

University of Arizona
computer center

**the
newsletter**

VOL. 9 NO. 5

IN THIS ISSUE:

WHY THE LINK?

APL ARRIVES

FTN 4.3 VS. FTN 4.2

plus regular features and reports

Tucson, Arizona

AUGUST 1975

COMPUTER CENTER DIRECTORY

Administration

Exchange for all phones is 884
Area code is 602

	<u>Extension</u>	<u>Room</u>
David L. Clark, Director	2915	203
Marianne Hanson, Administrative Assistant	2915	201A
Robert Mylls, Asst. Dir. for Admin. Services	3809	206
Ernest Payne, Asst. Dir. for Facilities Management	2983	211
Patrick Pecoraro, Asst. Dir. for User Services	2901	224

Frequently Called Numbers

Accounting Office	2985	209
Computer Users Group	3685	312
Customer Support	3651	215C
DEC-10 Remote Access phone numbers	3071,3761,4141	-
Equipment maintenance	2521	221
Main Office	2915	201
Operations Counter	2971	215
Production Counter	2781	114
Programming Support	4245	218A
Recycling	2521	221
Reference Room	2938	303
Tape Vault	1774	207

A recorded message providing current information about the computing facilities is available by calling extension 2986.

Publications

Michael Merchant, Communications Support Mgr.	2901	224
Cynthia Lancaster, Newsletter Editor	2982	212

Built in 1969, the University of Arizona Computer Center houses two large computers. The 65K word Control Data Corporation 6400, operating under Scope 3.4, and the 256K word Digital Equipment Corporation DECsystem-10 are accessed through batch and interactive terminals on site and in various locations throughout the campus. Established in 1956 as the Numerical Analysis Laboratory, the Computer Center is located at East Speedway Boulevard and North Mountain Avenue on the University of Arizona campus in Tucson, Arizona.

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From the Editor's Desk

"New" may be the most appropriate word for this issue of the newsletter, since articles on new computer equipment, new programming languages and, of course, the new CDC-DEC Link appear within its pages.

The Link, which began operation in the middle of June, has been the topic of much user comment--both favorable and unfavorable. Steve Jay discusses the Link and its problems and advantages using a "Why the Link?" approach in his newsletter article on page 4.

New computer equipment recently received by the Computer Center, or on order, includes new tape drives for the CDC 6400 and new terminals for the public access room, Computer Center room 118. The new terminals for room 118 include DECwriter II's, which have already arrived, and display screen terminals which are expected to arrive in a month or two. Details can be found on page 8.

APL, "A Programming Language," is a new programming language described by Mike Merchant in his article on page 14. An APL system has only recently been developed for the DEC-10, and the University Computer Center has been one of the first installations to purchase the product. Another programming language discussed in this issue of the newsletter is FLECS, a language designed to provide the FORTRAN programmer with powerful control structures. That article can be found on page 15.

Another "new" item--version 393 of the FORTRAN EXTENDED compiler (FTN 4.3)--is explored in an article by Mike Garnaat on page 17. A study was done to compare the attributes of the new version with the former FTN 4.2. Mike explains the results of that study, and spells out some of the advantages and disadvantages of the new compiler.

The newsletter is intended to inform Computer Center users of Center events and explain computer programs and languages available for your use. If there are any areas or items you would like to see explored in future issues of the newsletter, please let us know. We are here to serve you!

Cynthia A. Lancaster
Editor. the newsletter

Contents

COMPUTER CENTER DIRECTORY.....	inside front cover
FROM THE EDITOR'S DESK.....	page 1
EMPHASIS--COMMUNICATION.....	3
How to save time, money and resources on the DEC-10	
WHY THE LINK?.....	4
Operation begins, some problems arise	
NEED A CALCULATOR?.....	6
Reference Room has an HP-45	
"LAWS" OF PROGRAMMING.....	7
ROOM 118 RECEIVES NEW DEC-10 TERMINALS.....	8
Seven DECwriter II's arrive	
NEW TAPE DRIVES UNDERGOING TESTS.....	8
COMPUTER CENTER MANUALS AVAILABLE IN BOOKSTORE.....	9
Ranging from SITBOL to Unit Record Machines	
FORTRAN QUIZ.....	10
NEW SYSTEM CONFIGURATION.....	11
COMPUTER BOOKS AVAILABLE FOR REFERENCE USE.....	12
CDC CATALOG DESCRIBES EDUCATIONAL PROGRAMS.....	13
WHAT'S AN APL?.....	14
New programming language available on DEC-10	
FLECS HELPS FORTRAN PROGRAMMERS.....	15
FORTRAN QUIZ ANSWER.....	15
WHAT'S NEW AT THE COMPUTER CENTER.....	16
FTN 4.3 VS. FTN 4.2: ADVANTAGES, DISADVANTAGES.....	17
Study done to compare attributes	
WHAT'S WITH THE SYSTEM?.....	20
FROM THE SUGGESTION BOX.....	23
SCHEDULES.....	inside back cover

Emphasis--Communication

Increasing use of the DECsystem-10 has brought an increase in the number of users on the system during prime-time (9 a.m. to 5 p.m.), an increase in the amount of available disk space being used to store files and an increase in system-wide job response time. The following suggestions are intended as aids in saving resources, time and money on the DEC-10.

One way to save storage costs and to free disk space is to delete all unnecessary files. Such files might include those not accessed in the past month, .BAK files of files not being edited, .REL files of programs with .SAV files, .TMP and .TEM files generated by system programs and outdated or unwanted .LOG, .LST and .LPT files. Files not often used can be stored on magnetic tape and restored to disk only when needed.

