



WITCH

USER'S GUIDE

Wofford College Computer Center

WITCH
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an abbreviated guide to the use of
Wofford's Instructional Timesharing Computer from Hoechst

\$2.00 per copy

WOFFORD COLLEGE
COMPUTER CENTER

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I. Brief History of Computing at Wofford

Prior to 15 April 1968, any Wofford College Computer use was accomplished by taking cards to local firms and operating in a batch mode. That is the date of trial installation of a teletype time-sharing terminal. Usage of this terminal grew rapidly, encouraged by an NSF grant through the Southern Regional Education Board. A plotter and two off-line teletypes were added later. In addition to usage by computer science students, the terminal aided courses and projects in several other areas including Physics, Chemistry, Biology, Psychology, Economics, Government and Sociology. This system was in heavy use for seven years, but lacked flexibility and expansion capability provided by some newer mini-computer systems at approximately the same cost.

A generous grant from Hoechst made possible the installation of the present system in July 1975. This is a RSTS/E system based on the PDP-11 minicomputer made by Digital Equipment Corporation and initially supports five terminals. The system has been given the name "Wofford's Instructional Timesharing Computer from Hoechst" from which the acronym WITCH is derived. The system identification message is therefore "WOFFORD WITCH".

II. Wofford's Academic Computer Center

A. Goals of the Computer Center

The general philosophy under which the Wofford College Computer is operated is one of providing free access to all members of the Wofford Community, with emphasis and priority placed on academic

pursuits of the students or directly benefiting the students. The goals of the Computer Center include the following:

1. To make available to all students a "hands-on" stimulating contact with the computer age. Basic computer concepts are destined to be a part of everyone's life. They can be introduced without technical or mathematical backgrounds. Such experience is properly a part of a quality liberal arts education.
2. To explore and develop instructional uses within the undergraduate curriculum. An increasing number of valuable computer tools are available on this level. Experience gained here is preparation for later computer-assisted research investigations.
3. To provide the stimulus and hardware for an intensive study of computer concepts and uses in the form of Independent Study, Honors Work, Interim Projects, etc. and to support student use of the computer in projects of this type.
4. To support and accelerate the development of faculty research.
5. To aid with the data handling and computational needs of the College administration.
6. To provide demonstrations and limited service for the personnel and students of local schools and colleges and to share our experience with them.

B. Location and Description

1. Main System.

Timesharing service is provided by the RSTS/E operating system on a PDP-11 digital computer sold by Digital Equipment Corporation (DEC) of Maynard, Mass. The system presently includes:

central processor: PDP-11/40-BK

memory: 48 K words of 900 nanosec. parity core (HM11-UP)
(word size is 16 bits or two bytes and an
additional parity bit is provided for each byte)

real time clock: KW11-L

bootstrap loader: BM873 - YA

extended hardware instructions: KE11-E

memory management: KT11-D

two 1.2 Megaword disks (RK05 type)

input-output multiplexer and adapters (DH11-AA and
two DM11-DA)

console: LA36 DECwriter II

2. Terminals.

The system has the LA36 console and five terminals. Two of the terminals are located in the Chemistry Department. Three terminals (33ASR, LA36, and VT50) are in MSH 115. A Hewlett-Packard 7200A plotter is also available in MSH 115.

C. Organization and Staff

An attempt is being made to operate a time-sharing system with minimal staff. This means, in general, that the user is provided with a greater hardware facility than could otherwise be afforded, but with little or nothing in the way of supporting service such as software development, documentation and consultation.

The Center is operated as an academic service under the Office of the Dean of the College. Dr. Olds is the Director and has responsibilities for budget, allocation of facilities, and general regulation of the operation.

In addition, one or more student appointments are available as Computer Center Assistants. These students will have flexibly assigned responsibilities in connection with the operation of the Computer Center and its services. It is through these positions that we hope to provide users some of the staff services they may require.

D. Policies and Regulations

1. Who May Use the System?

Any member of the Wofford College student body, faculty or staff has the privilege of using the system (unless that person loses the privilege by continuing abuse--which has never happened). Each prospective user must apply to the Director for an account number and password to use in

signing on the system.

The Director may also assign account numbers to others. This will usually be done on the basis of a cost-recovery charge for service.

2. Sharing System Resources.

Any computer service has limited resources and, when the limit is approached, these resources must be allocated according to some system of priorities. The general philosophy in use at Wofford is that the full resources of the present system "belong" to academic applications by, or in direct support of, students and faculty. Competition for physical resources will exist in the following areas:

- a. Disk storage space--some of the disk space will be allocated to the programs and files required by system operation. Much of the remaining space will be allocated to "public library programs" serving several users. Some disk area will remain for the "private libraries" of individual users. This will be assigned by the Director

on the basis of need and availability. An initial limit of fifteen blocks is usually set for a new account. There is not enough disk space for all users to reach this limit, however, so users are requested not to store material longer than necessary. Users who require significant amounts of disk storage must consider the purchase of space on a private disk drive.

b. Terminal Time.

i. Console--generally limited to computer center staff and the automatic functions of system operation.

ii. Chemistry Department terminals--priority is given to applications in chemistry, but these terminals are also available to others. See Dr. Abel or Dr. Cavin for access rules. The Department presently has one 33ASR teletype and one VT50 DECscope.

iii. "Public Terminals"--These are located in MSH 115 and include a plotter, one 33ASR teletype, one LA36 DECwriter II and one VT50 DECscope. This room may be used freely when it is open or will be opened for you by the Security Department if you request this and present identification. No reservation system

has been implemented for these terminals so that they are on a first come, first serve basis, subject to priority conditions outlined below.

c. CPU Time -- Allocation of CPU time is controlled by the operating system monitor on a time-sharing basis. No other priorities are set, so access to the system guarantees CPU time. Additional users on the system degrade the response time for all, so those planning for major new applications might need to include additional core in their plans.

d. Device Time -- The system has none of the peripherals included under this heading except for the Plotter (KB7:5) which may be assigned by typing the CCL "PLOT".

e. Supplies -- The Computer Center budget is intended to cover all supplies needed for operation of the Center and the "public terminals". Nonacademic projects with significant need for supplies may be requested to share the cost.

