

1. IDENTIFICATION
- 1.1 Digital-8-16-S
- 1.2 Master Tape Duplicator/Verifier
- 1.3 July 20, 1965

2. ABSTRACT

This program will duplicate and verify 8-channel paper tapes using the PDP-8 with high-speed reader and high-speed punch. The program uses the program interrupt and allows both the reader and the punch to operate at maximum speed.

The program accumulates two types of checksums while reading and while punching: 1) the number of nonzero characters on the tape, and 2) the sum of characters on the tape (both are taken modulo 4096).

When duplicating, the program compares the checksums at the end of the tape with the checksums accumulated by the read routine. If these differ, a reader error has occurred and a message is typed. Tapes are verified by reading them and comparing accumulated checksums with those at the end of the tape. Only master tapes produced by the program may be duplicated. The master tape has the two checksums punched at the end.

3. REQUIREMENTS

3.1 Storage

The program uses all of memory, except for the last page, as a buffer.

3.3 Equipment

PDP-8 with high-speed reader and high-speed punch.

4. USAGE

4.1 Loading

The program is loaded with the Binary Loader (see Digital 8-2-U).

4.3 Switch Settings

4.3.1 Produce a Master Tape

A tape is read and duplicated by the punch. When the tape has run out of the reader, the accumulated checksums are punched. The tape that has been punched is the master tape used for duplication. It should be compared against the original to ensure that the tape was read correctly.

4.3.2 Duplicate the Master Tape

The master tape that has been produced (see 4.3.1) is reproduced by the punch. Checksums are accumulated by the read routine and are compared with the checksums at the end of the tape. Checksums are punched and are used for verification (see 4.3.3). If the master tape is short enough to fit into the buffer, the program will notify the operator that more copies may be remade without rereading the master. Blank tape is punched between copies.

4.3.3 Verify Duplication

Similar to duplication, but no punching takes place. Tapes are read and the accumulated checksums are compared against the checksums punched at the end.

4.3.4 General Procedure

4.3.4.1 Set C(SR) = 0200

4.3.4.2 Press LOAD ADDRESS; press START; the program will halt.

4.3.4.3 Set C(SR) for the mode of operation as follows:

Bit 0 = 1	Make master tape
Bit 1 = 1	Duplicate master tape
Bit 2 = 1	Verify duplication

4.3.4.4 Place tape in reader starting on blank tape (all modes of operation must be started with blank leader tape in the reader).

4.3.4.5 Turn reader on. Turn punch on.

4.3.4.6 Press CONTINUE.

4.3.4.7 The program will type a message when the operation has been completed and then it will halt.

4.3.4.8 Proceed from step 4.3.4.3 unless multiple copies are being duplicated.

5. RESTRICTIONS (Not Applicable)

6. DESCRIPTION

6.1 Discussion

This program uses the program interrupt to keep the reader and the punch running at full speed. The reader fills a buffer and the punch punches from it. Checksums are accumulated by both the reader and the punch routines.

7. METHODS (Not Applicable)

8. FORMAT (Not Applicable)

9. EXECUTION TIME

9.3 Average

Execution time is a function of reader time and punch time and hence depends upon the length of the tape.

10. PROGRAM

10.4 Program Listing

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/TAPE DUPLICATOR FOR PDP-5/8
/ -DEC-1/15/65
/SINGLE BUFFERING - READ AND PUNCH UTILIZING
/PROGRAM INTERRUPT
/COMPUTE A CHARACTER COUNT AND CHECKSUM
/FOR EACH TAPE - COMPARE WITH CHECKS AT
/END OF TAPE
/CHECKS ARE ALSO COMPUTED DURING PUNCHING
/AND COMPARED
/THREE MODES OF OPERATION:
/A. SWITCH 0 ON - MAKE MASTER TAPE
/B. SWITCH 1 ON - DUPLICATE MASTER TAPE
/C. SWITCH 2 ON - VERIFY DUPLICATION
/DURING DUPLICATION, THE PROGRAM WILL NOTIFY
/THE OPERATOR WHETHER OR NOT MORE COPIES
/CAN BE MADE WITHOUT RE-READING THE
/MASTER
/DEFINITIONS OF INTERRUPT LOCATIONS:
/FOR THE PDP-8; INTER=0
/FOR THE PDP-5; INTER=1
/PAGE 1
INTER=0

