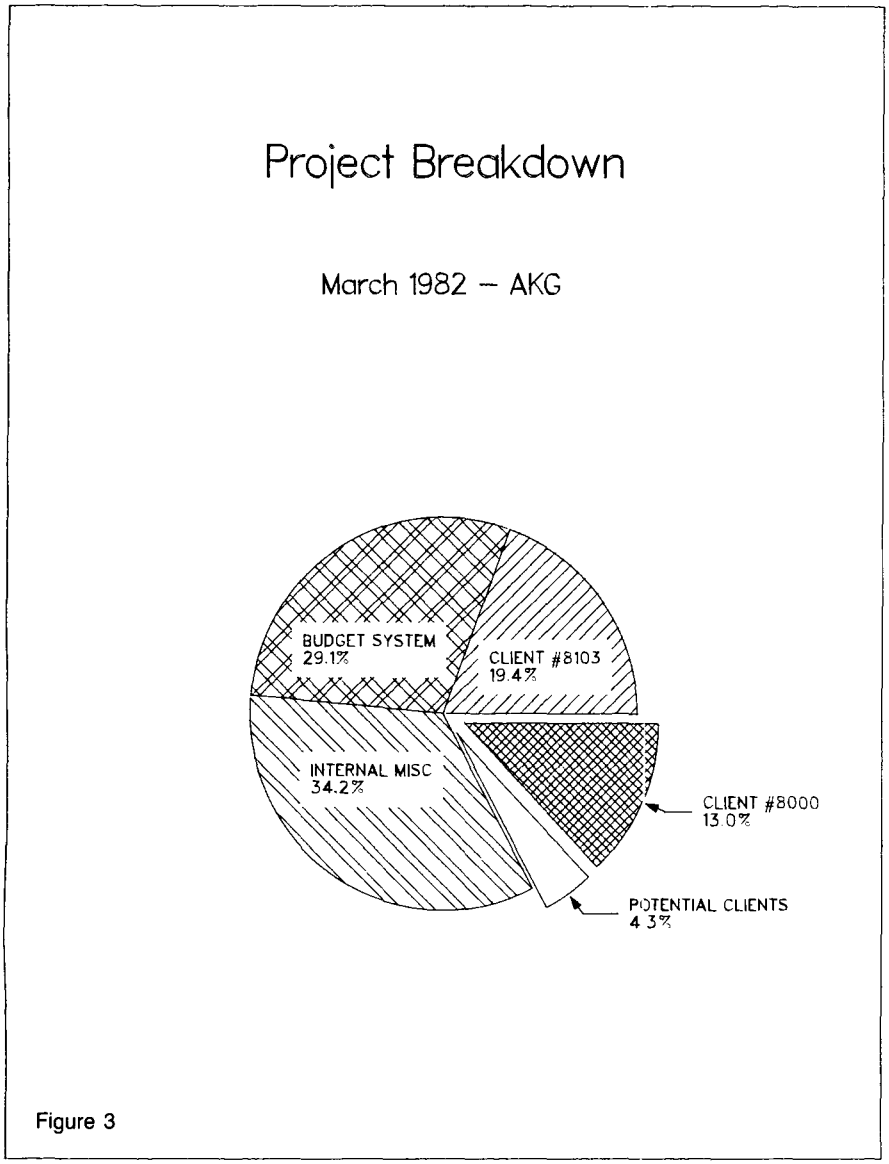

Figure 3

```
GENERATE A PIE.
DIVISION-LABELS IS "CLIENT
*8130" "BUDGET SYSTEM"
"INTERNAL MISC" "POTENTIAL
CLIENTS" "CLIENT *8000".
TITLE TEXT IS "Project Break-
down".
INPUT DATA.
"March 1982 - AKG"
1 15.8 2 23.7 3 27.8 4 3.5 5
10.6
END OF DATA.
SLICE 2, SHADE PATTERN IS 9.
SLICE 3, SHADE PATTERN IS 3.
SLICE 4, SHADE PATTERN IS 0.
SLICE 5, SHADE PATTERN IS 5.
SLICE 4, EXPLOSION IS 1.
SLICE 5, EXPLOSION IS 1.
GO.
```

The pie chart in Figure 3 is the result of these commands. In a pie chart, the integers before the data indicate the slice number of the pie. TELL-A-GRAF pie slices start at three o'clock and move counterclockwise around the pie. Explosion factors explode the slice outward. The diagram indicates those project areas not reported earlier.

You can generate a fourth chart with the data used in the bar charts by replacing the DISTRIBUTION data with CURVE data. You do this by SAVEing the file, then editing a TAGSAV.DAT file outside TELL-A-GRAF, or reentering the following commands:

```
GENERATE A MONTHLY PLOT.
X AXIS LABEL TEXT IS "1982".
Y AXIS LABEL TEXT IS
"HOURS".
TITLE TEXT IS "PROJECT
HOURLY REPORT" "Emp Initials:
AKG".
INPUT DATA.
"CLIENT #8130"
1 34.8 2 3.5 3 15.8 4 3.0 5
26.5
"BUDGET SYSTEM"
1 50.3 2 93.5 3 23.7 4 48.8 5
39.0
"INTERNAL MISC"
1 17.5 2 30.1 3 27.8 4 36.8 5
41.5
END OF DATA.
EVERY CURVE, SYMBOL COUNT
IS 1, BLANKING IS ON.
CURVE 1, THICKNESS IS 4.
CURVE 1, SYMBOL TYPE IS 7.
CURVE 2, SYMBOL TYPE IS 1.
CURVE 3, SYMBOL TYPE IS 2.
GO.
```

This fourth plot (see Figure 4) clearly indicates that the hours spent on profitable projects are fewer than those spend on internal tasks. The supervisor decides to increase income for her department by directing the employees to spend more time on outside projects and less on internal maintenance.

As we mentioned earlier, all graphs sent to MNPLOT with the SEND command can later be routed. Here's how to do it: after leaving TELL-A-GRAF with the QUIT command, use the command

```
$ enqueue calcomp plot.plt
```

A system message will provide the job and bin numbers of the hard copy output. In this case, the file has been sent to the CALCOMP four-pen plotter. See

```
$ help enqueue
```

for a list of the available devices.