3. Priorities.

When there is significant competition for system resources, it is necessary to assign priorities to various uses. The Computer Center budget is set with the approval of the Trustees and is administered by the Computer Center Director. It is the responsibility of prospective users to consult

with the Director well in advance of major changes in usage so that effective plans may be made. He will allocate the available resources in an attempt to meet the following priorities:

- a. First priority is given to students and faculty members using the system in connection with a course or interim project. The College will attempt to fund all legitimate uses in this category. However, if requests for usage exceed the resources, appropriate limitations must be set by the Director. The most serious current limitation is on disk storage space for individual users.
- b. Second priority is given to computer usage in connection with the administration of the Center and includes demonstrations, program development and the collection and analysis of system data.
- c. Third priority is given to Wofford personnel and organizations as paying customers. This includes funded research projects and funded administrative uses. All prospective users are urged to develop outside sources of support for their projects and thus aid the College in funding the Center. If requests exceed the resources available in this category, priority will be given in accordance with the direct influence of the project upon

the education of Wofford students.

d. Fourth priority is given to unfunded uses by Wofford personnel and organizations. This includes student and faculty research, administrative uses and personal development.

e. Fifth priority is given to funded projects external to Wofford College. Such uses will be welcome to the extent they do not interfere with the aims of the College and do contribute to the funding of the Center.

f. Sixth priority is given to the playing of "computer games" by Wofford personnel.

g. Lowest priority is given to non-funded uses by non-Wofford personnel and organizations (exclusive of limited demonstrations to visitors).

Each such project must have the approval of the Director and there must be good reason for Wofford to extend this courtesy.

E. How to Operate the Terminals

1. The ASR-33 Teletype.

These teletype terminals provide the user with a keyboard for entering information, a printer to produce hard copy, a paper tape punch to produce machine-readable copy, and a paper tape reader.

Power: A knob on the front panel of the teletype should be turned to the center position (OFF) when the terminal is not in use. Turn this knob to the right (LOCAL) to turn the power on without connecting to the computer and to the left (LINE) to turn the power on and connect to the computer.

Keyboard: The keyboard is similar to that of a standard typewriter, but has no lower case alphabet. All the numbers, including one and zero, appear on the upper row of keys. There is a shift key to allow typing certain symbols (such as \$, %, ", etc.) which appear on the upper portions of some keys.

Another shift key, marked CTRL, allows certain keys to produce still another character, some of which have special meanings to the RSTS/E system.

Printer: The teletype printer can be used in the local mode in a typewriter-like fashion. When connected to the computer, the typing is controlled by the computer and not directly by the keyboard. The

printer can run at up to ten characters per second and is usually set for a 72-character line.

Paper tape reader: This is located at the left front of the teletype, beside the keyboard. The tape used is a 1-inch, 8 channel paper tape which is driven by a star wheel by means of an extra set of (smaller) punch holes. The tape moves toward the front when in operation. To load a paper tape into the reader:

- **Place the reader switch in the OFF position.
- **Push the gray latch to allow the clear plastic cover to pop open.
- **Place the front end of the tape in the reader so the small perforations near the center engage the star-wheel drive mechanism. Remember that the tape will move toward the front.
- **Carefully close the plastic cover with the tape in position.
- **When you are ready to read the tape, move the reader switch to START.
- **If necessary to stop the tape, move this switch to STOP.
- **The switch may be set to FREE so the tape may be easily pulled through the reader without printing.

Paper tape punch: This unit is located to the left of the keyboard, behind the paper tape reader. If the unit is properly loaded, and the teletype power is ON, the preparation of punched paper tape is as follows:

- **Turn the punch ON by pushing the clear plastic button marked ON.
- **Start your tape with some leader by holding down the REPT key for a couple of seconds together

with the RUBOUT key (or space bar or other leader character)

**Type the information to be placed on tape or cause the computer to type the desired information. Note that any commands you type now will also go on your tape.

**When finished, add some trailer to your tape as you did the leader.

**Turn off your tape by lifting it up and back against the pointed end of the punch unit.

The utility program PUNCH can be used to punch files from the disk and will provide leader and trailer automatically.

2. The LA36 DECwriter II

This terminal has a keyboard and printer, can operate in either local or line mode and has speeds of 10, 15 and 30 characters per second.

Control Switches: A switch at the far left turns the power ON and OFF. Turn the power OFF when the terminal is not in use. Next to the power switch is the "LOCAL-LINE" switch. This is normally set to LINE so the terminal is connected to the computer.

A third switch here controls terminal operating speed. Leave this set at 300 because the computer is programmed to send and receive at this speed.

Keyboard: The general plan of the keyboard is that of a standard electric typewriter with a few extra keys. At the right end is an extra set of numeric keys which may be used as an alternative to those on the upper row. Since this terminal can operate in both upper and lower case, a shift key is provided. Certain additional non-printing characters are created by use of the CTRL key as another shift key. The DELETE key is used to cause the computer to DELETE the last character (more if repeated) you typed. This is shown on your paper as the computer prints the backslash, the deleted character(s) and (when you resume typing) another backslash. The BACKSPACE moves the printhead one space to the left, the RETURN key moves the printhead to the

left margin and the LF key advances the paper one line.

