1. IDENTIFICATION

1.1 Digital-7-94-U

1.2 DECTape Copy Program

1.3 January 21, 1966
2. ABSTRACT

The program is designed to copy all or part of any DECtape onto any other DECtape. The program reads a series of blocks, writes them on the second DECtape, and then rereads them checking for an accurate checksum and comparing the information just read with the information originally read. Any DECtape or comparison error will cause an identifiable halt. To keep the programming simple and to allow maximum space for copying purposes, block number references are entered using the console ACCUMULATOR switches. The program operates on either a 4K or 8K PDP-7. It is not designed for operation on a PDP-4.

3. REQUIREMENTS

3.1 Storage

The program occupies approximately the first 1400 locations of core memory but uses the remainder of memory through location (1) 7377 for copying and comparison areas.

3.2 Subprograms

The program makes use of the PDP-7 Bidirectional DECtape Subroutines (Digital-7-22A-I/O), with which the symbolic tape must be assembled. The subroutines are included in the binary tape used for running the program.

3.3 Equipment

Two DECtape drives attached to a PDP-7 DECtape control are required. The PDP-7 can have a 4K or larger memory.

4. USAGE

4.1 Loading

4.1.1 Mount the tape to be copied on a DECtape drive dialed to unit 1. The drive can be kept in WRITE LOCK position.

4.1.2 Mount the tape to be copied on a DECtape drive dialed to unit 2. The drive must be write enabled.

4.1.3 Read in the binary tape by starting at location (1) 7770.

4.1.4 Set bits 8-17 of the ACCUMULATOR switches to the first block to be copied (numbers 1-1100 only); then start at location 22.

4.1.5 When the computer halts, set bits 8-17 of the ACCUMULATOR switches to the last block number to be copied, and press CONTINUE.

4.1.6 When the computer stops at location 134 with the accumulator and link set to all 1's, copying has been completed. To copy another section, repeat the steps beginning at paragraph 4.1.4 using the required set of block numbers. Do not press CONTINUE.

4.2 Calling Sequence (Not Applicable)
4.3 Switch Settings

The ACCUMULATOR switches must be set to the starting block number before starting at 22, and to the final block number after the halt, which occurs immediately. Bits 6-17 are examined even though block numbers 1-1100 only are accepted.

4.4 The program can be restarted any time by setting the ACCUMULATOR switches to the first block to be copied and pressing START with the ADDRESS switches set to 22.

4.5 Errors in Usage

The following errors can occur:

<table>
<thead>
<tr>
<th>Halt Location</th>
<th>Meaning</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Illegal CAL instruction. Probable machine malfunction.</td>
<td>Reload the program and start over. If condition persists, the computer requires maintenance.</td>
</tr>
<tr>
<td>57</td>
<td>HALT to allow putting final block number in the ACCUMULATOR switches. Not an error.</td>
<td>Set ACCUMULATOR switches to final block number to be copied, and press CONTINUE.</td>
</tr>
<tr>
<td>134</td>
<td>Final halt. Accumulator and link should be all 1's.</td>
<td>Repeat program for additional areas to be copied, as necessary.</td>
</tr>
<tr>
<td>202</td>
<td>Interrupt occurred from other than DECtape, or a DECtape skip command did not function correctly. The ACCUMULATOR displays the result of an IORS command.</td>
<td>Start over. If error persists, maintenance should be performed to eliminate the spurious flag.</td>
</tr>
<tr>
<td>217</td>
<td>DECtape error during reading of original tape. The contents of the ACCUMULATOR lights indicate the type of error as follows: LAW 100 - Format error (should never occur) LAW 200 - Block number cannot be found LAW 300 - Non-end-of-tape error during searching</td>
<td>Press CONTINUE to try operation again. If the error is persistent, either the DECtape cannot be copied or the DECtape system itself is malfunctioning. Try copying another tape or section of tape, if possible.</td>
</tr>
</tbody>
</table>
5. **RESTRICTIONS**

The tapes copied must be in the standard DEC format of 1100b blocks of 400b words each. Note that block 0 cannot be copied.

6. **DESCRIPTION**

6.1 Discussion

The program first determines whether or not a 4K machine is used and allocates core locations accordingly. If a 4K machine is being used, 3000b locations (6 blocks) are allocated for reading and an additional 3000b locations are allocated for checking. If an 8K machine is used, 7000b locations (16b blocks) are allocated for each area.

The copying procedure is as follows:

1. Read (1)6 blocks from the original tape, in either direction.

2. Write the (1)6 blocks on the second tape, in either direction.

3. Reread the (1)6 blocks from the second tape, in either direction, into another core area and compare the two areas.

4. Repeat steps 1-3 until all requested blocks have been transferred, then halt.
6.2 Applications

The program can be used to copy any standard type of PDP-4, PDP-6, or PDP-7 DECTape without reference to the contents or data format on the tape providing only that the standard block format is used. It is, therefore, a fairly fast procedure for copying system tapes or other work tapes. This allows duplication of tapes for backup or for distribution to more than one user.