The last thing to remember is that TELL-A-GRAF creates files on your account (TAGSAV.DAT and TAGTRA.DAT). You should periodically rename the files you want to keep and purge all others. Have fun creating graphics *and* increasing productivity.

For additional information on TELL-A-GRAF and DISSPLA, see: WRITEUP(TAGDSPL) and WRITEUP(SERVICE=VAXVMS) on the Cyber systems; sys$writeup: tagdspl.lis, sys$writeup:vaxvms.lis, and help tellagraf on the VAX/VMS; or call the TELL-A-

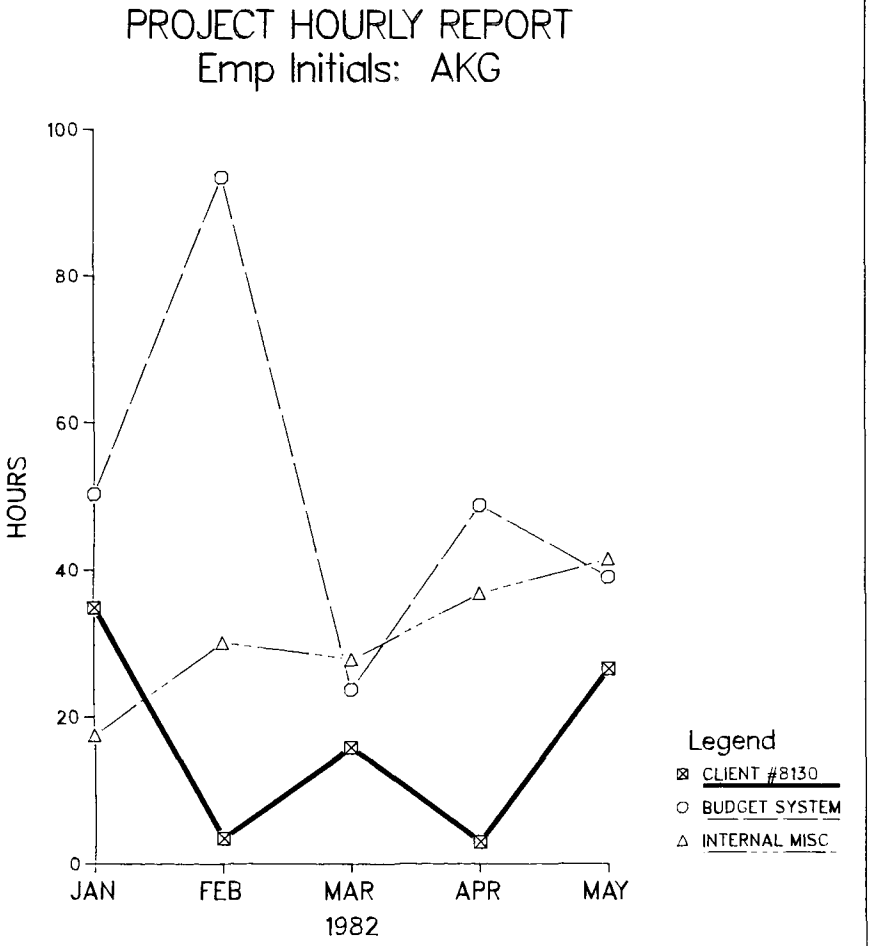

Figure 4

GRAF/DISSPLA HELP-line, 376-2663, from 1-3 p.m. Tuesdays and Thursdays. User manuals and pocket guides for both packages are available at the Computer Store.

References

Daniel P. Dern, "Now You See It," *Software News*, 7 June 1982.

Stanley Klein and Malcolm Steifel, "Hardware Makers Still Ahead in Graphics Market," *Software News*, 7 June 1982.

(Cheryl Vollhaber)

FORTRAN AT UCC

UCC currently has six different FORTRAN compilers. Four of these are on the Cybers. Why so many? To answer that question a little history is necessary.

In 1957, IBM began marketing FORTRAN. It quickly became the most popular computer language, but it had serious shortcomings. For the next decade, compiler writers extended the language to get around these shortcomings. The result was many different FORTRANs, making it difficult to transfer programs from compiler to compiler, much less machine to machine.

In 1966 an ANSI standard FORTRAN was created to end the chaos. But the 1966 standard included only a subset of the ways FORTRAN was being used, and compiler manufacturers continued to use old extensions in their new compilers. In 1978 a new standard, FORTRAN-77, was created with three goals:

1) To allow easy conversion to the new standard by retaining most of the 1966 standard features;
2) To incorporate the most useful extensions;
3) To bring FORTRAN into line with current software design philosophies, such as structured programming.

Nevertheless, we retain two 1966-conforming compilers on the Cybers: MNF and FTN. Why keep them? Most of our users have not converted to the 1977 standard. In addition, programs written in MNF or FTN will not always run on M77 or FTN5. Finally, the more relaxed language rules of the new standard have made efficient code production a little harder. Thus, for a number of programs, MNF and FTN run

FORTRAN Compilers at UCC

COMPILER	VENDOR	MACHINE
M77	University of Minnesota	Cybers
MNF	University of Minnesota	Cybers
FTN5	Control Data Corporation	Cybers
FTN	Control Data Corporation	Cybers
CFT	Cray Research, Inc.	Cray
Vax–11 FORTRAN	Digital Equipment Corporation	VAX/VMS

up to 10% faster than identical M77 and FTN5 runs. For example, DO loops that always execute at least once are significantly faster than the more general DO loop form of the 1977 standard; character handling with Hollerith, using intrinsic shift and masking functions, is faster than the new type CHARACTER. We are retaining FTN and MNF to provide an easier transition path and for the convenience of their many users.

FORTRAN-77 Features

The new standard has several advantages. First, FORTRAN-77 increases the portability of FORTRAN programs. (Both the VAX and the Cray support FORTRAN-77.) Second, writing programs in the 1977 standard avoids conversions in the near future. Third, FORTRAN-77's control structures, such as the block IF statement, make programs more understandable and easier to modify.