Eliminating files with a .REL extension can be especially effective for saving space, time and money. Each time a program is executed using the EXECUTE monitor command, the loader has to read the .REL file(s), interpret the loader directives and load the program before it can begin execution. However, if a program is stable and runs correctly, a user can load it into memory once and save the initialized binary image. To generate an image "absolute" file, the command "LOAD" can be substituted for the EXECUTE monitor command. When the loader exits back to monitor mode, "SAVE" is typed. This generates a file with a .SAV extension which contains a copy of whatever is in memory at the time (in this case a loaded and initialized

version of the program). At this point, the .REL files are no longer needed. In many cases, a .SAV file is smaller than its .REL file(s). Also, since the loader does not need to interpret any directives, the .SAV file can virtually be read directly into memory. For this reason, execution can begin much sooner.

Other ways to save disk space include: converting multiple spaces to tabs, deleting trailing spaces from records and deleting line numbers from files. (Deleting a file's line numbers saves six characters per line, which can save a considerable amount of space in large files.)

Efficient code will speed up program execution time. Also, debugging at a desk is preferable to using the terminal. Remember: just sitting with a job logged in costs money (and uses up a job slot). Running informative programs such as QS or I/NOT without logging in will also save money.

Another way to save money is to take advantage of the reduced rates in effect between 11 p.m. and 7 a.m. In addition, response time generally improves considerably after 7 p.m.

Using the above suggestions should improve disk space and CPU utilization, system response time and your computer services bill. For explanations of these and other suggestions, please contact the consultants in Computer Center room 215-C.

Mike Garnaat
User Services

Why the Link ?

"Besides what appears to be longer turnaround time...what other benefits does the link offer to the average user? Sure, the link is "neat," but to the vast majority of users it's a headache."

-Suggestion number 624

After the DEC-10/CDC 6400 Link went into operation more or less as planned on June 16, we were somewhat surprised at receiving several suggestions expressing views similar to the one quoted above.

More trouble was encountered in getting things going than we had expected, but by June 18th things were running reasonably well. (More on the problems later.) The first part of this article will attempt to answer the questions raised by the above suggestion.

We feel the Link offers several benefits to the average user.

The first is access to the CDC 6400. Previously, the only way to use the 6400 was via a card deck, which could be read at only six places around campus. In practice, this made access to the 6400 rather difficult and inconvenient.

The Link now allows access to the 6400 from anywhere that there is a terminal and a telephone. We are confident that 6400 users will find the Link a very convenient way to enter jobs.

For 6400 users who are not familiar with the DEC-10, the

Timesharing User's Manual, available from the ASUA bookstore, provides information for getting started on the DEC-10. Short courses on use of the DEC-10 will also be offered this fall. Documentation on submitting jobs to the 6400 from the DEC-10 is available from the consultants in Computer Center room 215-C.

A second benefit of the Link is less direct.

By using the DEC-10 to drive the Remote Batch Terminals (RBT's), we have been able to save significant amounts of both money and computer resource on the 6400. We have been able to eliminate all communication hardware (6671 multiplexor) and software (Intercom) from the 6400. This frees about 10,000 (octal) Central Memory words on the 6400, which allows more jobs to run simultaneously. We have also been able to eliminate the printer on the DEC-10.

The savings gained from the elimination of this hardware are allowing the Computer Center to add other hardware which will be more useful to the average user. For example, a 9-track tape drive is being added to the 6400, a capability desired for many years. (The additional memory on the 6400 is not yet available to users because of the new tape drives. Until the new drives are accepted, we have to keep two sets of tape drive software on the 6400. This temporary situation is using most of the memory freed by Intercom.)

Direct benefits of the Link to users of the DEC-10 are less obvious.

In fact, initially the Link has reduced the number of users the DEC-10 can reasonably support from about 50 to about 45. This is primarily because of the increased memory and processor time needed to run the RBT's.

The Computer Center is actively working to reduce the overhead caused by the RBT's. We are also working in other areas to improve response times on the DEC-10. However, the DEC-10 was already overloaded before the Link came up, and real relief for DEC-10 users will have to wait for the DEC-10 hardware to be expanded. We hope to add another processor (a KI-10) and more memory to the DEC-10.

In the meantime, DEC-10 users still have some benefits from the Link. Outputs from the DEC-10 may now be printed at the RBT's. Soon, we will be concentrating some interactive terminals through the RBT's, reducing some of the load on the dial-up lines. Finally, with easy access to the 6400 now available, some of the large CPU burning applications can be moved to the 6400, which can support such jobs more easily. This should eliminate some load from the DEC-10.

This last feature touches on the main reason why the Computer Center feels the Link is not only beneficial, but essential. There are many different kinds of computers on campus. Each

one can do certain operations more efficiently than others. The 6400 does batch processing very well. The DEC-10 time-shares well. Various other small computers on campus perform data collection and instrument control functions which cannot be done any other way. At the same time, each computer has certain operations which it does poorly. The 6400 doesn't do timesharing well. On the other hand, the DEC-10 doesn't handle large batch applications well. The various small computers have limited "number crunching" and data manipulation capabilities. When each computer is isolated, large inefficiencies for certain operations are inevitable.

The obvious way to eliminate these inefficiencies is to connect all the computers together in a "network."

This would allow each computer to do whatever it does best, and let other computers handle work appropriate for them. The Link between the DEC-10 and 6400 is the Computer Center's first step toward such a campus-wide computer network.

The features available now from the Link are only a very small subset of the features which will be available in the months and years ahead. The long range goal of the Computer Center is to make all Computer facilities available as one large computer system, with each individual computer doing primarily what it does best.

continued on next page...

The Computer Center strongly feels that a network of computers is the most efficient way to meet the University's computing needs over the coming years. Therefore the Link is an essential first step in creating this network. Naturally, as with any new computer technology, there will be bugs and other problems associated with the network. We will do our best to keep these problems to a minimum. User suggestions and comments such as the one noted at the beginning of this article are always welcome, and in fact are actively solicited. The more we hear from you, the better we can meet your computing needs.