7. METHODS

(See Discussion, Section 6)

8. FORMAT

Standard PDP-4, PDP-6, and PDP-7 DECTape block format of 11008 addressable blocks of 4008 (18-bit) words each.

9. Execution Time

Measurements indicate that a complete reel of tape can be copied and checked in almost exactly 3 minutes using an 8K computer, or about 4 minutes and 20 seconds on a 4K computer.

10. PROGRAM

Program Listing is attached. See Digital-7-22A-I/O for a complete listing of the PDP-7 Bidirectional Subroutines which are not included with the listing of the Copy program itself.

10.1 Core Map (None)

10.2 Dimension List (None)

10.3 Parameter List (None)

10.4 Program Listing

/sTape Copy Program
/sLmm 1-21-66

/go, WLT
/CAP (JMP INTERR) /CLEAR FLAGS
/LAC 1
/DAC (NOP) /SET UP INTERRUPT
/LAC (NOP)
/DAC SW1 /SET SW1
/DZM 7777
/DZM 17777
/DAC 17777
/SAD 7777
/JMP 603 /SKIP IF 8K MACHINE
/LAC (16) /4K MACHINE
/DAC K1 /NUMBER OF BLOCKS PER PASS
/LAC (17800) /NUMBER OF WORDS PER PASS
/DAC K2
/LAC K1
/CHA

/go2,
DAC 0
LAC R1 = 1
ADD K2
DAC R3 = 1
TAD (-0)
DAC R1
DAC R2
ADD K2
DAC R3
LAS
AND (7777)
ADD 0
DAC BN
WLT
LAS
AND (7777)
DAC K2
JMP SW1+1
LAC (6)
DAC K1
LAC (3000)
JMP 002
GO3.
READ DATA
R0,
JMS MMRDS
LAC BN
JMP ERR1
10000
RA1
RA1
JMS WAIT
JMS MMRDS
LAC BN
JMP ERR2
20000
RA1
RA1
JMS WAIT
R2,
JMS MMRDS
LAC BN
JMP ERR3
20000
RA2
RA2
JMS WAIT
R2A,
JMS MMRDS
LAC BN
JMP ERR3
20000
RA2
RA2
JMS WAIT
R3,
COMPARE THE TWO AREAS
LAW RA1 = 1
DAC AX1
LAM
TAD R3 = 1
DAC AX2
LAC R3
CMA
ADD R3 = 1
DAC C1
/BLOCK DISTANCE
/START OF 1ST READ AREA
/3000 OR 7000
/START OF 2ND READ AREA
/SUBTRACT 1
/END OF 1ST READ AREA
/3000 OR 7000
/END OF 2ND READ AREA
/STARTING BLOCK
/STARTING BLOCK = BLOCK DISTANCE
/PUT IN FINAL BLOCK
/LAST BLOCK
/READ
/BLOCK NUMBER
/ERROR RETURN
/UNIT
/FIRST ADDRESS
/LAST ADDRESS, MODIFIED
/WRITE
/BLOCK NUMBER
/ERROR RETURN
/UNIT
/FIRST ADDRESS
/LAST ADDRESS, MODIFIED
/READ AGAIN
/BLOCK NUMBER
/ERROR RETURN
/UNIT
/FIRST ADDRESS, MODIFIED
/LAST ADDRESS, MODIFIED
/START OF FIRST AREA
/START OF 2ND AREA
/COUNTER
R4,  
LAC I AX1
BAD I AX2
SKP
JMP ERR4
ISZ C#1
JMP R4

SW1,  
NOP
LAC RN
ADD K#1
DAC RN
ADD K1
CMA
ADD K#2
ADD (1)
SMAYCLL
JMP R0
ADD K1
RTL
RTL
RTL
RTL
TAD (=0)
DAC K1
LAC R1=1
ADD K1
DAC R1
DAC R2
LAC R3=1
ADD K1
DAC R3
DAC (STLYCLCYHLT)
DAC SW1
JMP R0

INTERR,  
DAC ACSAVE
MMEF
SKP
JMP I MMERR
MMDF
SKP
JMP I MMDATA
MMBF
SKP
JMP I MMBLF
IORS
WLTY
CAP

DISWIS=JMP
LAC 0
RAS
DAC ACSAVE
ION
JMP I 0

MMAP110  
0
WAIT:
0
LAC I MWA1
ISZ MWDONE
JMP :=2
JMP I WAIT

ERR1:
WLT
JMP R0
ERR DURING INITIAL READ

ERR2:
WLT
JMP R1A
ERR DURING WRITING

ERR3:
WLT
JMP R2A
ERR DURING 2ND READ

ERR4:
WLT
JMP R0
/COMPARISON ERROR

AX1=10
AX2=AX1+1
RA1=1400
RA2=RA1+3000

START

11. DIAGRAM (None)

12. REFERENCES (None)