FORTRAN-77 has these new features:

1) Character strings. Unlike the old Hollerith strings, character data is machine independent. Character strings can be declared, assigned values using character constants, concatenated with other strings, and referenced by substring. For example:

```
CHARACTER WORD*8,
 LINE*80,TEXT(100)*80
WORD = 'FORTRAN-'
LINE(1:10) = WORD //
 '77'
LINE(21:30) = 'IS HERE'
PRINT*,LINE
```

produces: FORTRAN-77 IS HERE

2) Block IF statements: IF-THEN, ELSEIF-THEN ELSE, and END-IF. These provide an easy method for using a logical IF statement to execute, or skip over, many statements. For example:

```
IF(N.GT.1)THEN
  I=6
  A(N)=I+N
ELSEIF(N.LT.50)THEN
  I=7
ELSE
  A(N)=N
ENDIF
```

3) Auxiliary I/O statements: OPEN, CLOSE, and INQUIRE. These permit greater control over files.

4) Direct-access files. Expanded I/O facilities allow files to be OPENed as direct access; this means they can be read and written by record number.

5) PARAMETER statement. This statement allows the assignment of names to constants. Named constants can be used any place a constant can be used. For example:

```
PARAMETER ( N=100,
 PI=3.14159 )
DIMENSION ARRAY(N)
ARRAY(1)=PI*PI+(10./8.)
```

6) Internal read and write can be done using a more generalized form of the READ and WRITE statements. Internal READ and WRITE statements should be used in place of ENCODE and DECODE statements. For example:

```
CHARACTER WORD*3,
 LINE*80
WRITE (UNIT=LINE,
 FMT='(A3)')WORD
READ (UNIT=LINE,
 FMT='(I3)') WORD
```

7) Alternate entry and returns for subroutines and functions.

8) Zero argument functions.

9) Multiple named BLOCK DATA subprograms.

10) Labeled END statements function as STOP.

11) ASSIGN statement can be used for FORMAT statements.

12) Array indices can have user-specified upper and lower bounds and up to seven subscripts. For example:

```
DIMENSION A(0:9),
 B(-1:1),C(-4:4,-4:4,5)
```

allows arrays to be defined that match the physical or mathematical model.

13) DO loops may have INTEGER, REAL, or DOUBLE PRECISION parameters. DO indices are valued after termination of the loop.

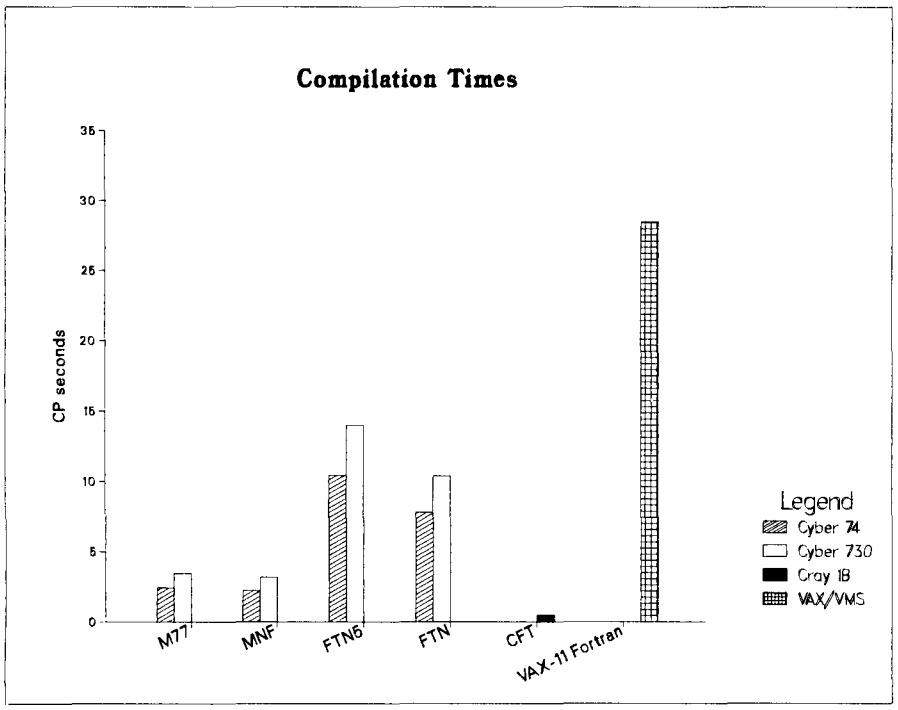

Figure 1

14) INTEGER expressions can be used in declarations.
15) New binary operators .NEQV. and .EQV. allow "exclusive or" and "and".

Many features included in the 1977 standard had already been added as extensions to the MNF and, in some cases, FTN compilers. These include:

1) List-directed I/O (called free-format in MNF).
2) IMPLICIT statement.
3) Block IF control statements (MNF only).
4) END= and ERR= parameters in READ statements (MNF only).
5) Free use of expressions in statements such as PRINT statements. (MNF only).

The major incompatiblities between the 1966 and 1977 are:

1) DO loops where the initial value is greater than the terminal value will be executed once in 1966 conforming compilers and not at all in 1977 conforming compilers.
2) Hollerith data and constants are not specified in the 1977 standard although H edit (field) descriptors are permitted as these are not constants. Reading into an H edit field in a FORMAT statement is prohibited. However, all the compilers available at UCC have retained Hollerith data.
3) An intrinsic function name that is used as an actual argument must appear in an INTRINSIC statement rather than an EXTERNAL statement.
4) Transfer into the range of a DO-loop from outside the loop is prohibited.

Current Status

M77

Three versions of M77 are available on our Cyber systems: past (2.0), current (2.1), and future (2.2). All three use the Michigan State Record Manager, so binaries can be intermixed. Most of the differences between these versions result from fixing bugs and making cosmetic changes to error messages. We recommend use of the current version (2.1). If you suspect a compiler error, try the future version. There should be no reason to use the past version. M77 is actively maintained. The future version is upgraded as new bugs are discovered and fixed. Watch SYSNOTEs and WRITEUP (M77NEWS) for these changes. M77TS, the M77 interactive subsystem, uses the same compiler as the batch version. M77 conforms to the 1977 ANSI standard to the following extensions:

1) TRACE statements.
2) WHILE and ENDWHILE statements.
3) Type XOTHER.
4) The LIST, NOLIST, CODE, NOCODE, REFERENCES, and NOREFERENCES statements.
5) Conditional compilation using C* lines.
6) A "/" in a PRINT or WRITE list can be used to control line feed.
7) Variable edit descriptors V and = in FORMAT statements.
8) Type INTEGER datum of absolute value exceeding 2**47-1 is printed by a format-free output statement as a character datum.
9) The random number function reference in the form RANF(n).