Speaking of problems, we certainly had more than our share during the first days of Link operation. June 16 and 17 were really pretty terrible. For this we apologize, and we will attempt to avoid such disasters in the future.

By way of explanation, we were hit by a bug in the DEC-10 operating system which only occurred under a very heavy load, so we never discovered it during our testing periods. This bug caused the DEC-10 to crash four times on June 16. On June 17, a bug in our own code caused the 6400 to crash. We can offer no excuse for this bug, except human fallibility.

There were several other less disastrous problems at first. We lost several individual jobs, particularly from the output queue. The QS program was late.

However, by July 1, most problems were solved. The Link now appears to be running smoothly.

Additional features for the Link are being planned now, which will be detailed in the next newsletter. In the meantime, we want to hear from our users. Feedback on the success or failure of the Link is strongly desired. So keep those cards and letters (and suggestions) coming in!

Steve Jay
Systems Support

Need a calculator?

A Hewlett-Packard HP-45 pocket calculator is now available for use in the Computer Center Reference Room, room 303.

One of the most advanced of the non-programmable electronic calculators, the HP-45 can perform trigonometric functions, has exponential and scientific notation and 14 storage registers.

The HP-45 is available on a first-come-first-served basis during regular Reference Room hours--8 a.m. to 5 p.m. The calculator can be used only in the room.

"Laws" of programming

Computer programming is often claimed to be more of an art than a science. To aid in the transformation and help provide a sounder basis for all of our work, we would like to present the following incontrovertable "laws" of programming.

Definition: A "working" program is one that has only unobserved bugs.

LAW 1: Every non-trivial program has at least one bug.

Corollary 1: A sufficient condition for program triviality is that it have no bugs.

Corollary 2: At least one bug will be observed after the author leaves the organization.

LAW 2: Bugs will appear in one part of a working program when another "unrelated" part is modified.

LAW 3: The subtlest bugs cause the greatest damage or problems.

Corollary 1: A subtle bug will modify storage, thereby masquerading as some other problem.

LAW 4: ("Lulled into Security Law"): A "debugged" program that crashes will wipe out source files on storage devices when there is the least available back-up.

LAW 5: A hardware failure will cause system software to crash, and the Customer Engineer will blame the programmers.

LAW 6: A system software crash will cause hardware to act strangely, and the programmers will blame the Customer Engineer.

LAW 7: The documented interfaces between standard software modules will have undocumented quirks.

LAW 8: The probability of a hardware failure disappearing is inversely proportional to the distance between the computer and the Customer Engineer.

LAW 9: Murphy designed all systems software.

LAW 10: (O'Toole's commentary) Murphy was an optimist.

NOTE: For those who may be in doubt, Murphy's Law states that if anything can go wrong, it will; and always at the most inconvenient time.

(From Michigan State University ACRONYMS, Vol. 4, No. 5)

Room 118 receives new DEC-10 terminals

Seven new hard-copy terminals have arrived at the Computer Center, and five new display-screen terminals have been ordered. All of the new machines will be available for public use in Computer Center room 118.

Funded by the Executive Computer Committee, the terminals were purchased to increase the number of public-access terminals available to users.

The new hard-copy terminals, called DECwriter II's, have upper and lower case capabilities and 132-character width lines, as opposed to an 80-character width maximum available on the older DECwriters.

In addition, the new hard-copy terminals can handle varying-width paper--from three inches to the full line-printer width--and can accommodate up to six layers of paper (for example, one original and five carbon copies of output can be obtained by using six layers of output paper, plus five sheets of carbon paper).

Both the DECwriter II's and the new display-screen terminals will have, in addition to a regular computer keyboard, a numeric keyboard. Similar to the keys on a calculator, the numeric keyboard should be convenient for users entering large amounts of numeric data.

The new display-screen terminals, Vistar II's, are expected to arrive by early fall. The new terminals, which will have an 80-character maximum line width, will be capable of upper

and lower case character display. The terminals will also have formatting capability, including cursor addressing, which will be settable both by using keys on the terminal and by program control.

New tape drives undergoing tests

Six new magnetic tape drives for the CDC 6400 have arrived at the Computer Center and are undergoing testing. The tape drives should be ready for customer use next month.

Five of the new drives are 7-track models with 150-inch per second capabilities, while the remaining tape drive is a 9-track model with 100-inch per second capabilities. All of the new tape drives are self-threading, a feature not found on the drives currently in use.

The new 9-track CDC tape drive will allow users to have their 9-track tapes read on either the CDC 6400 or the DEC-10. (The DEC-10 currently uses two 9-track tape drives.)

Throughout this month the Control Data Corporation will conduct training sessions for the corporation's customer engineers. The sessions will emphasize installation and maintenance of the new drives.

The tape drives have been temporarily hooked up to facilitate training and to check the

equipment, the accompanying software and the hardware capability. Permanent installation of the new tape drives will take place when Computer Center personnel are convinced the drives are compatible with the computer system.

Indications from other computer sites are that the new tape drives should prove more reliable than the drives currently in use. In addition, turnaround time should be improved somewhat because of the self-threading feature.

Computer Center manuals available in bookstore

Six locally-written Computer Center User's Manuals are currently available through the University Bookstore.

Computer Center User's Manuals are designed to provide users with information relating specifically to the University Computer Center. The manuals are sold at cost as a service to the Computer Center user community. All of the manuals have a characteristic orange cover.

The manuals currently available range in scope from the Timesharing User's Manual, designed to aid the user in getting started with interactive processing on the DEC-10, to the SITBOL User's Manual, which describes that programming language.

Writing the manuals is an ongoing process, with new manuals written and old ones updated as the need arises. Three new manuals--a manual dealing with magnetic tape use, a student's guide to the Computer Center and a manual outlining a general introduction to the Computer Center, are in the process of being written. In addition, the year-old SOS User's Manual and the Timesharing User's Manual are being updated.

