## SOFTWARE FEATURES

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If your KIM, SYM, or AIM system is hooked up to a printer or teletype get ready to have some fun! In the January 1979 issue of Kilobaud there was an article on page 64 called "Say it with Banner". This program prints out giant characters on your printer. There were three problems with the program:

- 1. It is written in 8080 code.
- 2. It uses octal notation,3. It uses almost 8K of memory.

I took the general concept of printing large characters and wrote an orginal program that has the following features:

- 1. Written in 6502 code.
- 2. I/O independent.
- Uses HEX notation.
   Only uses 2K of memory.
- 5. Relocatable data tables.
- 6. Easy user modification of character sets.

Let's talk about the I/O configuration first. Location 2004 and 2005 defines the Input character routine location for your system. If your terminal echos your input change 2003 to 4C. The character output routine location for your system is defined by locations 2007 and 2008. Your output routine must do the following:

- 1. Provide a line feed if necessary.
- 2. Provide null characters if neces
  - sary,
- 3. Must preserve the X, Y, and accumulator registers.

Text can be stored anywhere in memory and is defined by locations 200C and 200D. The text string can be as long as you want as long as you don't run out of memory. The data tables can be stored anywhere in memory as long as the starting address of the tables is stored in 2009 and 200A. SYM users will want to store the tables right after the program. The print character is defined in location 200B. Use the HEX equivalant of the ASCII character you want. The program is set up to use an @.
I will explain later on how to make up your own
characters or modify some of the ones I made up. To use the program start at 2000 and GO. You will see a prompt ( $\gg$ ). Type in the text you want

printed out. The program treats a carriage return as a space so take note. You terminate the text input with an @. If you typed in all valid characters you will see "@ o k" printed. Get your paper ready and type a carriage return to start the printing. If you type an illegal character you will see "@ " with the illegal characters sandwiched between the @ and the . Retype the text using only legal characters. At the end of the printout the program will prompt for more text. The legal characters are A thru Z, 0 thru 9, space, c/r, and the following characters: \* - + : ! ; ? \$ , . My characters are 10 rows by 35 columns. Obviously this is too big for the AIM printer. Don't worry, you can make up your own character set to work on the AIM. To create your own character set just follow these simple rules:

- 1. Always store ff at the end of the tables.
- 2. The first BYTE should be the HEX equivalent of the ASCII character.
- 3. The second BYTE should be the HEX number of data Bytes.
- 4. Carriage returns are defined by EE.
  5. Store the configuration of the charac
- ter in a serial manner.

  6. A "print spaces" data Byte is defined by Bit 7 being set to zero and Bits 0 thru 6 set to the number of spaces you want printed. Example: 07 would print 7 spaces.
- 7. To print a mark (or a character) set Bit 7 to one and Bits 0 thru 6 set to the number of marks. Example: 87 would print 7 @'s.

Maybe this will help you understand a little better. In order to print an "1" (one) that is 1(one) that is 15 columns by 7 rows wide, just put this in the tables: 31 OA EE EE 8F EE 8F EE 8F EE EE E. The 31 is the HEX equivalent of ASCII character one. The OA is the number of data Bytes. Then I print 2 carriage the number of data bytes. Inen 1 print 2 called returns, 3 rows of 15 characters and 2 more carriage returns. Hope you enjoy this program. If you want to modify any of my characters you can find their location by storing the character in 0004, then call the find character subroutine. The character's location plus 2 will be stored in 0000 and 0001.