In addition, many extensions were retained to maintain compatibility with MNF. For a detailed look at the differences between M77, MNF, and FTN5 see WRITEUP(M77).

FTN5

FTN5, Control Data FORTRAN Version 5, has two versions: past and current. Both conform to the 1977 standard and are maintained by CDC. FTN and FTN5 use the standard Cyber Record Manager (CRM). Extensions to the 1977 standard in FTN5 include:

1) The IOCHEC function (use the ERR= parameter).
2) The LEVEL 2 statement producing direct LCM references on the CDC 7600, 70 /76, 170/176, and on the 170-800 series.
3) The SYSTEMC error recovery routine.
4) The READMS, WRITMS, OPENMS, and STINDX random access library routines.
5) The COLLATE directive, and the COLSEQ, CSOWN, and WTSET subroutines to control collating sequence.
6) Special compiler directives (C$ in columns 1 and 2 of the line).

7) Conditional compilation.

Non-standard features in both M77 and FTN5 include:

1) ENCODE and DECODE statements.
2) PUNCH statement.
3) The forms Fw, Ow(.d), Rw, and Zw(.d) in FORMAT statements.
4) Aw edit descriptors used for non-character data.
5) Format in non-character array.
6) BUFFERIN and BUFFEROUT statements.
7) Record and buffer lengths of files in the PROGRAM statement.
8) BUFL= parameter in the OPEN statement.
9) Repeated parenthesized constant list in DATA statement.
10) Labeled COMMON storage may be preset by DATA statements in any program unit (not only in BLOCK DATA subprograms).
11) Names can have 7 letters (6 is standard).
12) Hollerith, octal, and hexadecimal constants.
13) .XOR. operator.
14) Complete generality of mixed-type arithmetic.
15) Masking expressions.
16) Multiple assignment statement.
17) RETURN statement in a main program unit.
18) LOCF, MASK, RANF, and SHIFT functions (and many others).
19) Overlays.
20) Sequenced source program from Cyber line editors.
21) Optional one trip DO loops.
22) BOOLEAN type statement and BOOL function.
23) A trailing comma in an output list to inhibit interactive line feed.

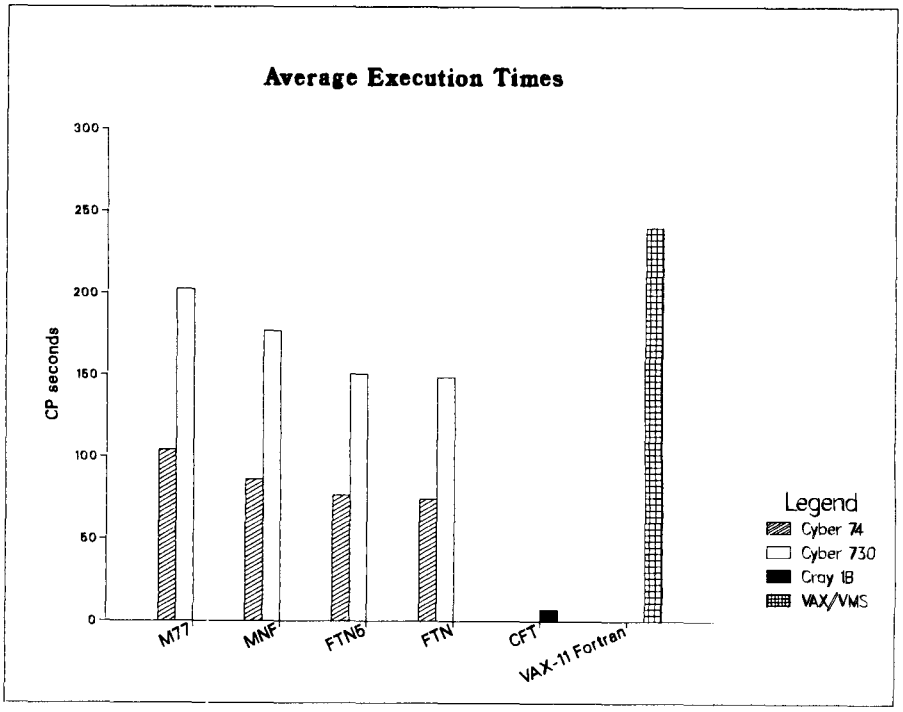

Figure 2

MNF

MNF has four versions: fetch, past, current, and future. The fetch version uses its own I/O routines, so it is not compatible with any other version; it is scheduled for removal since it is rarely used. The past and current MNFs both use Michigan State Record Manager (MSUIO). The future version uses Cyber Record Manager (CRM). The differences between the past and current MNF result from bug fixes, so current MNF should be used. MNF is regarded as a stable, "mature" product and is not being changed.

TSF, the compiler used by the MNFTS interactive subsystem, uses a subset of the MNF compiler. TSF does not:

1) Produce a cross reference map.
2) List object code.
3) Optimize DO loops.
4) Issue compiler DAYFILE messages.
5) Support double precision or complex numbers.

TSF also has smaller internal buffers than MNF, so the maximum size of a single source statement is limited. Otherwise TSF is identical to MNF. No changes have been made to any of the MNF compilers since 1980.

MNF extensions to the 1966 Standard include:

1) Block IF statements.
2) PARAMETER statement.
3) WHILE and ENDWHILE statements.
4) TRACE statements and MANTRAP, a symbolic postmortem dump package.
5) The LIST, NOLIST, CODE, NOCODE, REFERENCES, and NOREFERENCES statements.
6) Integer expressions allowed as DO or implied DO parameters.
7) / in a PRINT or WRITE statement controls line feed.
8) END= and ERR= parameters in READ statement.