A list of the six User Manuals now on sale, along with each manual's latest date of publication (several have been updated and reprinted since the manual's original publication) and abstract, follows. User suggestions or comments on the manuals are always welcome.

SITBOL USER'S MANUAL July 1975

SNOBOL4 is available on the DEC-10 as SITBOL. This manual explains how to use SITBOL. It describes input/output programming and the functions available for defining and manipulating files. This is not a reference manual on the SNOBOL4 language, but it explains exclusive features of SITBOL, including special features and keywords available. Included also are factors to be considered for efficient programming.

CDC 6400 SOFTWARE HANDBOOK June 1975

This manual provides explanations and instructions for using the most common utility programs on the CDC 6400. It describes local modifications to the SCOPE operating system. While not intended to replace the SCOPE

continued on next page...

Reference Manual, enough tutorial and introductory material has been included so that most users will not find it necessary to refer to other manuals to understand and use the software described.

PLOTTER MANUAL
March 1975

This manual describes how to use the Calcomp 664 plotter at the University of Arizona. The plotter is used by calling subroutines from a FORTRAN program on the CDC 6400. This manual describes the basic concepts relating to the plotter. The general requirements for use of the plotter are explained, along with the necessary job control cards. Documentation is given for the automatic plotter subroutines and the basic subroutines used for plotting. The plotter spooler and the PLOTAPE programs are described.

TIME SHARING USER'S MANUAL
January 1975

The purpose of this manual is to aid the user in getting started with interactive processing on the DECsystem-10. The use of a terminal is explained and some of the basic monitor commands are described. Also explained is the use of magnetic tape and the transporting of tapes from the CDC 6400 to the DEC-10. Also included is an introduction to available software and a description of the Program Library.

SOS MANUAL
July 1974

SOS is a powerful line-oriented

text editor for the DEC-10 computer. It contains features for insertion, deletion, replacement, searching and substitution of text. A powerful intraline editing capability known as "alter mode" exists. Advanced features include text justification, alternate file manipulation and file encryption.

UNIT RECORD MACHINES
July 1974

This manual describes the use of the IBM 026 and 029 card punches, the IBM 557 Alphabetic Interpreter and the IBM 83 sorter. It also lists the unit record equipment available at the University Computer Center and describes some card utility programs available on the CDC 6400.

FORTRAN quiz

What is the output from the following program?

```

DIMENSION A(10), B(10)
EQUIVALENCE (A(2), B(1))
DO 10 I = 1, 10
10  A(I) = I
DO 20 I = 1, 10
20  B(I) = A(I)
PRINT 25, B
25  FORMAT(1X, 10F5.0)
STOP
END
```

(Reprinted by permission from Sturgul and Merchant, Applied FORTRAN IV Programming)

ANSWER ON PAGE 15.

PROGRAM LIBRARY NOTES

Computer books available for reference use

The Computer Center Reference Room, room 303, has a small collection of books which can be used, in the room, to find information needed for classes, work or simply to enhance knowledge of Computer Science.

In the last month, about 75 new books were added to the collection. Five of the new books are described below.

Brainerd, Walter S. and Lawrence H. Landweber. Theory of Computation, Wiley & Sons, 1974.

This text discusses the "best" methods of presenting important basic results of computation theory. It holds to a mathematically rigorous approach and emphasizes the relationship between theory and reality (the programming language).

Brown, A. R. and W. A. Sampson. Program Debugging, American Elsevier, 1973.

A practical guide to the design, writing and testing of computer programs, this book explains how to find and correct errors. A sample program is described from start to finish.

Enslow, Philip H., Jr., Ed. Multiprocessors and Parallel Processing, Wiley & Sons, 1974.

This introduction to both the hardware and software aspects

of multiprocessors and parallel processing systems discusses the evolution of hardware systems organization, the various implementations and the special software problems involved.

Reitman, Julian. Computer Simulation Applications, Wiley & Sons, 1971.

This book shows how to apply system simulation to a variety of system design areas. Emphasis is placed on what to look for and what to avoid. Except for one example in SIMSCRIPT II, all examples use the GPSS programming package.

Uhr, Leonard. Pattern Recognition. Learning and Thought, Prentice-Hall, 1973.

Uhr examines the various ways computers are employed in developing theoretical models of cognitive process and "artificial intelligence." Coverage includes pattern recognition, game playing, theorem proving and complete programs that "learn" as they are used.

Please feel free to come to the Reference Room and browse.

Janet Brooks
Program Librarian

CDC catalog describes educational programs

A catalog describing nearly 250 educational programs developed at universities throughout the country can be found in the Computer Center Reference Room, room 303.

The catalog, called the Education Applications Software Catalog, was compiled by the Control Data Corporation (CDC) to promote the interchange of programs among educational institutions.

In addition to the CDC catalog, which contains a one-page description of each program available, a brief "Descriptive Table of Contents" is contained in the Reference Room.

The programs, which range in emphasis from a description of English literary style to dual simplex linear programming subroutines, can be obtained by writing directly to the university which developed the program. (The interested user may write a letter personally, or ask a Computer Center program librarian to handle the correspondence.)

The only fee for a program is the cost of writing and shipping a magnetic tape.

CDC is interested in expanding the catalog, and is soliciting new programs from CDC users. A memo received from CDC reads, in part:

"Many programs developed at educational installations are unique and designed for solving specific problems. However, some problems are common among all educational users. If you are aware of and have access to a large variety of programs already in existence, you may be able to solve your problem at far less expense."

Anyone wishing to submit a program description for inclusion in future issues of the CDC catalog should contact a program librarian in the Reference Room or write directly to CDC Corporate Headquarters, Box 0, Minneapolis, Minnesota 55440.