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*INTER+1
0001 5020 JMP HN DL /HANDLE INTERRUPT
0002 0632 NPNT, DPRT
0003 0600 E1, TES1
0004 0615 E2, TES2
*16
0016 0000 NDXR, 0 /AUTO-INDEX REGISTER
0017 0000 NDXP, 0 /AUTO-INDEX REGISTER
0020 6011 HN DL, RSF
0021 7410 SKP
0022 5431 JMP I READ /750 CAUSED INTERRUPT
0023 6021 PSF
0024 7410 SKP
0025 5434 JMP I PNC /75A PUNCH CAUSED INTERRUPT
0026 4567 JMS I CRLF /EXTRANEIOUS-CLEAR FLAGS
0027 6001 DSMS, ION /ENABLE INTERRUPT
0030 5400 JMP I INTER /RETURN
0031 0000 READ, 0 /CALLED AS A
0032 6014 RFC /SUBROUTINE TO PROVIDE
0033 5027 JMP DSMS /RETURN ADDRESS
0034 0000 PNC, 0 /CALLED AS SUBROUTINE

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0035	6026		PLS	/PROVIDES RETURN
0036	7200		CLA	
0037	5027		JMP DSMS	
0040	1417	PNCH,	TAD I NDXP	/GET NEXT CHARACTER
0041	7510		SPA	/IF IT IS 7777,IT
0042	5570		JMP I PDUN	/IS END OF TEXT
0043	3143		DCA HLD2	
0044	1143		TAD HLD2	
0045	7440		SZA	
0046	2145		ISZ ZROP	/COUNT NON-ZERO CHARACTERS
0047	7000		NOP	/MODULO 4096
0050	1147		TAD CHKP	/ACCUMULATE SUM MODULO 4096
0051	3147		DCA CHKP	
0052	1143		TAD HLD2	
0053	4034		JMS PNC	
0054	5040		JMP PNCH	/GO GET NEXT
0055	6012	RDI,	RRB	/READ 750 BUFFER
0056	3142		DCA HLD1	/SAVE IT
0057	5105	RST1,	JMP FRST	/OR "SCND" OR "THRD"
0060	1142		TAD HLD1	
0061	7440		SZA	
0062	2144		ISZ ZROR	/COUNT MODULO 4096
0063	7000		NOP	
0064	1146		TAD CHKR	/ACCUMULATE SUM
0065	3146		DCA CHKR	
0066	1160		TAD TIME	/RESET END-OF-TAPE TIMER
0067	3157		DCA TIMR	
0070	7410	RST2,	SKP	
0071	5155		JMP VY	
0072	1142		TAD HLD1	/GET CHARACTER
0073	3416		DCA I NDXR	/PUT IN BUFFER
0074	2163		ISZ RCNT	/IS BUFFER FULL?
0075	7410		SKP	/NO
0076	5571		JMP I FUL	/YES
0077	4031		JMS READ	/FETCH NEXT CHARACTER
0100	2164		ISZ STRT	/DELAY START OF PUNCHING
0101	5055		JMP RDI	
0102	7240		CLA CMA	
0103	3175		DCA SCON	
0104	5040		JMP PNCH	/START PUNCHING
0105	1142	FRST,	TAD HLD1	/TEST TO SEE IF
0106	1161		TAD TST1	/CHARACTER IS FIRST
0107	7640		SZA CLA	/IN CHECK-SUM IDENTIFIER
0110	5060		JMP RST1+1	/IF IT IS-SET SWITCH
0111	1153		TAD TRY2	/TO TEST FOR SECOND
0112	3057		DCA RST1	/CHARACTER NEXT
0113	5060		JMP RST1+1	
0114	1142	SCND,	TAD HLD1	/CHECK FOR SECOND CHARACTER
0115	1162		TAD TST2	/IN IDENTIFIER - IF FOUND