FTN

FTN, Control Data FORTRAN Extended Version 4, has two different versions: past and current. FTN conforms to the 1966 standard and is maintained by CDC. We recommend use of the current version. In addition to different versions, FTN can be run at different optimization levels. The different optimization levels perform almost as different compilers. OPT=0 must be used for debugging runs, but it runs so slowly that it's better to use MNF for debugging. FTN extensions to the 1966 Standard include:

1) Alternate return using CALLS and RETURNS statements.
2) Non-standard DATA statement. (For example, DATA(K=5)
3) Two branch arithmetic IF statement.
4) Maximum record length of a file may be declared in the PROGRAM statement.

5) FTN compares both parts of COMPLEX values when .EQ. or .NE. are used.
6) Exponents may be COMPLEX.
7) Many alternate forms of formatted I/O statements. For example:

PRINT(6,10) K

Non-standard (1966) features of MNF and FTN include:

1) List directed I/O.
2) $ separator between statements on the same line.
3) 7-character symbolic names.
4) IMPLICIT statement.
5) DOUBLE and TYPE declarations.
6) Implied DO allowed in DATA statement.
7) BUFFERIN and BUFFEROUT statements.
8) ENCODE and DECODE statements.
9) Random access routines OPENMS, READMS, WRITMS, STINDX.
10) Format field descriptors Dw, Ew, Gw, O(octal), and X.
11) NAMELIST declaration.
12) OVERLAY statement and OVERLAY subroutine.
13) Text constants can have alternate forms: nL,nR, '...', and *...*
14) Subscripts can be type REAL, COMPLEX, DOUBLE PRECISION, or arithmetic expressions.

CFT

CFT is maintained by Cray Research and has three versions: past, current, and future. Past CFT is version 1.09 with bugfix 5; current CFT is version 1.09 with bugfix 6. The differences between past and current CFT result from bug fixes, so current CFT (default) should be used. CFT version 1.09 conforms to the 1977 standard with the exception of CHARACTER type.

UCC is a pre-release testing site for the future version (1.10). It is in complete conformance with the 1977 standard. It uses a library different from the current version. See WRITEUP(CRAY=CFT) for instructions on how to access the different versions of CFT and its libraries. Extensions to the standard in CFT include:

1) POINTER statement.
2) IMPLICIT NONE declaration.
3) NAMELIST declaration.
4) READMS, WRITMS statements for random access I/O.
5) Boolean expressions.
6) Hollerith constants.
7) ENCODE and DECODE statements.
8) Two-branch arithmetic IF statements.
9) PUNCH statement.
10) ORDERS sort subroutine

To take full advantage of the Cray's vector processing, some reprogramming may be necessary. The Cray contains its own scientific library, SCILIB.

VAX-11 FORTRAN

VAX-11 FORTRAN is the compiler provided under the VMS operating system. It conforms to the 1977 standard. Compilation and execution times can vary according to the workspace allocated. Check the page fault count to determine if you should allocate additional workspace for your program. VAX-11 FORTRAN is maintained by DEC. Extensions to the standard in VAX-11 FORTRAN include:

1) Mixed mode expressions with any data type including COMPLEX.
2) Device-oriented I/O.
3) Keyed access and indexed I/O.
4) Additional data types: LOGICAL*1, LOGICAL*2, INTEGER*2, REAL*16, COMPLEX*16
5) INCLUDE statement.
6) Optional debugging statements.
7) Symbolic names of up to 31 characters.
8) ENCODE, DECODE, and DEFINE FILE statements.

Benchmarks

We ran several benchmarks on the six different compilers to test their processing power. Figures 1 and 2 show the results of these tests. The choice of benchmarks is subjective. Different benchmarks would have generated different results. Those we chose for this comparison do little I/O and are heavily slanted toward numerical analysis. Also, to run all jobs identically, none of the new 1977 features are present in any of the programs. Thus care must be used in interpreting these results.

Figure 1 compares the sum of the compilation times in CP seconds. Figure 2 compares the average execution times in CP seconds. These give an approximation of the cost involved in running the different compilers. Since the billing structures are different on the different machines, the CP seconds only estimate the actual differences. For instance, the Cyber 730 is charged at .68 the rate of the Cyber 74. For most of the machines, the actual job cost is a weighted sum of CP seconds, mass storage used, file transfers, and off-line costs. This means it is difficult to predict what the difference in cost will be for any program. Other hidden costs are file storage and data transfer between machines. For many small-to-medium size programs, the effort involved in transferring to the Cray for a few runs would probably be excessive. Utility programs involving data already on a particular machine should probably be written on that machine. The VAX/VMS has full ASCII support and powerful editors, making it ideal for text manipulation. Costs of running on the VAX vary depending on how heavily loaded the system is and on how much workspace is acquired.

Choosing a FORTRAN Compiler for Your Job

Your choice may depend on execution speed, compilation speed, compatibility with existing routines, or portability to another site. Do not let these be your only criteria, however. If you compile a program 40 times in order to debug it and only run the program a few times, you may find that compilation speed or ease in debugging is more important than execution speed. The cost and effort of transferring data between machines may also be a consideration. If the program is very small or intended for one use only, familiarity or ease of access may be of prime

importance. Ultimately the choice is up to you.

Coding new programs in FORTRAN-77 may eliminate the need for later conversion and make transporting them to another facility easier. FORTRAN-77 supports more structured programming. The documentation for the individual compilers clearly indicates which features are non-standard: many of the compilers will optionally print caution messages when non-standard features are used. Be wary of non-standard features; there is no reason to use an obsolete feature in a new program.

M77 is best suited for student use. This compiler provides excellent error messages and uses PMD (the post-mortem dump feature) by default. This keeps you from looking at a messy dump every time you make an error. It compiles very quickly, so errors are less costly. Cray's CFT is the cheapest compiler for large programs. FTN5 may be the best choice for production runs on the Cybers. Most programs will execute more quickly under FTN5(OPT=2) than under MNF or M77. Since M77 compiles more quickly than FTN5, it may be to your advantage to write and debug production programs with M77 (or MNF), then recompile under FTN5 (or FTN) to generate efficient object code for production runs.