Categories of programs already in the CDC catalog include: Agriculture and natural resources (21 programs), Business and management (34), Communications (2), Engineering (6), Fine and applied arts (4) and Home Economics (5).

Other categories included in the catalog are Physical sciences (2), Social sciences (2), Administration (22), CONDUIT (1), Mathematical aids (117), Programming languages (2), Systems software (29), Area studies (1) and Education (1).

For further information about the CDC Education Applications Software Catalog, please contact the Reference Room, room 303. 884-2938.

What's an APL?

APL is a new programming language, now available on the University's DECsystem-10.

APL stands for "A Programming Language." It was developed by Kenneth E. Iverson in 1962 but not actually implemented as a computer language until sometime later, when it was brought up on the IBM 360. Recently, an APL system has been developed for the DEC-10. The University of Arizona is among the first sites to purchase this product.

APL is an interactive language. In its simplest applications, it lets the terminal be used as a desk calculator. You can type in $2+2$ and APL will respond with 4. In calculator mode, it can also be used to find exponentials, logarithms, multiples of pi, factorials, gamma functions and natural and hyperbolic trig and inverse trig functions.

A major difference between APL and most other programming languages is its ability to handle vectors and arrays. For example, there are basic APL operators to multiply two matrices and to find the inverse of a matrix. Storage is allocated dynamically, so arrays can be created and augmented without preallocating memory space (e.g., no DIMENSION statement is required).

APL uses a special character set to denote its basic functions. For example, the following is a typical APL statement (which sorts an array of alphabetic data)

```
A←A[⊆(2+pC)⊆Q⊆A;]
```

There are some commercially available terminals which can use the APL character set directly, but none are yet available at the Computer Center. However, APL can be used from a standard terminal by using codes for the special characters. For example, .RO stands for the APL character ρ (rho), and .EP stands for ε (epsilon).

In addition to the basic operations defined in the language, a programmer may define functions of his own. These may then be used interactively, just like the basic functions.

The program librarians have contacted other APL installations throughout the country and have built a library of more than 400 groups of APL functions. These have been classified according to their purpose, and are stored on disk where they can easily be accessed from APL.

The Reference Room has a copy of the DEC-10 APL manual. For users who are familiar with the APL language, this book will be sufficient to get started with DEC-10 APL. Incidentally, IBM APLers will be happy to know that the DEC-10 version is very close to APL/360.

For people who are not familiar with APL, a short course will be offered in the fall. Also, the Reference Room has some introductory texts.

If you would like to find out more about APL on the DECsystem-10, contact Mike Merchant in Computer Center room 224, 884-2901.

FLECS helps FORTRAN programmers

FLECS is a language which provides the FORTRAN programmer with powerful control structures.

As an example, the FLECS statements

```
WHEN (MOD(I,2) .EQ. 0)
    PRINT 7, X, Y
    K = K + 1
ELSE
    PRINT 8, Y
    K = K - 1
FIN
```

will execute the first PRINT statement and add 1 to K if I is even; otherwise, the second PRINT statement will be executed and K will be decreased by K.

Another example of a FLECS control structure is the following, which sums numbers until a zero value is read.

```
SUM = 0.
REPEAT UNTIL (X .EQ. 0)
    READ (5, 10) X
    SUM = SUM + X
FIN
WRITE (5, 20) SUM
```

These examples illustrate two of the ten control structures in FLECS. FLECS stands for "Fortran Language with Extended Control Structures."

It is a precompiler, rather than a compiler. This means that FLECS takes as input a FORTRAN program which uses the extended control statements, and produces as output the same program rewritten in standard FORTRAN. Nothing is changed in the original program except the FLECS statements. Thus, the use of FLECS does not depend on any particular FORTRAN compiler.

FLECS was written by Terry Beyer of the University of Oregon. A version is now available on the U of A DECsystem-10, and will be soon available on the CDC 6400. For information on running FLECS at the U of A, please contact User Services in room 215-C (884-3651).

Michael J. Merchant
Manager,
Communications Support

FORTRAN quiz answer

(Quiz on page 10)

The output is:

1. 1. 1. 1. 1. 1. 1. 1.

This is because of the EQUIVALENCE statement, which causes the array B to share the same storage locations as the array A, but with different subscripts. Thus when the DO 20 loop sets B(2) = A(2), it is actually setting B(2) = B(1). Similarly, B(3) = A(3) is the same as B(3) = B(2), and so on.

M. J. Merchant

What's new at the Computer Center

Listed below are a series of recent changes made at the University Computer Center with user service in mind. Many of the items have been previously published in HOTLINE bulletins. Additional information on any of the items may be obtained from the Computer Center Reference Room, room 303, 884-2938.

NEW PAPER CONSIDERED--A number of users have suggested that a new color combination would be preferable to the pink and green striped paper recently adopted as the default paper for printed output. The Computer Center has found a supplier who can provide paper the same size as the current standard but with one-half inch blue and white stripes. The Center is considering making this the default paper at some future time. Users are invited to express an opinion: to do so, contact Ernest Payne, Computer Center room 211, 884-2983.

PLOTTER OUTPUT--Users may now pick up their Cal-Comp plotter output at Station Zero, instead of having to ask the operators for the output. Bins have been set up for plots, to be used in the same fashion as the bins for other output. The change was made to facilitate turn-around.

MOUNT COMMAND CHANGES--Modifications have been made to the MOUNT command to enhance magnetic tape and DECTape security on the DEC-10. The command HELP MOUNT explains all the switches for

the MOUNT command (which now, with the exception of /DENSITY, apply to either magnetic tapes or DECTapes), while the HELP FILE command will give complete information on the forms of the FILE command, which has been extended to accept DECTape passwords.

