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THE UTILITY PROGRAMS

1.0 INTRODUCTION

The Utility Programs are a group of programs designed to help in the preparation of paper tape. They consist of an Editor program, two tabulator programs, a page format program, a binary tape assembler and disassembler which are described in later sections. The minimum complement of equipment to use these programs is any of the PDP-8 or a PDP-5 computer and a high speed reader. This program can utilize a high speed punch if one is available.

1.1 THE EXECUTIVE PROGRAM

The utility program is loaded in the normal manner using the BIN loader. The starting address of the program is 200. Once the program is started the computer is in the executive mode. Any of the utility programs may now be selected by typing the corresponding letter on the teletypewriter. Whenever a program is terminated control is returned to the executive program.

The executive program only responds to the letters B, D, E, F, L, N, P, Q and T, all other commands are ignored. The computer executes the following program when the corresponding keys are struck.

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B - Bin to QK program (See sec. 5.1)
D - Duplicator program (See sec. 6.0)
E - Editor program (See sec. 2.0)
F - Fortran tabulator program (See sec. 4.1)
L - Type 12 inches of leader and stay in executive program
N - Editor program alternate entry (See sec. 2.0)
P - Page format program (See sec. 3.0)
Q - QK to Bin program (See sec. 5.2)
T - Tabulator for assembly language program (See sec. 4.2)
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There are three switch register options common to all programs. Bit 11 determines whether the output is to be on the high speed reader or the teletypewriter. In the "one" position the output is on the high speed reader. In the "zero" position the output is on both. If low speed output only is desired, the high speed reader should be turned off and the switch placed in the zero position. This switch may be thrown at any time.

Bit 10 controls the optional halt in various programs. In the "one" position the program will stop the computer at an optional halt, while in the zero position optional halts are ignored.

In all programs for which the tape being processed is symbolic (ASCII), all non-printing symbols are deleted so that the printed copy indicates exactly what is on the tape. This feature may be defeated by putting bit "0" into the "1" position.

2.0   THE EDITOR PROGRAM

The editor program is used to correct a symbolic tape by copying it over and making necessary changes under teletype control. The tape to be edited is placed on the high speed reader and a corrected tape is produced on either the high or low speed punch by the switch register selection bit 11 described in section 1.1. This program may be entered from the executive program by either typing an E or an N while in the executive program.

Typing an E is the normal entry into the editor program. The program will then type a section of leader (200 code), read a section of the tape to be edited into the computer memory buffer, and insure that the tapes begin with a carriage return and line feed. Then the computer waits for a primary command described below. Typing an N enters the editor program without producing leader, or reloading the buffer. To reload the buffer type a second N.

2.1   THE PRIMARY COMMANDS

In the command mode of the editor program the computer ignores any key typed except C, E, T or L. These are the primary commands. Once they are typed the computer waits for a secondary command. At this point typing a rubout returns the program to the command mode and a new primary command may be typed.

Typing a C will eventually cause the computer to copy the tape to be edited onto the edited tape until a prearranged point determined by the secondary command. Typing an E "erases" the tape to be edited

until a prearranged point; while typing a T permits new material to be typed onto the edited tape from the teletypewriter. Typing an L indicates that the editing is finished, the computer then punches the trailer on the edited tape and returns control to the executive program.

2.2 THE SECONDARY COMMANDS

The secondary command must follow immediately after the primary command. They can be X (see sec. 2.4) a - (minus sign) or an I (see sec. 2.3), or any sequence of symbols, followed by a decimal number, and delimiter. This decimal number is interpreted as the number of lines for which this primary command must be executed. Typing a rubout before the secondary command is delimited permits a new secondary command to be entered, and typing two rubouts permits a new primary command to be entered.

Whenever the computer finishes an operation there is an optional halt. This may be ignored by placing bit 10 in the zero position as described in section 1.1. The purpose of this halt is to regain control in case wrong commands have been entered. If new commands are to be entered at this point, restart the program at "1200" (alternately start at 200 and type an N). The computer will now be in the command mode ready to accept a new primary command and continue on from where the computer halted.

If the secondary command is a number then it is interpreted as a desire to perform the primary command for that many lines. Thus C7 copies 7 lines, E5 erases 5 lines, and T3 permits 3 lines to be entered from the teletypewriter. A line for the purposes of this program must have less than 128 characters. If one attempts to copy a line with more than that many characters, the computer will halt in location 5362. Pressing continue will return control to the executive program.

In the case of all T commands an additional delimiter of a line feed in necessary. This permits an editing tape to be prepared so that an operator does not have to be present while the editing is in process. The editing tape is placed in the teletypewriter reader and controls the process.

2.3 THE IDENTIFICATION MODES

The identification mode is useful in editing longer programs
where it is impractical to count the number of lines until the desired
place is reached. To get into this mode immediately after typing the
primary command type either a minus sign or an I. This is followed by
a tag. The computer then performs the primary until it gets to the line
that begins with the tag. If a minus sign has been typed then the
computer returns to the command mode, but if an I has been typed then
the computer performs the primary command on this line as well. Thus
if it is desired, to copy everything up to the line but not including
the line numbered 300 the command would be C-300. However if it is
desired to copy that line as well the command would be CI300.