The Future

We are attempting to simplify the status of the FORTRAN compilers at UCC. This is a long-range project that includes changing the MNFTS subsystem to access the MNF compiler rather than a subset (TSF), and removing the fetch version of MNF.

M77 uses the Michigan State Record Manager (MSUIO). We are in the process of creating a version of M77 (M77RM) that uses the Cyber Record Manager (CRM). This version could more readily adapt to radical system changes and will permit users a virtually free interchange of precompiled binary routines between M77RM and FTN5.

We will continue to maintain M77 in response to reported errors, so please report any suspected bugs. MNF remains stable. CDC continues to provide good support for FTN5.

You can get additional information about the different FORTRAN compilers from WRITEUPs and the associated reference manuals. For a comparison of computer systems running FORTRAN jobs see "Choosing a Computer System for Your FORTRAN Jobs" in the October 1981 UCC *Newsletter*. *(Janet Eberhart)*

SYSTEM NEWS/NOTES

Statistical Packages

BMDP

The previous CURRENT version of BMDP (77) has become the PAST version. To use this version, the following system control cards are required:

```
PAST(BMDPxx)
RFL(nnnnn)
BMDPxx.
```

where xx is the two-character code for the program you wish to use, and nnnnn is the amount of field length (in octal) required to execute the program. See the BMDP Update (UCC, 1977) for the field length required by each program.

The previous FUTURE version of BMDP (79) has become the CURRENT version. To use this version, the following system control card is required:

```
BMDPxx(parameters)
```

where xx is the two-character code for the program you wish to use. The parameters are described in the BMDP-79 Update. Documentation for this version consists of:

(1) BMDP 1979, UCLA Press, 1979.
(2) BMDP-79 Update, UCC, 1982.

SPSS

The previous CURRENT version of SPSS-6000 (8.0) has become the PAST version. To use this version, the following system control cards are required:

```
PAST(SPSS)
SPSS(parameters)
```

The previous FUTURE version of SPSS-6000 (8.3) has become the CURRENT version. To use this version, the following system control card is required:

```
SPSS(parameters)
```

Documentation for version 8.3 consists of:

(1) SPSS, McGraw-Hill Book Company, 2nd Edition, 1975.
(2) SPSS-6000 Version 8.3 Update, UCC, 1982.
(3) SPSS Update 7-9, McGraw-Hill Book Company, 1981.
(4) UCC publications: REGRESSION, JFACTOR, CTAB, G3SLS, TETRACHORIC, SUMMARY TABLES, PLOT, SPECTRAL.

The first three references are essential; you need the others only if you plan to use those particular programs.

As a result of this change, SPSSONL on the MIRJE system now uses SPSS-6000 Version 8.3. When this has been tested out, the MERITSS system will also be changed.

News/Notes to 85

Statistics in Review

Last year slipped away without this particular review, but a new fiscal year resolution to communicate ensured that we would once again express our achievements and declines in numbers. Although we combine all our units in an interconnected system, you typically see us as one of three systems: instructional timesharing on the MERITSS (Cyber 172) system; research or public service timesharing or remote job entry on the MIRJE complex (Cyber 170-730, Cyber 74, CRAY-1A); or special services on the VAX/VMS system.

MERITSS Grows to Fit Your Needs

The increase in both microcomputers and students with programming experience has doubled the user central processor seconds /connect hour from 11 in 1974 to 26 in 1981-82. Students are now doing larger and more signficant programs on the central processor. In fact, central processor limitation on the Cyber 170-720 in June 1981 required a changeover to the dual processor Cyber 172. You can see why this was necessary if you multiply the CP seconds/connect hour times the maximum number of users times 1+ the system overhead.

In 1981, for example, 21.1 x 188 x 1.08 = 4304 seconds, about 20% more than the 3600 seconds in one CP hour. With two CPs providing 7200 seconds per hour, the current system can handle 254 maximum simultaneous users (7200 divided by 1.08 x 26.2), assuming that the 1981-82 figure of 26.2 CP seconds/connect hour is appropriate. Other bottlenecks, such as a lack of peripheral processors (PPUs) and controllers to do mass storage swapping of interactive jobs, were addressed with the addition of four PPUs and an additional mass storage controller in April. The large increase in central memory is required to handle the larger jobs of MERITSS users. MERITSS users were originally limited to 52K octal; now the nominal limit is 65K octal. Classroom instructors may request as much as 101K for special courses.

MERITSS User Costs

The most significant use of MERITSS is on the terminals in the instructional labs on the Twin Cities campuses. These 153 hardwired and 43 dial-up ports into MERITSS were connected for 306,000 of the 423,000 total connect hours. The Duluth and Morris campuses and the state university system use additional instructional ports. As part of the total central support money alloted to us, MERITSS provides these ports at a cost of $3000/port last year and $2400/port for next year. In addition, the department using the port pays a $.50/connect hour charge. Last year, the average cost for these lab terminals was about $2.42/connect hour, or $1.09/session. Next year the ex-

The MERITSS Instructional Timesharing Service

	1979-80	1980-81	1981-82	% change '81 to '82
MACHINE	170-720	170-720	Dual CP 172	+67
Central Memory in 1000 words	98k	98k	197k	+100
Connect Time Hours	282,324	347,932	423,372	+21.7
Sessions	562,990	764,085	938,094	+22.8
Central Processor Hours	1,748	2,046	3,077	+50.4
Average Monthly Maximum Users	144	176	199	+13.1
Peak Maximum Users	APR 152	NOV 188	FEB 220	+17.0
Machine Availability	99.1	99.3	99.7	
CP Seconds/ Connect Hour	22.3	21.2	26.2	
CP Seconds/ Session	11.2	9.64	11.8	
Minutes/Session	30.1	27.3	27.1	

Session Length

The decrease in terminal session length is the culmination of the change from predominantly 10 cps terminals to those with 30 and 120 cps capability. When only 10 cps terminals were available, the average session length was about 33 minutes; terminal output time was typically 40% of a session, or about 13.2 minutes. The 30 cps terminal reduces that same session to about 24 minutes. But the computing maxim, "output increases to fill the vacuum of faster terminal speed," ensures longer sessions with more output from faster terminals.