NEW CONTROL CARDS--The Computer Center has added two more control cards to the CDC operating system--CCON and CCOFF (for Carriage Control ON and Carriage Control OFF). The CCOFF control card allows users to suppress normal carriage control processing for a print file. The CCON control card provides a means for reversing the effect of a CCOFF control card, restoring normal carriage control processing. For more information, please refer to HOTLINE bulletin number 26, June 27, 1975, or contact the Consulting Office, Computer Center room 215-C, 884-3651.

POST, RECEIVE COMMANDS--POST is a program available on the DEC-10 which is used to send "mail" to another user. The POST command allows a user to send a message to a list of one or more selected recipients. The message is saved in a special disk area, and can be retrieved by the recipient with the RECEIVE command. (Upon logging in to the system, the recipient is notified that there is mail to be retrieved.) Complete instructions on sending and receiving mail can be obtained from the commands HELP POST and HELP RECEIVE.

FTN 4.3 vs. FTN 4.2: advantages, disadvantages

Since the installation of version 393 of the FORTRAN EXTENDED compiler (FTN 4.3) more than three months ago, the Computer Center staff has had an opportunity to observe a few of the advantages and disadvantages of the new FTN.

The most noticeable advantage of FTN 4.3 is the reduction in compilation and execution time for many FORTRAN programs previously compiled using FTN 4.2.

In a study done at the University Computer Center, a brief time comparison was made to identify time differences required by the two compilers under various program conditions. The study also focused on the differences in execution time for programs compiled with both compilers.

In the comparison, four small programs were compiled using first the old compiler and then the new. The compiled code was loaded and executed, and the dayfiles yielded the results for the comparison.

The four programs included one "garbage" deck, full of compilation errors to test for syntax checking time; one I/O bound program which "pounded the disk" (used large amounts of input and output in the disk area) to test I/O processing time; one I/O-compute bound program which was used to print a picture of Abraham Lincoln (string processing) while testing "crunching" (CPU) time, and one compute-bound program which used double-precision three-dimensional array manipulations

with DO loops to test CPU instruction processing time.

The results of the time comparison showed that syntax checking and I/O processing took about the same amount of time in FTN 4.3 as in FTN 4.2. This was hardly surprising since FORTRAN syntax is still the same and the I/O routines used by both programs and compiled by both compilers are the same.

The study also showed there was at least a slight difference, and sometimes a significant difference, in both compilation time and execution time for CPU-bound programs, especially those using double precision variables.

The time advantages seem to hold for all three optimization levels (OPT=0, 1 or 2). In the case of the double-precision three-dimensional array program, the amount of execution time required using FTN 4.3 was a mere ten per cent of the time required when the program was compiled by FTN 4.2.

Besides the time advantages, but directly related to them, is the advantage of a better version of the code optimizers in FTN 4.3. The new optimizers seem to do a reasonable job, as born out by the brief time comparison. Using optimization levels 0 and 1 seems to produce code which is moderately faster than code produced by their FTN 4.2 counterparts, while optimization level 2 seems to generate code which, at times, is extremely fast. As previously continued on next page...

mentioned, the optimizer at level 2 is extremely useful for programs using double precision variables.

So far, a rather rosy picture of the advantages of FTN 4.3 over FTN 4.2 has been painted, but like most software, FTN 4.3 is not without its bugs.

For example, the optimizer at level 2 usually generates faster and better code than its FTN 4.2 counterpart. When it does not work correctly, however, the optimizer generates apparently bombastic code.

Caution is advised when using

FTN 4.3 with optimization level 2.

It is also advisable to compile programs under optimization level 0 or 1 before converting to level 2. This will preserve sanity and will help the Computer Center locate bugs in the new compiler.

If you should find that some of your programs compile incorrectly using level 2, but correctly using level 0 or 1, please contact the consultants in Computer Center room 215-C and supply supporting evidence.

OPTIMIZING LEVEL DIFFERENCES				
FOR CDC 6400 FORTRAN (FTN 4.2)				
DESCRIPTION OF JOB	OPT LEVEL	COMPILATION TIME	EXECUTION TIME	CM REQUIRED
I/O bound	OPT=0	.264 CP sec	6.72 CP sec	33744B
(5000 records)	OPT=1	.276 CP sec	6.71 CP sec	33740B
Disk I/O	OPT=2	.324 CP sec	6.71 CP sec	33740B
CPU bound	OPT=0	.723 CP sec	7.49 CP sec	30340B
data expansion	OPT=1	.855 CP sec	5.74 CP sec	30305B
list processing	OPT=2	1.126 CP sec	5.69 CP sec	30306B
Compiler bound	OPT=0	.346 CP sec	N/A	N/A
(error bound)	OPT=1	.354 CP sec	N/A	N/A
97 errors	OPT=2	.364 CP sec	N/A	N/A
Compute bound	OPT=0	.357 CP sec	15.251 CP sec	35341B
double precision	OPT=1	.455 CP sec	10.407 CP sec	35215B
3-D array	OPT=2	.517 CP sec	10.402 CP sec	35216B

Another apparent disadvantage of FTN 4.3 is that FTN 4.3 generates more instructions in order to gain speed of code generated. This means that many programs will require more core to load. The compiler itself also requires more core. In the four test programs used in the time comparison, loader core requirements showed an increase of between one and three per cent.

In conclusion, the FTN 4.3 compiler seems to have several good features and a few bad features (bugs).

Generally, the new compiler generates faster code than FTN

4.2 did. With this increase in speed, there was an increase in code generated. This may seem wasteful, but speed usually wins out over core in the eyes of many FORTRAN programmers.

I am personally glad to see the improvements in level 2 of the optimizer, but would also advise caution in its use. Expect the worst from optimization level 2 until CDC debugs the FTN optimizer.