If you are on-line to the computer, use the RETURN Key to get both a return and a line-feed.

The Printer: This terminal uses tractor-feed paper in a variety of widths. If the paper jams, runs out or must be changed, open both tractor covers to expose the drive pins. Feed paper from below the keyboard up and behind the typing head. Insert the left side of the paper with the holes directly aligned on the drive pins and close the left tractor cover. Repeat on the right. If necessary, the right tractor can be adjusted horizontally by loosening the black adjustment knob above it by about $\frac{1}{4}$ turn, sliding the tractor to the new desired position and re-tightening the knob.

The width of the printed line is set by a computer program to match the paper supplied with the LA36 terminal, but may be changed by running the program \$TTYSET.

The LA36 is capable of forming upper and lower case characters and certain special symbols in a 7x7 matrix of dots formed by wires in the printhead. When connected to the computer, the characters

that are typed come from the computer, not the
keyboard. Most of the time, the computer will
echo your alphabetic typing with upper-case letters.

3. The VT50 DECscope.

This terminal has a keyboard and a video display screen, but provides no hard copy. It is quieter and runs faster than the printing terminals.

Power: The ON-OFF switch is located on the right side of the cabinet.

The Keyboard: The keyboard arrangement is much like that of an electric typewriter with a few special keys added. There are no lower case alphabetic characters, however. The more important special keys include: DELETE, BACKSPACE, CTRL, RETURN, LF, and TAB.

DELETE causes the computer to delete the previous character. It may be used repeatedly to clear away errors on a single line.

BACKSPACE causes the cursor to move one space left on the current line. Note that a new character may now be placed on the screen at this position but this does not erase characters from the computer's input information.

CTRL is used with another key to form special command characters. See appropriate section of this manual.

RETURN returns cursor to left of screen.

LF moves cursor to new line (Note: when on-line to computer, use RETURN and the computer will perform both functions.)

TAB moves the cursor over to the next^{tab}/column on the screen. TAB stops are set every 8 spaces up to the 72nd space, then every space.

The Screen: The display screen is 80 columns wide and 12 lines high. A blinking cursor (underline) shows where the next character will be displayed.

Special Control of the VT50 Display.

Built into the logic circuitry of the DECscope is the ability to recognize special character sequences as commands. These commands are in the form of ASCII characters which may be obtained in BASIC-PLUS with the use of the CHR\$() function.

CHR\$(155%) changes the operating mode of the VT50 from normal mode to "escape mode" or "escape mode" to normal mode. When in escape mode, the terminal recognizes the next character received as a command. Among the commands recognized are:

CHR\$(65%) or A moves the cursor up one line.

CHR\$(67%) or C moves the cursor right one position.

CHRS(72%) or H moves the cursor to the home position
(upper left corner of screen)

CHR\$(74%) or J erases from cursor position to end of screen.

CHR\$(75%) or K erases from cursor position to end of line.

The bell, backspace, tab, line-feed/^{and} carriage return work in either terminal mode and do not change the operating mode. Most normally-printing characters, however, when received in escape mode will not print but will return the terminal to normal mode. As an example of display control, the following sequence

will clear the screen, advance the cursor to about the center and display the time:

```
PRINT CHR$(155%)+ "H" + CHR$(155%) + "J" + CHR$(155%) +  
STRING$(6,10) + STRING$(5,9) + TIME$(0%)
```

4. The HP 7200A Plotter.

The plotter controls are in front of the plotter bed. To prepare for a plot, proceed as follows:

- a. Install one of the special plotter pens kept in a drawer near the plotter. Insert the pen in the holder on the moveable plotter arm. Twist to lock but do not exert undue pressure or torque on the plotter arm. Pens should be capped when not in use.
- b. Press the power switch. The POWER light should come on.
- c. Place your paper on plotter bed and smooth down.
- d. Press CHART HOLD and smooth paper to plotter bed again.
- e. Open the cover at the right of control panel to expose four control knobs.
- f. Press LOWER LEFT then PEN DOWN to mark the lower left corner of your graphing area. Adjust this to the desired position with the two POSITION knobs. Keep pen at least slightly away from the limits of its travel.
- g. Press UPPER RIGHT then PEN DOWN to mark the upper

right corner of your graphing area. Adjust this to the desired position with the SIZE knob. Again keep the pen at least slightly away from the limits of its travel.

An appropriate computer program will send plot commands to the plotter and the green light will come on. The yellow (IMPROPER FORMAT) light comes on to indicate a faulty plot command or number.

III. Abbreviated Guide to RSTS/E System Usage

A. Introduction

RSTS/E is a timesharing system and services many users at the same time through local and remote terminals. (The terminals are described in another section of this manual.) A computer algorithm for scheduling users gives each active job attention for a fraction of a second, then moves to the next one that is ready for service. It may be that not all the jobs requiring service can find space in core memory at one time, and in that case, one or more jobs must be swapped between disk and core. The scheduling and swapping of jobs is handled automatically by a program in the computer. How much actual computing a job will be given in any one minute is a function of the nature of the job and of the other demands on the system.

B. How to Sign ON

All the present terminals are hardwired to the system and are put on-line by a switch at the terminal. When the terminal is on-line, type HELLO to begin the sign-on procedure. The system then types a line of identifying information and then the number sign (#) to request your project-programmer number (PPN). Each user must obtain his own PPN and password from Dr. Olds. You then type your PPN (two numbers separated by a comma) and if this was done correctly, the system responds by requesting your "PASSWORD." You type the password you have been assigned. For added security, this password will not be printed at the terminal. The system

then asks for your usage category. Each user must classify his computer usage according to the department or area involved. The current categories are:

1. Computer Science
2. Physics
3. Chemistry
4. Biology
5. Geology
6. Mathematics
7. Psychology
8. Government
9. Sociology
10. Education (dept.)
11. Economics/Accounting
12. English/Arts/Language
13. History/Philosophy/Religion/Humanities
14. Other Academic Uses
15. Computer Center Work
16. Demonstrations
17. Games
18. Non-Wofford Uses
19. Administration

When you enter the appropriate number followed by a return key, the system responds by typing the name of your category and a message supplied by the system manager.