MIRJE Research and Public Use Statistics

	1980-81	1981-82	% Change
CYBER MACHINE	74/172	74/170-730	
Central Processor Hours	2180/3844	1664/3163	–3.6*
Total Jobs (Batch, SUBMIT, Session)	1,390,931	1,214,240	–12.7
Batch (Central, RJE)	556,978	313,543	–43.7
SUBMIT (from timesharing)	332,744	369,090	+10.9
Interactive MIRJE sessions	501,209	531,607	+6.1
Mass Storage Transfers (KPR)	6,610,517	6,725,676	+1.7
Magnetic Tape Transfers (KPR)	176,902	188,055	+6.3
Tapes Mounted	139,228	125,865	–9.6
Pages Printed	12,032,043	10,610,569	–11.8
Cards Punched	3,408,744	2,359,538	–30.8

* The comparison of central processor time is calculated using multipliers of 1.0 for the Cyber 74, .7 for the Cyber 170-730 and .48 for the Cyber 172.

pected cost is 20% less for central University support: $2.04/connect hour; the cost per session would be only 92 cents.

The Future

Despite reductions in central support money for UCC in 1982-83 due to deep retrenchment cuts for service organizations, we are planning to increase the instructional lab terminals from 153 to 175 and to provide additional MERITSS dial-in ports during non-prime time hours for students with their own terminals. Thus we are confident that MERITSS will provide more service at lower cost, at least through June 1983.

Cyber Use Changes

The major change for the Cyber systems has been the dramatic fall off in batch jobs at the central site, high speed stations, and remote job entry (RJE) terminals. Increases in SUBMIT jobs and interactive sessions were not enough to prevent a decrease in total Cyber system use. We believe that part of this decrease is due to poor economic conditions that have resulted in fewer research grants to the University and central administration cutbacks in all departments. To accomodate the change in user demands, on July 1 we cut by one-third the number of 1004 RJE sites and corresponding keypunches for batch input. The terminal clusters we announced in previous *Newsletters* should ensure that we remain sensitive to the expanding interactive needs of our users.

(Lawrence A. Liddiard)

MATTER

The interactive matrix manipulation program MATTER has been changed from type DO to type FETCH on both the MIRJE and MERITSS systems. To use this program, the following system control cards are required:

```
FETCH(MATTER)
MATTER.
```

MULTREG

A new version of the interactive regression program MULTREG has been installed on the MIRJE and MERITSS systems. The version 4.0 Multreg Users' Manual of Summer 1981 is still the current manual, but you can get a one-page update, Multreg 1982 Update, Version 4.2, at the Computer Store in Experimental Engineering. Multreg is executed with the following system control cards:

```
FETCH(MULTREG)
MULTREG.
```

IVAN AND LOGIT

New versions of the IVAN and LOGIT programs have been installed on both the MIRJE and MERITSS systems. The existing documentation is still valid. Both programs are of type FETCH on both systems (they had been type DO on MERITSS). See the MATTER example above for access method.

CTAB

An interactive program to do contingency table analysis has been installed on the MIRJE system; this is the same program that has been available on the MERITSS system. This program can be executed on both systems with the system control cards:

```
FETCH(CTAB)
CTAB.
```

Documentation for this program, the CTAB Users' Guide, can be obtained through the School of Statistics.

SCSS (VAX)

The interactive statistical package SCSS has been removed from the VAX/VMS system. SPSS, VAX version 8.1, is still available on that system.

APOLOGIA

We wish to apologize for the several unannounced changes to the statistical packages during June and July (changed versions, new access methods) and regret the inconvenience and delay this caused our users. The advent of the new CALLPRG index in June presented us with some problems that were best solved by these sudden changes. We do not foresee such a problem arising again, and will adhere as much as possible to our policy of announcing changes in advance of implementing them. (*Betty Hinkley*)

Text Processing

QUEUING UP FOR THE XEROX 9700

A new option, X9700, on the VAX/VMS ENQUEUE command, lets you send regular text files as well as Scribe files to the Xerox 9700 laser printer. For non-Scribe text files, you must do the formatting and page setup. ENQUEUE options for these text files include printing 66 or 88 lines per page and landscape printing. For a description of ENQUEUE syntax and a complete list of command qualifiers, see HELP ENQUEUE X9700 on the VAX. MOREHELP X9700 describes the Xerox 9700 service, including when files are dumped to tape each day, the cost of the service, and how to achieve effects such as boldface and italics in your text file. The VMS PRINT command remains another means for sending Scribe output files to the 9700, but we recommend this new option since it is much simpler. (*Renee Holoien*)

Libraries

MINNLIB WRITEUPS

You can now obtain on-line writeups on the Cybers for all the routines in the MINNLIB library (except PLOTPAC) with the control statement:

```
WRITEUP(MINNLIB)
```

Due to excessive unrecovered costs, paper copies of the writeups will no longer be printed; only on-line copies will be available when our current stock of paper copies runs out.

All Systems Bulletins

CYBER UPGRADE

We hope to complete conversion of the Cyber operating systems to NOS 1.4 by September 19, 1982. User noticeable changes will be minimal. See WRITEUP (UPGRADE) for additional information.

CYBER <—> VMS FILE TRANSFER

On-line information explaining how to transfer files between the Cyber 730+74+Cray and the VAX/VMS system is now available. The documentation discusses transfer in both directions using tape or microcomputer.

On the VMS system, retrieve the information with the MOREHELP command as follows:

```
$ morehelp file_transfer
```

(May be abbreviated to just MOR FILE.) This will display introductory information. To access more detailed information, use MOREHELP just like the HELP command. For example:

```
$ mor file...
```

will display all file transfer information, while

```
$ mor file tape nostovms
```

will display just information on doing NOS to VMS transfer via tape. Typing

```
$ morehelp morehelp copying
```

will explain how to get a permanent hard copy of the documentation.

On the Cyber, the same documentation is available in WRITEUP(VAXVMS=FILETRA).

UNIX GOES AWAY

Our UNIX service (operating on the Lauderdale VAX) will be discontinued effective September 1, 1982.