Michael J. Garnaat
User Services

OPTIMIZING LEVEL DIFFERENCES				
FOR CDC 6400 FORTRAN (FTN 4.3)				
DESCRIPTION OF JOB	OPT LEVEL	COMPILATION TIME	EXECUTION TIME	CM REQUIRED
I/O bound	OPT=0	.246 CP sec	6.80 CP sec	34403B
(5000 records)	OPT=1	.232 CP sec	6.80 CP sec	34403B
Disk I/O	OPT=2	.358 CP sec	6.77 CP sec	34403B
CPU bound	OPT=0	.667 CP sec	7.17 CP sec	30760B
data expansion	OPT=1	.776 CP sec	6.05 CP sec	30760B
list processing	OPT=2	1.493 CP sec	4.80 CP sec	30745B
Compiler bound	OPT=0	.331 CP sec	N/A	N/A
(error bound)	OPT=1	.332 CP sec	N/A	N/A
97 errors	OPT=2	.339 CP sec	N/A	N/A
Compute bound	OPT=0	.286 CP sec	12.898 CP sec	35424B
double precision	OPT=1	.229 CP sec	10.319 CP sec	35331B
3-D array	OPT=2	.458 CP sec	1.576 CP sec	35341B

What's with the system?

Quite a few things have happened to our systems since the last newsletter and, as usual, we have many changes planned between now and the next newsletter.

The Link

The big news item is the installation of the long awaited Link between our Control Data 6400 and our Digital Equipment DECsystem-10.

The Link has been received by our user community with mixed emotions.

Those who primarily use the DEC-10 have complained of a degradation in response. The Link has allowed us to connect the five remote batch stations around campus to the DEC-10. The degradation in response is due to the additional overhead required to support the batch terminals on the DEC-10. This is noticeable because the DEC-10 was already heavily loaded before the remote batch terminals were connected to it.

The first few days of operation of the Link were not exactly smooth. A few bugs were encountered that showed up only in a heavily loaded system.

We have now reduced the number of known bugs and the Link is running quite well. We have even received some notes from people who are pleased with the Link and the capability of submitting batch jobs to the CDC 6400 directly from terminals logged in on the DEC-10. We have also noted better turn-around on the CDC 6400 since the

remote batch terminals and INTERCOM were removed.

We will continue development on the Link project and will work at reducing the overhead associated with the Link on the DEC-10. The Link is discussed in more detail in another newsletter article by Steve Jay on page 4.

DEC-10 TIDBITS

Since the last newsletter we have made a few changes to the DECsystem-10 system software.

6.01A monitor installed

The major change was the installation of the 6.01A monitor, which features virtual memory.

This monitor was installed about two months ago on a trial basis. We have been satisfied with it and will continue to run it for a while. We have made a few adjustments to the scheduler in this monitor in order to improve response.

Accounting changes

Another change we have made is in the area of accounting.

Accounting for each session consists of three components--kilocore seconds, Input/Output (I/O) time and a charge for being connected to the computer. We have changed the way the connect charge is determined. Previously, users were charged a flat hourly rate biased by their terminal transmission speed (baud rate). That charge was applied regardless of whether

the terminal was actually transmitting or receiving data.

Our new method of connect time accounting is based on charging a user for the resources consumed. The connect charge now consists of flat hourly rates for each job slot used (including PTYs) and for each access line, plus a charge for each character transmitted or received. We believe this is a fairer way of charging for computer resources actually used.

We are looking at other areas of accounting with the goal of charging users as fairly as possible based on actual resource consumption.

Tape processing

In another area of service, we have done extensive work on the processing of magnetic tape and DECTape requests. We have expanded the password scheme for tape access and have applied it to the use of DECTapes. Now, the method of accessing tapes is the same on both systems and for DECTapes.

One enhancement to the password scheme is that users may now specify that a password is required for reading a tape as well as for writing onto the tape.

A second enhancement is that passwords rather than PPNS are used to control access to DECTapes as well as magnetic tapes. Each time a tape is requested write-enabled, the system operator is asked by the software to enter the password from the tape. If the password entered matches the password specified by the user, all is well. If

not, the operator will be asked to verify the exact situation on the premise that the wrong tape may have been mounted. This should help to prevent accidental destruction of tapes.

The system also verifies that the tape density and write-enable ring status are correct before finally assigning the tape to a user job.

We are particularly pleased with these modifications because they have strengthened our data security.

RIB errors eliminated

Another important modification in the data security area is the installation of code which has eliminated Retrieval Information Block (RIB) errors on user files. We had lost a number of user data files due to errors in the RIBs of the file which rendered the files inaccessible.

Planned software changes

In the next few months, we plan additional changes to the software on the DECsystem-10 in support of our user community.

In order to reduce the size of the system, we will be installing modifications to log off inactive, detached jobs automatically after a given period of time. This will allow us to reduce the number of job slots in the monitor and save core and processing time since we will only allocate enough job slots for active jobs.

We will also be working on the new 6.02 monitor for the

. continued on next page...

DEC-10. We have reached an agreement with DEC that allows us to be a pre-release field test site.

The 6.02 monitor includes a new scheduler which supports job classes and allows us to allocate the system resources to the various classes of jobs. This means we can prevent one class of user from utilizing all the resources and guarantee other classes of users a certain percentage of the resources. Users in each class will compete with one another for their share of the resource allocated to their class, but will not have to compete with other users in other classes. This should help to allocate the resources more fairly.

The 6.02 monitor also includes some new software called DECNET.

The DECNET package is the first actual computer networking package released by any major computer manufacturer. It allows several computers to be linked into one large network. Any computer in the network may access any other. DECNET will provide more reliable support of the remote batch terminals, and it will allow us to link various campus PDP/11 minicomputers to the DEC-10. We are looking at the possibilities of using DECNET to link the DEC-10 and the CDC 6400.