The entire log-on sequence might look like (you type the parts underlined):

HELLO

RSTS V6A-02 WOFFORD WITCH Job 3 KB5 05-Aug-75 11:12 AM

#75,8

Password: _____

USAGE CATEGORY (?FOR HELP)? 1

COMPUTER SCIENCE
(variable message)
READY

The sign-on procedure can be shortened by typing the PPN on the same line with HELLO. Replacing the comma in the PPN by a slash will suppress message printing. The fast procedure looks like:

HELLO 120/80

PASSWORD: _____

USAGE CATEGORY (?FOR HELP)? 5

GEOLOGY

READY

When you already logged-in and wish to know time, date, job number, and keyboard number, just type HELLO with no PPN

C. How to RUN a Program

If the program you want to run is already stored on the computer disk, under your account number, you may execute that program by simply typing RUN followed by a space and then the program name (see the section on RSTS/E file names). If the program is stored under another account number, you must specify that number. If someone has stored a program named SHARE under his account 100,85, you type

RUN (100,85) SHARE.

Of course, the owner of that account and program may or not have allowed others access to this program. If not, you will get an error message.

When the system receives a RUN command, it searches the proper account for the specified file, assuming a .BAC extension, brings the file into the user's work area and begins execution. If no such file is found, it then searches for the given account and file name, assuming a .BAS extension. If this found, the file is brought into core, compiled, then executed. The compilation step may be noticeable as a short delay before execution begins. The delay is longer for longer programs.

The command PUNNH (RUN No Header) is also available. It applies only to the current program in the user's area and causes that program to be executed without printing out the header line which contains program name and the system date and time.

If a program exists in both the compiled (.BAC) form and the source (.BAS) form and you wish to execute the .BAS version, it is necessary to use both the OLD and the RUN commands.

D. How to Enter a Program

Instead of running a program already saved in the computer, you may wish to enter a new program. This sequence is initiated by the NEW command followed by a return key. The system responds NEW FILE NAME-- and you must enter the name you wish to give your program (one to six alphanumeric characters). The procedure may be abbreviated by typing the name on the same line as the NEW command as

NEW MYPROG

The system responds by typing READY, after which you may enter your BASIC-PLUS program from the keyboard or from paper tape.

E. Simple On-Line Editing

While you are typing a source program into the system, you will probably have need for one or more of the RSTS/E editing features and system commands.

The most immediate type of error correction is equivalent to erasure and back space on a typewriter. If you notice an error in the line you are currently typing, use the rubout (or DELETE) key to "backspace and erase", once for each character to be removed. On printing terminals the system will respond by echoing the characters removed (beginning and ending with the backslash character). When you have removed the error this way, continue typing as before with the correction you wish to make. An example is:

```
10 PRINT A/A TM/NT Z
```

which changes the line to

```
10 PRINT Z
```

It may be easier to replace the whole line rather than use the RUBOUT key repeatedly. There are several ways to do this. The "control-U" character will delete the current line and allow you to start over. To delete a previous line, type the line number and RETURN key. To replace a previous line, just type a new line with the same line number.

Also useful at this stage are the system commands LIST, DELETE, RENAME, LENGTH, and REPLACE.

F. Debugging Aids

When your program has been corrected in syntax so that it will run, you are ready to test the logic and see if it gives correct answers. If not, you must try to locate the reason.

One of the most useful debugging techniques is the examination of intermediate answers or the determination of whether or not a program segment is actually executed. One method of doing this is to insert extra print statements into the program to print out intermediate results or messages. This can also be useful in a long compute-bound program to provide evidence of progress toward the answer.

Another method is to insert extra STOP statements at strategic points in the program. The computer will stop execution and print a message like:

STOP AT LINE 540

The user may continue by typing CONT, confident that his program has reached this point or he may choose to use immediate mode commands to examine or modify values in his program.

A program can also be interrupted by use of the control-C character. To find where the program stopped, type

PRINT LINE

and the line number will be printed. Immediate mode commands may be used as before and execution continued by the CONT command. (See Ch. 4 of BASIC-PLUS Manual).

G. How to Sign Off.

The command BYE is used to log off the system. Log-offs are not allowed if a user's disk storage exceeds the limit of his allocation. For this reason the BYE command is made to activate a program which allows a user to examine his disk storage and perhaps delete some of it. After you type BYE, the computer types CONFIRM: and expects you to type one of the following characters:

haracter	Meaning
N	no - I don't want to log off. System types ready and returns to command mode.
I	Individually examine each file saved under the user's account. The system prints a file description followed by a question mark and the user responds with a K to kill (delete) the file or a carriage return to retain the file.
?	Causes the system to print a brief summary of expected replies.
Y	Yes - Proceed with log-out--i.e. check that disk quota is not exceeded and print an accounting message recording system usage.
F	Fast log-off. If disk quota is not exceeded, no messages are printed.

The response to the CONFIRM: request may be typed on the same line with BYE so the fastest way to log-off is

BYE F

if your disk quota is not exceeded.

In any case when a log-off is attempted while disk quota is exceeded, the system prints an appropriate message explaining the

excess and asks you to delete some files which you do by using the I option to inspect them and the K reply to kill some.