0116	7640		SZA CLA	/TEST FOR THIRD NEXT
0117	5123		JMP .+4	/IF NOT, RESET FOR FIRST
0120	1154		TAD TRY3	
0121	3057		DCA RST1	
0122	5060		JMP RST1+1	
0123	1152		TAD TRY1	
0124	5121		JMP .-3	
0125	1142	THRD,	TAD HLD1	/TEST FOR THIRD CHARACTER
0126	1161		TAD TST1	/IN IDENTIFIER - IF FOUND
0127	7640		SZA CLA	/READ CHECKS FROM TAPE
0130	5123		JMP .-5	/IF NOT - RESET FOR FIRST
0131	7240		CLA CMA	
0132	3416		DCA I NDXR	/SET END-OF PUNCH FLAG
0133	4541		JMS I GET1	
0134	3151		DCA MCHK	/MEASURED CHECK-SUM
0135	4541		JMS I GET1	
0136	3150		DCA MZRO	/MEASURED ZERO-COUNT
0137	5540		JMP I .+1	
0140	0303		SWT1	
0141	0565	GET1,	GET	/GET 12-BIT WORD
0142	0000	HLD1,	0	
0143	0000	HLD2,	0	
0144	0000	ZROR,	0	/# OF NON-ZERO READ
0145	0000	ZROP,	0	/#OF NON-ZERO PUNCHED
0146	0000	CHKR,	0	/CHECK SUM - READ
0147	0000	CHKP,	0	/CHECK SUM - PUNCH
0150	0000	MZRO,	0	/#OF NON-ZERO MEASURED
0151	0000	MCHK,	0	/CHECK SUM - MEASURED
0152	5105	TRY1,	JMP FRST	
0153	5114	TRY2,	JMP SCND	
0154	5125	TRY3,	JMP THRD	/WHEN VERIFYING-DON' START
0155	4031	VY,	JMS READ	/PUNCHING
0156	5055		JMP RD1	
0157	0000	TIMR,	0	
0160	0000	TIME,	0	
0161	7526	TST1,	7526	/2'S COMPLEMENT 1ST AND 3RD IDENTIFIER
0162	7653	TST2,	7653	/TWO'S COMPLEMENT OF 2ND IDENTIFIER
0163	0000	RCNT,	0	
0164	0000	STRT,	0	
0165	7000	NOPT,	NOP	
0166	7410	SKIP,	SKP	
0167	0345	CRLF,	CFLG	
0170	0000	PDUN,	0	
0171	0320	FUL,	BFUL	
0172	0077	BIT6,	0077	
0173	0000	DCON,	0	
0174	0000	VCNT,	0	
0175	0000	SCON,	0	/START OF PUNCHING FLAG
0176	0377	C377,	0377	
0177	0002	TWO,	0002	