The new 6.02 monitor will support dynamic reconfiguration of the system hardware. This will help us to make the various disk drives, tape drives and memory units available or unavailable to the system without necessitating a reload of the system.

There are other new goodies in the 6.02 monitor, but the most significant item is that it is very stable--it doesn't crash often, according to other DEC installations serving as field test sites.

CDC 6400 NOTES

Yes, we're working on the CDC 6400 too!

Express jobs implemented

We have recently implemented express jobs on the 6400. Any job which is smaller than the system default core size (44,000 words) and time limit (20 seconds) and uses no tapes, is run immediately when it enters the system. This will allow students to turnaround small jobs even when the system is heavily loaded. We also have a printer available to print small output files.

In addition to express small job processing, the scheduler has been tuned to improve overall turnaround. We have now made it possible for users to suppress carriage control (CCOFF) of print files from control cards. And perhaps most significantly, we have eliminated the causes of about 90% of our crashes.

CDC plans

In the future, we are going to install some new tape drives, models 667 and 669 on the 6400. These are self loading, single capstan drives and we expect them to be much more reliable than our current drives. We will have five seven-track tape drives and one nine-track.

The plan is to do away with the seven-track drive on the DEC-10 (MTA1) and use nine-track tapes to move large files between the two machines. Eventually we will try to convert primarily to the use of nine-track tapes on the 6400.

We also plan to install the new CYBER loader and multiple index sequential file processing on the 6400. Our plans also include the installation of optical character recognition facilities at the Computer Center.

Our efforts are to support the computing needs of our University. We have come a long way in the past three years and we have plans to go a long way in the future. Help us make this one of the best computer centers anywhere--let us hear from you.

L. E. Fields
Manager,
Systems Support

From the Suggestion Box

The following suggestions are a sampling of the many suggestions the Computer Center has recently received. All of the suggestions received, and their replies, are posted on the bulletin board located on the west wall of the Computer Center building.

Suggestion No. 581

The University Stores department presently stocks binders for the old size computer paper (11 inches wide). Binders for the new size computer paper (8 1/2 inches wide) must be special-ordered and as a result cost more. Stores department has indicated that they would stock the new size binders if there is sufficient demand. Could a HOTLINE bulletin or an article in the newsletter be circulated to bring this matter to the attention of computer users? Since the narrow paper is now standard it seems more logical for Stores to stock binders for that size. Thank you.

Reply:

Will do. Please drop a note to Jackie, c/o Stores, 884-1901, to convey the need in your department.

Editor's note: As the newsletter goes to press, Stores has informed us that the new binders are on order.

continued on next page...

Suggestion No. 568

Could the terminal room be made a non-smoking area?

Reply:

We have posted a copy of a letter from Physical Resources which states that smoking is prohibited "in classrooms and laboratory buildings...". As the terminal room is considered a laboratory, we ask all users' cooperation in this matter.

Suggestion No. 571

No gripe, really,.... just wanted to see how this thing worked, thank you.

Reply:

Glad you tried it. Your suggestions and comments are welcome.

Suggestion No. 486

Why not put name-tags on all the new black boxes in the glass-windowed computer room. It would be nice to know what each cabinet's contents does. (Disc control, memory, power, etc.)

Reply:

We'll work on this.

Suggestion No. 564

Please re-program the CDC to give special preference (and leniency) to my programs.

Rejected

Reply:

Dear Rejected: The problem is that your job name has eight letters.

Suggestion No. 566

Just a word of thanks. I've only had two suggestions this semester and both elicited immediate response. You are doing an excellent job.

Reply:

Thank you, too!

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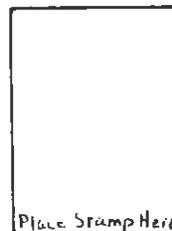
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the newsletter
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Staple here and mail

SCHEDULES

COMPUTER CENTER BUILDING SCHEDULE

Open 24 hours a day
except holidays

Operations Counter	Weekdays	7 a.m. - 11 p.m.
	Weekends	7 a.m. - 5 p.m.
Customer Support	Weekdays	8 a.m. - 4 p.m.
Production Counter	Weekdays	7 a.m. - 11 p.m.
Reference Room	Weekdays	8 a.m. - 5 p.m.

Pickup and Delivery Schedule for Remote Stations

Station	Departure Times:	Station	Departure Times:	Station	Departure Times:
75 PMM	8:50 a.m.	13 Chemistry	8:40 a.m.	76 Tree Ring	8:30 a.m.
	10:20 a.m.		10:10 a.m.		1:50 p.m.
	11:40 a.m.		11:30 a.m.	16 Med Ctr	8:00 a.m.
	2:10 p.m.		2:00 p.m.		1:20 p.m.
	3:40 p.m.		3:30 p.m.		11 Anthro- pology
5:00 p.m.	4:50 p.m.	2:20 p.m.			
12 Optical Sciences	8:20 a.m.	14 Engineer- ing	9:10 a.m.	74 Coop Health Statistics	8:10 a.m.
	10:00 a.m.		10:30 a.m.		1:30 p.m.
	11:20 a.m.		11:50 a.m.		
	1:40 p.m.		2:30 p.m.		
	3:20 p.m.		3:50 p.m.		
4:40 p.m.	5:10 p.m.				

Stations 11 through 16 have a remote batch terminal.

AT THE FOLLOWING TIMES THE COMPUTERS ARE SCHEDULED FOR
PREVENTIVE MAINTENANCE AND MAY NOT BE AVAILABLE FOR USE

CDC-6400

Monday through Friday
5 a.m. to 8 a.m.

Saturday and Sunday
5 p.m. to 9 p.m.

DEC-10

Monday through Friday
6:30 a.m. to 8 a.m.

Tuesday
8:30 p.m. to midnight

Friday
5:30 p.m. to midnight

Saturday and Sunday
5 a.m. to 9 a.m.



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