H. RSTS/E File Names.

A complete file name has the following five parts:

device, filename, extension, (proj., prog.) <protection code>

Devices on the present system are:

VPn: to KBn the terminals

use KB: to indicate your own terminal and KB5:

(for example) to designate another specific keyboard.

If no device is specified, the public disk is often assumed.

SY: The public disk(s)

DK0: and DK1: the two disk drives individually.

Filename: a string of 1 to 6 alphanumeric characters.

Extension: a dot (.) and one to three alphanumeric characters.

A few extensions have special meanings to the system. Basic source programs use the extension .BAS and compiled programs use the extension .BAC. The .BAS extension assumed when using NEW, SAVE, UNSAVE, OLD or LIST.

(proj., prog.): The PPN. The current PPN is assumed unless specified.

<protection code>: specifies who may have what kind of access to the file. A default protection of 60 is usually assumed. This prevents access by all except the owner.

Missing portions of a file specification are usually supplied by the system on a default basis. Beginning users usually only need to specify the name field. For more information see the BASIC-PLUS manual.

I. System Commands.

Appendix B of DEC's BASIC-PLUS Language Manual contains a summary of the commands and special control characters recognized by the system. It is assumed that user^s will own or otherwise have access to this manual. More detailed information on these commands is available in DEC's RSTS-11 System User's Guide. Only certain of the more frequently used commands will be summarized here.

APPEND	used to include contents of a previously saved source program in the current program and is a way in which a program may be made to incorporate commonly used functions or subroutines such as those for plotting. You may name the file to be appended on the line with APPEND or else the system will ask you for file name.
BYE	to sign off
CAT	to obtain a list of file descriptions as stored on the disk. Specify PPN if other than your own.
COMPILE	to store the compiled form of your program, using the .BAC extension with the current file name. This form requires more disk space but will execute more rapidly. It cannot be listed or edited. The command may be used in the form COMPILE REPORT to specify a name for the compiled program.

CONT	to continue execution of a program after a STOP or control-C interruption.
DELETE	specify line numbers you wish deleted from your program. Forms include: DELETE 50 DELETE 50-650 DELETE 80,90,100-150, 200-250, 900, etc.
HELLO	to sign on
KEY	to enable the echo feature at the terminal if it was disabled using the TAPE command. Terminate with a line feed or the ESC key.
LENGTH	to determine the amount of core currently occupied by the user's program (in 1K segments).
LIST	to send a copy of your current program to your terminal.
LISTNH	Use LISTNH to avoid listing the title header. and LISTNH LIST/may be used with line number options shown with the DELETE command.
NEW	either command clears the users core area and expects a program name which may be typed on the line with the command or when the system requests it. The NEW command causes the computer to expect a program from the terminal while the OLD command causes a search for the program in your disk storage (unless another account or device is specified).
OLD	

RENAME changes the name of the current program to the name you specify after the word RENAME.

RUN to run (execute) the current program in core unless followed by another file name. RUNNH omits the printing of the header information but works only on the current program.

SAVE causes the current program in core to be saved on the disk under its present name with the extension .BAS unless another device or name is specified.

TAPE used to disable the echo feature at your terminal while reading in paper tape.

UNSAVE used to remove a file from storage. If no device is specified, the system disk is assumed. If no extension is specified, the .BAS extension is assumed. If no file name is specified, the name of the current program is assumed.

J. Special Control Characters.

Certain non-printing characters formed by holding down the CTRL key and another key are recognized by the system as special commands. Among these are:

CTRL/C	interrupts any processing or printing and causes the system to return to command mode.
CTRL/I (or TAB)	operates as a tab feature, moves the next character position to the next tab stop.
CTRL/O	alternately turns on or off the output being sent to a terminal. Avoids the necessity of having long print-outs when only a later portion is needed.
CTRL/S	the system can be set to allow this character to interrupt transmission to the terminal. This is generally used on scopes--otherwise the information might be lost from the screen before it could be used. Transmission may be resumed by typing any character at the keyboard.
CTRL/U	deletes the line currently being entered.
CTRL/Q	the recommended character for causing output to resume after CTRL/S

K. Special Programs.

Several of the utility programs in the public library are described in Chapter 4 of DEC's System User's Guide. Some of these are described briefly here for the convenience of those who do not have that reference. These programs are stored under account (1,2) or \$. **WARNING:** These commands cause a program to be run which replaces and destroys your previous program unless it has been saved.

1. SYSTAT causes a report of the current status of each job and the disk to be sent to the terminal. May be run by simply typing SYS.
2. PIP "Peripheral Interchange Program" moves information from one file specification to another. Since a complete file specification includes a device name, a frequent use of PIP is to move a file or program from one disk to another or from disk to keyboard. PIP uses one output file specification and one or more input file specifications. A command line could look like:

PIP (output file)<(input files)

Since PIP supplies assumed values for many of the file name components not specified, some sample uses could take the forms:

PIP MYPROG causes a listing at your terminal of a file
on the disk under your account named MYPROG.BAS.

PIP DK0:PROG.BAK<DK1: \$SNOOPY

moves a copy of the program named SNOOPY.BAS
stored under account (1,2) on disk #1 to your
account on disk unit 0 and gives it the name
PROG.BAK.

PIP can be used with an = rather than < in
which case it does not make a new copy of the
input file but changes the file specification
to that of the output file if the command is
followed by /RE (for replace).

PIP NEW.BAK<40> = OLD.BAS/RE

assigns new name, extension and protection code
to the program OLD.BAS

PIP/DI

lists a directory of all your files on the system
disk

PIP (100,120)/DI

lists a directory for the account (100,120) or
whatever account you specify.