		*200	CLA	
0200	7200		DCA Z VCNT	/RESET VERIFY COUNT
0201	3174		CLA	
0202	7200	LOOP,	DCA ZROR	/RESET PUNCH, READER
0203	3144		DCA ZROP	/COMPUTED CHECKS
0204	3145		DCA Z CHKR	
0205	3146		DCA Z CHKP	
0206	3147		DCA DCON	/RESET BUFFER OVER FLAG
0207	3173		RRB	/CLEAR HARDWARE FLAGS
0210	6012		PCF	
0211	6022		CLA	
0212	7200		DCA SCON	/RESET START PUNCH FLAG
0213	3175		TAD Z TRY1	/SET PROGRAM SWITCHES
0214	1152		DCA Z RST1	
0215	3057		TAD Z SKIP	
0216	1166		DCA Z RST2	
0217	3070		TAD Z SKIP	
0220	1166		DCA SWT1	
0221	3303		TAD DLAY	/SET START OF PUNCHING DELAY
0222	1341		DCA Z STRT	
0223	3164		HLT	
0224	7402	LOP1,	CLA OSR	
0225	7604		RAL	
0226	7004		SZL	
0227	7430		JMP CRTE	/BIT 0=1, CREATE MASTER
0230	5250		RAL	
0231	7004		SZL	
0232	7430		JMP DUP	/BIT 1=1, DUPLICATE
0233	5255		RAL	
0234	7004		SZL CLA	
0235	7630		JMP .+3	/BIT 2=1, VERIFY
0236	5241		CMA	/ERROR SET C(AC)=7777
0237	7040		JMP LOP1	
0240	5224		TAD NOPT	/NO PUNCHING - DON'T
0241	1165		DCA SWT1	/WAIT FOR PUNCH
0242	3303		TAD Z NOPT	
0243	1165		DCA RST2	/DON'T START PUNCHING
0244	3070		TAD VRPT	
0245	1342		DCA CONR	/SET-UP RETURN FOR END
0246	3336		JMP GO	
0247	5261		CLA	
0250	7200	CRTE,	TAD CRPT	
0251	1343		DCA CONR	/SET-UP RETURN FOR END
0252	3336		DCA Z VCNT	
0253	3174		JMP GO	
0254	5261		CLA	
0255	7200	DUP,	TAD DUPT	
0256	1344		DCA CONR	/SET-UP RETURN FOR END
0257	3336		DCA Z VCNT	
0260	3174		JMS CFLG	/CLEAR FLAGS
0261	4345	GO,		

0262	1337		TAD BUF	
0263	3016		DCA NDXR	/SET-UP BUFFER
0264	1337		TAD BUF	/POINTERS FOR
0265	3017		DCA NDXP	/READ AND PUNCH
0266	1340		TAD OVR	
0267	3163		DCA RCNT	/SET BUFFER-FULL COUNT
0270	1333		TAD SA	
0271	3000		DCA INTER	/INITIALIZE INTERRUPT
0272	1160		TAD Z TIME	
0273	3157		DCA TIMR	/SET END-OF-TAPE TIMER
0274	4031		JMS READ	/START READING
0275	5055		JMP Z RD1	
0276	2157	SAT,	ISZ Z TIMR	
0277	5276		JMP .-1	
0300	6002		IOF	/END-OF-TAPE
0301	7240		CLA CMA	
0302	3416		DCA I Z NDXR	/SET END-OF-PUNCHING FLAG
0303	7410	SWT1,	SKP	/OR NOP FOR VERIFY
0304	5736		JMP I CONR	
0305	1336		TAD CONR	
0306	3170		DCA PDUN	/SET RETURN FOR PUNCH DONE
0307	1175		TAD Z SCON	
0310	7700		SMA CLA	/DID WE START PUNCHING?
0311	5315		JMP .+4	/NO -
0312	6001		ION	/YES - WAIT FOR PUNCHING
0313	7200		CLA	
0314	5313		JMP .-1	
0315	1334		TAD SA1	/START PUNCHING
0316	3000		DCA INTER	
0317	5102		JMP Z FRST-3	
0320	7240	BFUL,	CLA CMA	/BUFFER-FULL
0321	3416		DCA I Z NDXR	/SET-UP END-OF-PUNCHING FLAG
0322	2173		ISZ Z DCON	
0323	1335		TAD RET	/'FILL'
0324	3170		DCA Z PDUN	
0325	5307		JMP BFUL-11	
0326	1341	FILL,	TAD DLAY	/ENTER WHEN BUFFER
0327	3164		DCA STRT	/OVERFLOWED AND HAS
0330	3175		DCA Z SCON	
0331	6022		PCF	
0332	5262		JMP GO+1	/BEEN PUNCHED
0333	0276	SA,	SAT	
0334	0312	SA1,	BFUL-6	
0335	0326	RET,	FILL	
0336	0000	CONR,	0	
0337	1063	BUF,	X-1	/START OF BUFFER
0340	1274	OVR,	X+210	/BUFFER-FULL COUNT
0341	7760	DLAY,	7760	/DELAY START OF PUNCHING
0342	0400	VRPT,	VRFY	/DONE POINTERS
0343	0404	CRPT,	CRET	