The minus mode does not work in the T mode, however if you
wish to type a group of lines the last one being numbered 300 you would
give the command TI300 followed by a carriage return and line feed.

A tag may consist of any combination of numbers, letters, *,
or /, and is terminated by any other symbol such as a space or a carriage
return. Typing a rubout immediately after the I or minus sign returns
the program to the command mode. Typing a rubout after a tag has been
typed but not delimited permits one to type another tag. Leading spaces
before a tag are ignored. However if one types CI followed, say, by a
comma, then the computer copies until it finds a line that has no tag,
that is, a line that begins with a symbol other than a letter, number,
/ or *.

2.4 THE CHARACTER MODE

If a primary command is followed by an X, then the number
typed is interpreted as so many symbols rather than lines. For example,
CX5 will copy 5 characters from a line. In the character mode the end of
a line will not be exceeded. For example typing EX1000 will erase all
the symbols on a line up to but not including the carriage return and
line feed.

The X may be immediately followed by an I than a tag entered. Now the primary command will be executed on the line until that tag is found. The primary command will also be executed on the tag and the delimiter.

2.5 NEW TAPES

The editor program may be used to merge two tapes together by copying one tape to the end, then place the second tape on the reader, type an N and copying it to the end.

3.0 PAGE FORMAT

The purpose of this program is to obtain hard copy, cut up into page sized formats for reports, etc. The listing included at the back of this program was prepared using the page format program. Place the tape to be formatted in the high speed reader. This program may be selected by typing P while in the executive mode. The program then types a section of leader and goes into the command mode. Now initialize the program as described in section 3.1.

3.1 THE B or P COMMAND

When it is desired to start the page format program the operator can type a B for begin. The program will then type out one page of text and number it page one. When this is finished there is an optional halt to permit the operator to remove the page from the teletypewriter. If it is desired to cut the program into page size sheets at a later time this halt may be omitted as described in section 1.1 for Bit 10.

If it is desired to start numbering the first page some number other than one, such as the case when a listing is an appendix to the report, as in the case of this one, then instead of typing B, type P followed by the number of the first page. P1 performs the same task as B.

3.2 THE N, E and L COMMANDS

At the conclusion of the page formatting of a tape there are several alternatives. If one types an E, the computer finishes off the page. On the other hand if a second tape is to be formatted immediately following the preceeding text, place this tape on the high spaced reader and type an N. In any case the computer remains in the command mode of the page format program until an L is typed causing the computer to type a section of trailer and return command to the executive program.

4.0 THE TABULATOR PROGRAMS

The tabulator programs are designed to align the columns in programs to make them more readable and to facilitate spotting errors.

4.1 FORTRAN TABULATOR

This program standardizes the format of fortran programs written for the PDP-8. Excess spaces are eliminated except in hollarith statements where they are used for formatting. To use this program place tape in high speed reader and type an F. A formatted tape is produced on the punch chosen (see section 1.1) and the control is returned to executive.

4.2 ASSEMBLY LANGUAGE TABULATOR

This program is written for the formats used in PAL and MACRO. One feature of this program is that comments which would be too long in pass 3 of PAL are automatically shortened by starting a new line. To use this program type a T after tape has been placed in the high speed reader.

5.0 QK LANGUAGE

The QK programs are translator programs from binary to QK and back. They are designed to help identify and edit binary tapes directly. For short programs this is a fast way of preparing a binary tape since all one does is type the sequency of octal instructions and an binary tape is produced in one pass.

5.1 BIN to QK

If one places a binary or RIM Format tape on the high speed reader and types a B a QK tape is produced. The format of the tape is the location followed by its contents both in octal. This symbolic tape may now be edited and then a new binary tape produced as described in the following section. For binary tapes the checksum is typed at the end. This must be edited out before converting back to binary.

The output of this program is in one of two formats. If bit 2 is in the "zero" position a continuous tape is prepared. This tape can be edited and then converted back to a binary tape with the QK-BIN program. If bit 2 is in the "one" position then the output is in page format.

5.2 QK to BIN

If one places a QK tape on the high speed reader and types a Q either a binary or RIM format tape is produced depending on the setting of bit 10 on the switch register (0 = BIN, 1 = RIM). The format of QK is less restrictive than that produced by the BIN to QK program. For example, leading zeroes may be omitted in octal designations. For entering quantities in successive location, instead of typing a new location number, simply type a period. Also, for the remainder of line after the instruction has been delimited, comments may be typed until the end of the line. Similarly, lines that are comments without numbers on them are ignored. No termination character is needed at the end of a program. Trailer is used to identify the end.

The following QK formats will produce the same binary tape:

```
        0200      5205
        0201      7402
        0202      3333
        0205      1201
        0206      5201
             and
        200       5205       COMMENT
           COMMENT
         .7402
         .3333
        205       1201
         .5201
```

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6.0 DUPLICATOR PROGRAM

This program is used to duplicate a binary tape. Place the tape to be duplicated in the high speed reader and type a D. The program checks for reader error by computing the checksum. If an error has occurred, the computer will halt before typing the trailer. In copying a rim tape the computer will halt because these tapes do not have a checksum at the end, therefore at this point press continue and the computer will finish the tape and return to the executive program.