PIP has many more uses for which you should consult DEC's RSTS-11
System User's Guide. However, many of these functions

are better handled by the newer program DIRECT.

3. QUOLST

Use RUN \$QUOLST to see how much of your disk storage quota you have used, how much you have left and how many free blocks remain on the disk.

4. MONEY

Use RUN \$MONEY to obtain a report of your system usage. The output provides the following information:

- a. ACCT, your account number (PPN)
- b. CPU-TIME used in hours: minutes: seconds. tenths.
- c. KCT's = kilo core ticks. This is a measure of how large your programs are and how long they run. One KCT is the usage of 1K of core for one tenth of a second. A 6K program running for 4 tenths of a second is charged $6 \times 4 = 24$ KCT.
- d. CONNECT time (or on-line time) in hours: minutes.
- e. DEVICE time in hours: minutes (assigned devices including the Plotter).
- f. DISK storage used (in blocks).
- g. QUOTA in blocks of allowed disk storage.
- h. UFD is the cluster size of your user's file directory.

This program obtains accounting data from the disk which is not updated until you sign-off.

Therefore, \$MONEY cannot be used to monitor your usage within a single log-on.

5. EDIT

You may use "EDIT" to alter portions of your programs without retyping whole lines. An outline of how to use "EDIT" follows; if more information is needed consult the RSTS/E Text Editor Manual.

You must have a copy of the program (to be edited) SAVED under your account. It is also advisable to have another copy of the same program SAVED under a different name in case the copy you are working on is accidentally lost during the EDIT procedure. (Not a requirement) It is best to EDIT while at a Dec-scope due to the convenience and speed. (Remember CTRL S to stop and CTRL Q to begin). Other CTRL characters should not be used during EDIT. Another word of caution: edit slowly and repeatedly check your edited text. (Reason for Dec-scope.)

To start the edit program type in "EDIT" followed by the complete program name and extension as it is saved under your account. This causes the "EDIT" program to be loaded into core. The program you intend to edit is opened as an input file and another temporary file is opened as the output. The symbol "*" will be printed when the computer is ready to begin the editing procedure. You now proceed to type in symbols (numbers and letters) to alter the text of your program. After each command symbol return the carriage; the computer will perform the operation and when ready for the next command will print "*". More than one command may be input before returning the carriage, in which case all are performed in sequence. (Make sure you know exactly what each command will do before you use combination commands.) If you make a "logic" mistake the computer will return the command with a question mark "?". When you have finished altering your program type "EX" (EXIT). This will cause the temporary output

file to be closed and given the program name plus the extension .BAK (Backup), then the old program is replaced with the new version and the input file is closed. You have now altered your program and you have two copies in your account.

The program is divided into units called Pages. Some may be short enough to fit completely on one page; others may not. There are operation commands to move to the next page. You cannot move back to a previous page.

In order to alter your program correctly you must provide the computer with three basic instructions:

- 1.) Where does the program need altering?
- 2.) What type of alteration is needed?
- 3.) How much alteration?

Location of Alteration

The position in the program where the computer will start the next command operation is called "dot". "Dot" is a pointer and you can move "dot" to indicate where you want the operation performed. "Dot" is moved by certain commands.

Another temporary pointer is called "mark". It allows you to mark a position in the program then move "dot" to another position and then perform some alteration on the text between "mark" and "dot" by using the "@" character. Only one position can be marked at a time. The symbol "M" moves "mark" to the "dot" position.

Later movement does not affect "mark" unless "M" is used again.

What Type of Alteration

Letters are used to indicate the type of alteration such as Delete, Insert, List or Move dot. See the table that follows for the letter code and explanation of each command.

How Much Alteration

Numbers preceding the letter codes indicate how much or how many times the command should be performed. If a positive number (n) is used the operation will be performed n times from dot to the end of the page. A negative number (-n) causes the operation to be performed from dot toward the beginning of the page. If "0" (zero) is used the operation will be performed between "dot" and the beginning of the line containing "dot". A "/" causes the operation to be performed from "dot" to the end of the page. The "@" causes the operation to be performed between "mark" and "dot".

Some letter codes do not take a number and others may not use all the special symbols (-n, /, @). Those that do are indicated in the table.

TABLE OF COMMANDS

A ' represents any legal text delimiter.

Advance	nA	Moves dot past n end-of-line characters to the beginning of the succeeding line. (takes -n, 0, /, @) (See Jump)
Beginning	B	Moves dot to beginning of the page
Change	nC'xxxx'	Changes n characters following dot to xxxx. (xxxx represents any string and must be set off by delimiters.) Moves dot to follow xxxx. (Same as a Delete and Insert.) (takes -n, /, @)
Delete	nD	Deletes n characters following dot. (takes -n, 0, /, @)
Exchange	nX'xxxx'	Exchanges n lines for xxxx. (takes -n, 0, /, @)
Execute Macro	nEM	Performs the Macro command n Times (See Macros)
Exit	EX	Closes files
Get	nG'xxxx'	Searches for the <u>nth</u> occurrence of xxxx and positions dot behind it. (If the end of the page is encountered before the <u>nth</u> 'xxxx' then nG'xxxx'? is returned.)
Insert	I'xxxx'	Inserts 'xxxx' in front of dot.
Jump	nJ	Moves dot ahead n characters
	-nJ	Moves dot backward n characters.
	OJ	Moves dot to beginning of line.
	/J	Moves dot to end of page.
	@J	Moves dot to mark.
Kill	nK	Kills (removes) n lines of text beginning at dot. (takes -n, 0, /, @)
List	nL	Lists n lines beginning at dot. (takes -n, 0, /, @) Does not change position of dot.
Mark	<u>M</u>	Sets mark at dot.
Next	nN	Moves forward n pages or to end of file.
Verify	V	Prints the line containing dot, does not change position of dot.
Whole	nH'xxxx'	Searches for the <u>nth</u> occurrence of xxx nad positions dot after it. If the end of page is encountered before the <u>nth</u> 'xxxx' then the next page is searched, and so on until n'xxxx' is found. (if n'xxxx' does not exist then nH'xxxx'? is returned).