0344	0445	DUPT,	DUPL	
0345	0000	CFLG,	0	/CLEAR FLAGS
0346	6042		TCF	/TELEPRINTER
0347	6072		6072	/LIGHT PEN
0350	6772		MMCF	/MICRO TAPE
0351	6502		6502	/PLOTTER
0352	6732		6732	/DISABLE ERF FLAG (57A)
0353	7320		CLA CLL CML	
0354	7012		RTR	/SET C(AC)=2000
0355	6722		6722	/DISABLE WCO FLAG (57A)
0356	7004		RAL	/SET C(AC)=4000
0357	6702		6702	/DISABLE TCR FLAG (57A)
0360	6652		6652	/LINE-PRINTER FLAG
0361	6534		6534	/138 ADC FLAG
0362	6032		KCC	/KEY-BOARD (AND AC)
0363	5745		JMP I CFLG	
		PAUSE		
		*400		
		VERFY,	ISZ Z VCNT	/COMPUTED VS MEASURED CHECKS
0400	2174		JMS I E1	/VERIFY ERROR
0401	4403		JMP VER	/VERIFY OK
0402	5361		JMP VOK	/COMPUTED VS PUNCHED
0403	5351		JMS I E2	/MEMORY ERROR
0404	4404	CRET,	JMP MER	
0405	5345		JMS BLNK	
0406	4314		TAD HERE	
0407	1327		DCA INTER	/SET INTERRUPT POINTER
0410	3000		TAD T1	/PUNCH CHECKSUM
0411	1325		JMS Z PNC	/IDENTIFIER CODES
0412	4034		TAD T2	/BIT PATTERN IS:
0413	1326		JMS PNC	/10101010
0414	4034		TAD T1	/01010101
0415	1325		JMS PNC	/10101010
0416	4034		TAD CHKR	/PUNCH CHECKS
0417	1146		TAD C377	/ALTER CHECKS
0420	1176		JMS SIX	
0421	4231		TAD Z ZROR	
0422	1144		TAD Z TWO	
0423	1177		JMS SIX	
0424	4231		JMS BLNK	/PUNCH BLANK TAPE
0425	4314		TAD AD1	
0426	1335		JMS I PRNT	
0427	4734		JMP I LOP	
0430	5733		0	/PUNCH NUMBER IN AC
0431	0000	SIX,	DCA Z HLD2	
0432	3143		TAD HLD2	/IN BINARY FORMAT
0433	1143		RTR	
0434	7012		RTR	
0435	7012			

0436	7012		RTR	
0437	0172		AND Z BIT6	
0440	4034		JMS Z PNC	
0441	1143		TAD Z HLD2	
0442	0172		AND Z BIT6	
0443	4034		JMS Z PNC	
0444	5631		JMP I SIX	
0445	4403	DUPL,	JMS I Z E1	/COMPARE COMPUTED VS MEASURED CHECKS
0446	5347		JMP RER	/READER ERROR
0447	4404	GO1,	JMS I Z E2	/COMPARE COMPUTED VS PUNCHED CHECKS
0450	5345		JMP MER	/MEMORY ERROR
0451	1327		TAD HERE	
0452	3000		DCA INTER	
0453	1325		TAD T1	/PUNCH THIRD IDENTIFIER
0454	4034		JMS Z PNC	/READER STOPPED WHEN THIRD IDENTIFIER
0455	1146		TAD Z CHKR	/HAS BEEN FOUND, IE IT IS NOT IN THE
0456	4231		JMS SIX	/BUFFER
0457	1144		TAD Z ZROR	
0460	4231		JMS SIX	
0461	4314		JMS BLNK	/PUNCH BLANK TAPE
0462	1173		TAD Z DCON	
0463	7640		SZA CLA	
0464	5356		JMP DOK	/BUFFER OVERLAP-NO MORE DUP.
0465	1324		TAD DCNT	
0466	7640		SZA CLA	/STARTED MULTIPLE DUPLICATION??
0467	5305		JMP TST4	/MULTIPLE DUPLICATION HAS STARTED
0470	1336		TAD AD2	
0471	4734		JMS I PRNT	
0472	7402		HLT	/READ NUMBER FROM SR
0473	7604		CLA OSR	
0474	7041		CMA IAC	
0475	3324		DCA DCNT	
0476	1332		TAD HER1	
0477	3170		DCA Z PDUN	/SET RETURN FOR PUNCHING DONE
0500	1360		TAD BF	/RESET BUFFER POINTER
0501	3017		DCA Z NDXP	/RESET PUNCH-COMPUTED CHECKS
0502	3145		DCA Z ZROP	
0503	3147		DCA Z CHKP	
0504	5040		JMP Z PNCH	/START PUNCHING
0505	2324	TST4,	ISZ DCNT	/ARE WE DONE YET?
0506	7410		SKP	
0507	5356		JMP DOK	/YES
0510	1337		TAD AD3	/NO
0511	4734		JMS I PRNT	
0512	7602		HLT CLA	/HALT
0513	5300		JMP TST4-5	/MAKE NEXT COPY
0514	0000	BLNK,	0	/SUBROUTINE TO PUNCH
0515	1323		TAD MCNT	/BLANK TAPE
0516	3157		DCA Z TIMR	
0517	4034		JMS Z PNC	