UCC SHORT COURSE PRICES

We will begin charging for short courses in fall 1982. A tentative list of courses to be offered, and their prices, appears at right. You can register at the Computer Store in Experimental Engineering; we will accept mail registrations, but they must include an additional $1 fee. Fees may be paid by cash, check, University journal voucher, or charged to your UCC user account. If you have any questions about short courses or registration, call Jerry Stearns at 376-8806.

FOR SALE

Two, like-new, Texas Instruments silent 700 data terminals (model 745). Must sell. U of M department purchase only. $900 each. Call Mike Peterson, 373-0082.

DOCUMENTATION UPDATE

UCC's *Guide to Interactive Computing* and *Guide to Batch Computing* are now on sale at our Computer Store, 211 Experimental Engineering. They cost $1.20 each. The Store also sells *Pascal 6000 Rel. 3* ($3.70) and *Guide to Paper Tape* ($1.20). Documents that remain in 140 Experimental include: UCC Briefs and Fact Sheets, the Documentation Directory, the Prose Instruction Manual, the XEDIT 3.1 Reference Summary, and copies of the current UCC *Newsletter*. These are available without charge. Some MINNLIB writeups remain in 140; however, a complete set of MINNLIB descriptions is available through the Cyber command WRITEUP (MINNLIB).

LABOR DAY HOURS

Operating hours for the Labor Day weekend will be as follows:

	Down	Up
Lauderdale	Mon., 9/6/82, 0100	Mon., 9/6/82, 1800
Exp. Eng.	Sat., 9/4/82, 1600	Tues., 9/7/82, 0800
Shepherd Labs	No operator coverage on Monday, 9/6/82	

Introductory Courses

Course	Student	Staff	Non-Univ
Intro to Computer Terms	$10	$20	$30
Introduction to UCC	$10	$20	$30
NOS (Network Operating Sys)	$10	$20	$30
Interactive System Commands	$10	$20	$30
XEDIT (Cyber Editor)	$10	$20	$30
Text Processing: Overview	$10	$20	$30
Introduction to VAX/VMS	$10	$20	$30
EDT (VAX/VMS Editor)	$10	$20	$30
Intro to Batch Computing	$10	$20	$30
Intro to Programming	$10	$20	$30
Intro to DBMS	$10	$20	$30
Intro to the CRAY 1-A	$10	$20	$30
Microcomputing	$10	$20	$30
Graphics: An Overview	$10	$20	$30

Electives

Course	Student	Staff	Non-Univ
Beginning FORTRAN	$25	$35	$60
Pascal for Programmers	$25	$40	$75
COBOL	$30	$45	$75
PROSE	$20	$30	$50
Scribe	$30	$40	$60
Text Processing on Micros	$25	$35	$60
Intro to System 2000	$30	$40	$50
SIR	$30	$40	$50
Graphics	$20	$30	$50
COS or CTSS	$25	$35	$60
CRAY FORTRAN Features (CFT)	$30	$30	$60
CRAY Assembly Language (CAL)	$30	$50	$65
SPSS	$25	$40	$65

SLIDES NOW $5

To stimulate interest in and use of our advanced graphics capabilities on the VAX/VMS system, we are reducing color slide processing charges to five dollars per image through December 31, 1982. Please consider taking advantage of this price reduction on high-quality graphic output. You'll be pleased with the results.

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 a.m.-5 p.m., Monday-Friday
  Business Data Products 376-1761
    1-3 p.m., Monday-Friday
  Statistics Packages 376-5062
    1-2 p.m., Monday-Friday
  Data Bases 376-1761
    1-3 p.m., Monday-Friday
  Microcomputers 376-4276
    10-12 a.m. and 2-4 p.m., Monday-Friday
  Non-Traditional Computing 373-5780
    10:30-11:30 a.m., Monday, Wednesday, Friday
  TELL-A-GRAF/DISSPLA 376-2663
    1-3 p.m. Tuesday, Thursday
Contract Programming 376-1764
Data Base Applications 376-1764
Educational Services 376-3963
EDUNET Liaison 373-7745
Engineering Services 376-1023, 376-8153
Equipment Purchase/Information 376-8153
Experimental Engineering I/O 373-4596
Field Engineering 376-7584
Graphics Software 376-1849
HELP-line 376-5592
    9 a.m.-5 p.m., 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 Services 373-4995
Lauderdale Services Manager 373-7538
Lauderdale Users' Room 373-4921
MECC Liaison 373-4573
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 376-8806
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

OPERATING HOURS

	Cyber 74/730	Cray	MERITSS (Cyber 172)	VAX
M-F	8 a.m. - 4 a.m.	8 a.m. - midnight	7:45 a.m. - 1:30 a.m.	8 a.m. - 6 a.m.
Sat	4 a.m. - 5:15 p.m.	8 a.m. - 5 p.m.	7:45 a.m. - 1:30 a.m.	24 hours
Sun	4 p.m. - 1 a.m.	4 p.m. - midnight	4 p.m. - midnight	24 hours

PUBLIC LABS—TWIN CITIES CAMPUS

Location	Batch	Interactive	Micro
East Bank			
Arch 160		X	X
CentH		X	
ComH		X	
DiehlH 270, 207		X	
EltH 121, 125		X	
EltH N640	X		
ExpE 130	?	*	
FolH 14, 14a		X*	X
LindH 25		X	
MasCan 39	X		
MechE 308		X	
Physics 69		*	
SanfH		X	
TerrH		X	
VincH 4		X	
WaLib 204		X	
West Bank			
BlegH 91T			X
BlegH 140		X	
MdbH		X	
OMWL 2	X	X	
SocSci 167		X*	
St. Paul			
BaH		X	
ClaOff 125	X	X	
NorH 24	X		
Lauderdale			
Users Room	X		

* Research cluster; access to Cyber 730 and VAX/VMS
X in interactive column indicates access to MERITSS
? Unknown at the present time

University Computer Center Newsletter

User Services
227 Experimental Engineering
University of Minnesota
208 Union Street SE
Minneapolis, Minnesota 55455

UNIVERSITY ARCHIVES
10 WALTER LIBRARY
UNIVERSITY OF MINNESOTA
EAST BANK
117 PLEASANT STREET SE
MINNEAPOLIS MN 55455