Delimiters and Text Objects

All C,X,G,I, and H commands must have a text object xxxx set off by delimiters. A delimiter is the first character following a C, X, G, I, or H command. The text object is all the characters between the 1st delimiter and the next character like the delimiter (2nd delimiter) the text object may be one character or a group (string up to 255 characters), but may not contain a Carriage Return (CR), Line Feed (LF) or the delimiter character. The single quote (') is a convenient delimiter to use. I 'HELLO' would Insert the word HELLO in front of dot. Spaces may be used in delimiters to Insert spaces. Also spaces may be used as delimiters.

If your text object contains a CR or LF or is too long to fit on one line, a special mode may be used. It may be used with C, X, G, I or H. To use: After the * prompter is returned type in a C, X, G, I, or H then depress the CR key. This will generate a return/line feed; now any text object may be entered (without delimiters) including CR. The end of the text object is indicated by a LF. The LF is not part of the text object. In order to insert a LF it must be the 1st character after the 1st CR; a 2nd LF terminates the text object.

{ *X - Exchange
*3X" - " replaces 3 lines with
*3X" <CR> <CR> <LF>" replaces
3 lines with 3 new ones.

EXAMPLES

SQUARE.BAS

```
10 INPUT X
20 PRINT X, X^2
30 END
```

Program that takes a number X and prints X and X squared.

To change to a program that prints X, X squared and X cubed

(underlined is user response)

EDIT SQUARE.BAS(CR)

* L (CR)

List first line

10 INPUT X

* AL(CR)

Advance 1 line and list it.

20 PRINT X, X^2

↖ dot is here

* G'X^2' L(CR)

Search for the 1st occurrence of X^2 and place dot behind it, then list from dot to the end of line.

+ only a (CR) between dot and end of line

* V(CR)

Verify line.

20 PRINT X, X^2

↑ dot is here

* I', X^3' (CR)

Insert X^3 in front of dot.

* V(CR)

Verify (could have followed the above command)

20 PRINT X, X^2, X^3

* B/L(CR)

(B) move dot to beginning of page
(/L) list from dot to end of page

10 INPUT X

20 PRINT X, X^2, X^3

DO EDIT

* EX(CR)

Exit; terminate EDIT

Ready

EXAMPLE 2

ROOT.BAS (Mistakes are underlined)

```

10 REM  ROOT.BAS
20 PRATT "ROOT.BAS WILL PRINT ABLES OF X+1/N"
30 PRINT "FROM 2 TO X FOR A GIVEN N."
40 INPOT "X AND N VALES"; X; I
50 PRINT X, N
60 FOR A = 2 TOO X
70 PRNT X; X+1/N,
80 ANOTHER TABLE

```

(User response is underlined)

```

EDIT ROOT.BAS(CR)
* G'20' 3J 2C'IN' V (CR)
20 PRINT "ROOT.BAS WILL PRINT ABLES OF X+1/N"
* G 'PRINT ' I'T'V(CR)
20 PRINT "ROOT.BAS WILL PRINT TABLES OF X+1/N"
* G '40 INP'C'U' G'VAL'I'U' 2G';'C'N'V(CR)
40 INPUT "X AND N VALUES"; X; N
* AL (CR)
50 PRINT X, N
* KL (CR)
60 FOR A = 2 TOO X
* G 'TO' D V(CR)
60 FOR A = 2 TO X
* AL (CR)
70 PRNT X; X+1/N,
* 5JI'I' V(CR)
70 PRINT X; X+1/N,

```


* AL (CR)

80 ANOTHER TABLE

* X (CR)

80 PRINT "ANOTHER TABLE"; (CR)

90 INPUT A\$ (CR)

100 IF A\$ = "YES" THEN 40 (CR)

(LF)

* -3A3L(CR)

80 PRINT "ANOTHER TABLE";

90 INPUT A\$

100 IF A\$ = "YES" THEN 40

* B G '60' 0AL (CR)

60 FOR A = 2 TO X

* I (CR)

50 PRINT "TABLE OF THE" N"TH ROOTS OF 2 TO"X(CR)

(LF)

* V(CR)

60 FOR A = 2 TO X

* -A2L(CR)

50 PRINT "TABLE OF THE "N"TH ROOTS OF 2 TO"X

60 FOR A = 2 TO X

* EX (CR)

Ready

X - exchanges the line for the 3 following. Notice that (CR) is the first delimiter and (LF) is the last one.

MACROS

Suppose there are several identical mistakes in your program. You can use a macro to correct all of these mistakes in one sweep through the program.

Suppose all the variables A1 should be Z. Use the format (user response is underlined)

*BI(CR)

G'A1'~2C'Z'V(CR)(LF)

*BSK 100 EM(CR)

G'A1'?

*

Note that due to the 'V' each correction would be printed before G'A1'? but has been omitted here

This will begin at the beginning of the page and search for each occurrence of A1, change it to Z then list that line. It will be performed 100 times or until it runs out of A1 or comes to the end of the page. (G'A1'? indicates end of page)

To Write Your Own Macros

First type

*BI (CR)

Then any type of search message and alteration command

G '?' V (CR)(LF)

Simply G '?' V will list every occurrence of ?

followed by a (CR) then (LF)

Which will cause the * prompt to be printed.