0520	2157		ISZ Z TIMR	
0521	5317		JMP .-2	
0522	5714		JMP I BLNK	
0523	7600	MCNT,	7600	
0524	0000	DCNT,	0	
0525	0252	T1,	0252	/CODES FOR CHECK-SUM
0526	0125	T2,	0125	/IDENTIFIERS
0527	0530	HERE,	HERE+1	
0530	7200		CLA	
0531	5330		JMP .-1	
0532	0447	HER1,	G01	
0533	0202	LOP,	LOOP	
0534	0673	PRNT,	PRIN	
0535	0741	AD1,	TAB1	/MASTER CREATED
0536	0751	AD2,	TAB2	/PRINT TABLE
0537	1007	AD3,	TAB3	/PRINT TABLE
0540	1017	AD4,	TAB4	/VERIFY OK
0541	1026	AD5,	TAB5	/DUP OK
0542	1036	AD6,	TAB6	/MEMORY ERROR
0543	1045	AD7,	TAB7	/READER ERROR
0544	1054	AD8,	TAB8	/VERIFY ERROR
0545	1342	MER,	TAD AD6	
0546	5354		JMP VOK+3	
0547	1343	RER,	TAD AD7	
0550	5354		JMP VOK+3	
0551	1174	VOK,	TAD Z VCNT	/VERIFY OK
0552	4402		JMS I Z NPNT	
0553	1340		TAD AD4	
0554	4734		JMS I PRNT	
0555	5733		JMP I LOP	
0556	1341	DOK,	TAD AD5	/DUPLICATION OK
0557	5354		JMP VOK+3	
0560	1063	BF,	X-1	
0561	1174	VER,	TAD Z VCNT	/VERIFY OK
0562	4402		JMS I Z NPNT	
0563	1344		TAD AD8	
0564	5354		JMP VOK+3	
0565	0000	GET,	0	/ROUTINE TO READ 2-6BIT CHARACTERS
0566	4031		JMS Z READ	
0567	6012		RRB	
0570	7106		CLL RTL	
0571	7006		RTL	
0572	7006		RTL	
0573	3142		DCA Z HLD1	
0574	4031		JMS Z READ	
0575	6012		RRB	
0576	1142		TAD Z HLD1	
0577	5765		JMP I GET	