* BSK 100 EM(CR)

Now type in BSK ##EM(CR) where ## is some number of times to perform the Macro. If you do not know how many times to perform the Macro then use a large number (100-500) in order to alter each mistake.

If an H is used instead of G then the Macro will be performed throughout the program (through each page) beginning on the present page. A G will perform the Macro on a given page.

6. **DIRECT** Lists file information from a disk directory. The command line may look like:

`DIRECT (file spec.) / options`

File specification represents a full five-part disk file specification, except for protection code but the system provides defaults for portions not specified. If the device is not specified, the public disk is assumed. The file name, extension and PPN can be replaced by *s to indicate you want to include all possibilities. Examples are:

`DIRECT (100, *) * .BAS` to list a directory of all files on the public disk for any programmer in project 100 with any file name that has a .BAS extension.

`DIRECT` to obtain a directory of all your files on the public disk.

`DIRECT (*,*) SNOOPY,*` to obtain a directory of all programs named SNOOPY under any account on the public disk.

`DIRECT DK1:!/W` to obtain a directory of the files on disk 1 in account (1,3). The /W option causes a faster abbreviated directing to be printed, listing file names only and printing several across the width of the page. This is a useful option when the file names are all you need.

7. **RESEQ** Will change line numbers in your program. Type `RUN $ RESEQ` and reply to the first question with the name of a program stored under your account

on which you wish RESEQ to operate. WARNING:
Any program you have in core at this time will
be lost because its space is taken by the RESEQ
program. Respond to the next prompter by typing
a line like

0 - 9000 = 100 + 10

which is taken to mean renumber all the lines in
my old program which had numbers from 0 thru 9000
and give them new numbers beginning with 100 and
incrementing by 10. RESEQ will modify all the
internal line number references as required. It
uses two passes to do so and prints appropriate
messages.

8. PASSWD Changes your password. It first requests your
new password, does not echo as you type, then
prints what your new password will be, pauses
briefly, and blots out the password for security.

9. TTYSET Modifies the computer's information about the
nature of your terminal. This program can be
run by typing the command SET.

Examples are:

SET WIDTH 50

This sets the output line width to 50 characters.

(Any number may be specified up to 254.) The
system will automatically start a new line
after 50 characters are printed.

SET LC OUTPUT

SET NO LC OUTPUT

These commands tell the system whether to send lower case characters to your terminal or to translate them to upper case. Only the LA36 terminals will display lower case characters.

SET LC INPUT &

SET NO LC INPUT tells the system whether or not to allow you to input lower case characters or to translate all your input to upper case.

Many other terminal characteristics can be set by this program. See DEC's RSTS-11 System User's Guide

WARNING: Use of the SET command causes the TTYSET program to replace (and destroy) what you currently have in your user space.

IV. Program Library

Certain accounts contain "public library" programs. One of these is account (1, 2) so that

RUN (1, 2) SYSTAT

runs the public library program SYSTAT. Account (1, 2) may also be represented by a dollar sign so that RUN (1, 2) SYSTAT or RUN \$SYSTAT or RUN SYSTAT\$ all accomplish the same thing.

Other public libraries and their abbreviations are:

(1, 3) = !

(1, 4) = %

(1, 5) = &

The contents of the libraries have been initially assigned as follows:

<u>DKO:</u>		<u>DK1:</u>
(1,2) = \$	The compiled forms of DEC system utility programs	Statistical programs
(1,3) = !	Local utilities and files	Other academic applications programs.
(1,4) = %	Programs waiting removal to proper disk	TUTOR series and game programs
(1,5) = &	BAS form of utilities	Not assigned

NB: Do not attempt to log-on under these account numbers. The programs available to you can be run from your own account by including the proper device name and account number in your RUN command.

B. Finding Useful Programs

A problem exists in getting complete program information to each user in an immediately useful format. Many of the programs were supplied by Digital Equipment User's Society (DECUS) and documentation may be ordered from them in those cases. The use of certain programs is explained in DEC's User's Guide. Other faculty and student users may be able to provide advice on certain programs or tasks.

In order to acquaint yourself with the programs in the computer library, you might follow these steps:

1. See above for allocation of library accounts by program application.
2. Consult the posted lists of available program titles and brief descriptions.
3. Obtain a DIRECTORY listing of any library account that may contain programs of interest to you--e.g., type DIR DK1:!/W.
4. List a program of possible interest and read (especially) the comments and PRINT messages.
5. Determine whether the program requires data files, keyboard in put or both.
6. Run the program.
7. Ask a member of the Computer Center Staff to check the files for further documentation.

C. Current and Future Library.

At the present time a collection of over 300 programs is available to the user of the academic Computer Center. These programs have been collected from several sources and vary significantly in complexity, utility, and documentation. Some of them have not yet been tested at Wofford.

This collection is still growing, but is limited by available disk space. In our efforts to keep the library current and useful the Computer Center staff would appreciate being notified of the good or bad features of the present programs, suggestions for improvements or additions, and comments which will help improve the documentation.

The listing on the following pages provides a brief description of the presently available programs.

V. Some items not in DEC manuals

- A. The USAGE CATEGORY question was added at Wofford and is explained in this manual.
- B. In BASIC-PLUS, the word PRINT may be abbreviated with the ampersand.
- C. A KB: can no longer be claimed with ASSIGN.
- D. Additional CCLs
 - 1. PLOT to assign KB7: (the plotter)
 - 2. FREE to deassign KB7:
 - 3. ABC a dummy CCL that currently prints the rest of the alphabet
 - 4. RESEQ (when implemented) will run the \$RESEQ program. You may include a file name in your command. The system will use your account number, the system device and the .BAS extension and resequence a program in your disk storage.