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*600
0600 0000 TES1, 0 /COMPARE READER COMPUTED SUMS
0601 7200 CLA
0602 1144 TAD Z ZROR /TO MEASURED SUMS
0603 7041 CMA IAC /IF EQUAL, RETURN TO CALL+2
0604 1150 TAD Z MZRO /OTHERWISE RETURN TO CALL +1
0605 7640 SZA CLA
0606 5600 JMP I TES1
0607 1146 TAD Z CHKR
0610 7041 CMA IAC
0611 1151 TAD Z MCHK
0612 7650 SNA CLA
0613 2200 ISZ TES1
0614 5600 JMP I TES1
0615 0000 TES2, 0 /COMPARE PUNCH COMPUTED SUMS
0616 7200 CLA
0617 1145 TAD Z ZROP /TO READER COMPUTED SUMS
0620 7041 CMA IAC
0621 1144 TAD Z ZROR /IF EQUAL, RETURN TO CALL+2
0622 7640 SZA CLA /OTHERWISE RETURN TO CALL+1
0623 5615 JMP I TES2
0624 1146 TAD Z CHKR
0625 7041 CMA IAC
0626 1147 TAD Z CHKP
0627 7650 SNA CLA
0630 2215 ISZ TES2
0631 5615 JMP I TES2
0632 0000 DPRT, 0 /CONVERT BINARY WIRD IN AC
0633 3143 DCA Z HLD2 /TO 4 DIGIT UNSIGNED DECIMAL
0634 3142 DCA Z HLD1 /NUMBER AND TYPE IT
0635 1264 TAD CNTR
0636 3272 DCA CNT /IDENTICAL TO ROUTINE IN LIBRARY
0637 1263 TAD ADDR
0640 3245 DCA XYZ+3
0641 7410 SKP
0642 3143 XYZ, DCA Z HLD2
0643 7100 CLL
0644 1143 TAD Z HLD2
0645 1265 TAD CON
0646 7430 SZL
0647 2142 ISZ Z HLD1
0650 7430 SZL
0651 5242 JMP XYZ
0652 7200 CLA
0653 1142 TAD Z HLD1
0654 1271 TAD C260
0655 4325 JMS TYPE
0656 3142 DCA Z HLD1
0657 2245 ISZ XYZ+3
0660 2272 ISZ CNT
0661 5244 JMP XYZ+2

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0662	5632		JMP I DPRT	
0663	1265	ADDR,	TAD CON	
0664	7774	CNTR,	7774	
0665	6030	CON,	6030	
0666	7634		7634	
0667	7766		7766	
0670	7777		7777	
0671	0260	C260,	0260	
0672	0000	CNT,	0	
0673	0000	PRIN,	0	
0674	3143			/ROUTINE TO PRINT A STRING
0675	1543		DCA Z HLD2	/OF PACKED ASCII CHARACTERS
0676	7450		TAD I HLD2	/ENTER WITH S.A. OF STRING IN
0677	5320		SNA	
0700	7012		JMP CR	/AC; EXIT ON 0 ELEMENT IN STRING
0701	7012		RTR	/AFTER TYPING CR-LF
0702	7012		RTR	
0703	4310		RTR	
0704	1543		JMS GPRT	
0705	4310		TAD I Z HLD2	
0706	2143		JMS GPRT	
0707	5275		ISZ Z HLD2	
0710	0000	GPRT,	JMP PRIN+2	
0711	0172		0	/THIS ROUTINE CONVERTS
0712	1334		AND Z BIT6	/6BIT TO ASCII
0713	7510		TAD M40	
0714	1335		SPA	
0715	1336		TAD C100	
0716	4325		TAD C200	
0717	5710		JMS TYPE	
0720	1337	CR,	JMP I GPRT	
0721	4325		TAD CAR	/TYPE CR-LF
0722	1340		JMS TYPE	
0723	4325		TAD LF	
0724	5673		JMS TYPE	
0725	0000	TYPE,	JMP I PRIN	
0726	6046		0	/TYPE CHARACTER IN AC
0727	6041		TLS	
0730	5327		TSF	
0731	6042		JMP .-1	
0732	7200		TCF	
0733	5725		CLA	
0734	7740	M40,	JMP I TYPE	
0735	0100	C100,	7740	
0736	0240	C200,	0100	
0737	0215	CAR,	0240	
0740	0212	LF,	0215	
0741	1501	TAB1,	0212	
0742	2324		1501	/PRINT TABLES
0743	0522		2324	
			0522	

0744	4003		4003
0745	2205		2205
0746	0124		0124
0747	0504		0504
0750	0000		0000
0751	2305	TAB2,	2305
0752	2440		2440
0753	2327		2327
0754	1124		1124
0755	0310		0310
0756	0523		0523
0757	4024		4024
0760	1740		1740
0761	1625		1625
0762	1502		1502
0763	0522		0522
0764	4017		4017
0765	0640		0640
0766	0317		0317
0767	2011		2011
0770	0523		0523
0771	4024		4024
0772	1740		1740
0773	0205		0205
0774	4015		4015
0775	0104		0104
0776	0540		0540
0777	2022		2022
1000	0523		0523
1001	2340		2340
1002	0317		0317
1003	1624		1624
1004	1116		1116
1005	2505		2505
1006	0000		0000
1007	2022	TAB3,	2022
1010	0523		0523
1011	2340		2340
1012	0317		0317
1013	1624		1624
1014	1116		1116
1015	2505		2505
1016	0000		0000
1017	4040	TAB4,	4040
1020	2605		2605
1021	2211		2211
1022	0631		0631
1023	4017		4017
1024	1340		1340
1025	0000		0000

1026	0425	TAB5,	0425
1027	2014		2014
1030	1103		1103
1031	0124		0124
1032	1117		1117
1033	1640		1640
1034	1713		1713
1035	0000		0000
1036	1505	TAB6,	1505
1037	1517		1517
1040	2231		2231
1041	4005		4005
1042	2222		2222
1043	1722		1722
1044	0000		0000
1045	2205	TAB7,	2205
1046	0104		0104
1047	0522		0522
1050	4005		4005
1051	2222		2222
1052	1722		1722
1053	0000		0000
1054	4040	TAB8,	4040
1055	2605		2605
1056	2211		2211
1057	0631		0631
1060	4005		4005
1061	2222		2222
1062	1722		1722
1063	0000		0000
1064	0000	X,	0

/START OF BUFFER

ADDR	0663
AD1	0535
AD2	0536
AD3	0537
AD4	0540
AD5	0541
AD6	0542
AD7	0543
AD8	0544
BF	0560
BFUL	0320
BIT6	0172
BLNK	0514
BUF	0337
CAR	0737
CFLG	0345
CHKP	0147
CHKR	0146
CNT	0672

CNTR	0664
CON	0665
CONR	0336
CR	0720
CRET	0404
CRLF	0167
CRPT	0343
CRTE	0250
C100	0735
C200	0736
C260	0671
C377	0176
DCNT	0524
DCON	0173
DLAY	0341
DOK	0556
DPRT	0632
DSMS	0027
DUP	0255
DUPL	0445
DUPT	0344
E1	0003
E2	0004
FILL	0326
FRST	0105
FUL	0171
GET	0565
GET1	0141
GO	0261
GO1	0447
GPRT	0710
HERE	0527
HER1	0532
HLD1	0142
HLD2	0143
HNDL	0020
INTER	0000
LF	0740
LOOP	0202
LOP	0533
LOP1	0224
MCHK	0151
MCNT	0523
MER	0545
MZRO	0150
M40	0734
NDXP	0017
NDXR	0016
NOPT	0165
NPNT	0002

OVR	0340
PDUN	0170
PNC	0034
PNCH	0040
PRIN	0673
PRNT	0534
RCNT	0163
RD1	0055
READ	0031
RER	0547
RET	0335
RST1	0057
RST2	0070
SA	0333
SAT	0276
SA1	0334
SCND	0114
SCON	0175
SIX	0431
SKIP	0166
STRT	0164
SWT1	0303
TAB1	0741
TAB2	0751
TAB3	1007
TAB4	1017
TAB5	1026
TAB6	1036
TAB7	1045
TAB8	1054
TES1	0600
TES2	0615
THRD	0125
TIME	0160
TIMR	0157
TRY1	0152
TRY2	0153
TRY3	0154
TST1	0161
TST2	0162
TST4	0505
TWO	0177
TYPE	0725
T1	0525
T2	0526
VCNT	0174
VER	0561
VOK	0551
VERFY	0400
VRPT	0342
VY	0155

X	1064
XYZ	0642
ZROP	0145
ZROR	0144

11. DIAGRAMS (Not Applicable)
12. REFERENCES (Not Applicable)