0010	2000				#KIM-1	BANNER PROGRAM	
0015	2000					EN BY JIM ZUBER	12/23/78
0020	2000					01 01 2022K	12, 23, 70
0025	2000					<b>*</b> =\$0	
0030	0000				PNTL	*=*+1	
0035	0001				PNTH	*=*+1	
0040	0002				BUF1	*=*+1	
0045	0003				BUF2	<b>*</b> =*+1	
0050	0004				TEMP	*=*+1	
0055	0005				TEMPX	<b>*</b> = <b>*</b> +1	
0060	0006				TEMPY	<b>≠=*</b> +1	
0065	0007						
0070	0007				#KIM I	/0	
0075	0007				BETCH	=\$1E5A	
00B0	0007				OUTCH	=\$1EA0	
0085	0007				CRLF	=\$1E2F	
0090	0007						
0095	0007				E08	=\$40	FEND OF STRING CHAR
0100	0007						
0105	0007					*=\$2000	
0110	2000	4C	0E	20	STAR	JMP OVER	
0115	2003	4C	2C	21	INU	JMP INPT	FINPUT ROUTINE
0120	2006	4C	34	21	OUTV	JMP OUTC	FOUT VECTOR
0125	2009	00			TBLL	.BYTE \$00	FTABLE LOW
0130	200A	30			TBLH	.BYTE 430 22	FTABLE HIGH
0135	200B	40			PRCH	.BYTE \$40	PRINT CHAR
0140	200C	00			BUFL	BYTE \$96 50	#BUFFER LOW
0145	200D	40			BUFH	BYTE \$40 21	#BUFFER HIGH
0150	200E						
0155	200E	D8			OVER	CLD	
0160	200F	ΑO				LDY #0	
0165	2011		FΑ	20		JSR INTB	FINPUT TEXT
0170	2014	A9				LDA #/>	FFROMPT CHAR
0175	2016		06			JSR OUTV	
0180	2019		06	20		JSR OUTV	
0185	201C	A9				LDA #\$OD	SEND A CR
0190	201E	20	06	20		JSR OUTV	

000000000000000				_			
888888888888888888888888888888888888888		0195 0200		20 03 20	CHAR	JBR INV	<b></b> FINPUT STRING
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			91 02 C9 40		STA (BUF1),Y CMP #EOS	FEND OF STRING?
86566	888888888888888888888888888888888888888			FO 06		BEO CHEK	AEMD OF SIKING!
86888	88888	0215		20 10 21		JSR INCB	
2000	8888	0220		4C 21 20		JMP CHAR	
<b>8888</b>	-86888 88888888888888888888888	0225 0230 <b>888</b>	2030 2033	20 FA 20 A0 00	CHEK	JSR INTE	FCMECK CHARS
	000000000000000000000000000000000000000		2035	B1 02	LOP3	LDY #Q LDA (BUF1),Y	
	06666666666666666666		2037	C9 40		CMP #EOS	FEND STRING?
		0245	2039	F0 17		BEQ OK	TENS OTHER
		0250	203B	85 04		STA TEMP	
2000	886	0255 0260 <b>666</b>	203D 2040	20 C9 20 C9 FF		JSR FDCH	FIND CHAR
86888		888 0265	2042	DO 08		CMP ##FF BNE LOP4	#IS IT BAD?
86886		0270	2044	A5 04		LDA TEMP	
88888		9 <b>00</b> 9 <b>00</b> 0275	2046	20 06 20		JSR DUTV	START OVER
88888		988 0275 988 0280	2049	4C 00 20		JMP STAR	VSIARI DVER
0000 <b>0</b> 00000		0285	204C	20 10 21	LOP4	JSR INCB	
	************************	0290	204F	4C 33 20		JMP LOP3	
	8656666666666666666666	7777	2052 2054	A9 4F 20 06 20	OK	LDA #'0 JSR DUTV	PROMPT "OK"
000000000000000000000000000000000000000	000000000000000000000000000000000000000	0305	2057	A9 4B		LDA #'K	
		0310	2059	20 06 20		JSR OUTV	
		0315	205C	A9 OD		LDA #\$OD	
	000000000000000000000000000000000000000	0705	205E	20 06 20		JSR DUTV	AUATT FOR KEY
888888888888888888888888888888888888888	000000000000000000000000000000000000000		2061 2064	20 03 20 20 FA 20		JSR INV JSR INTB	#WAIT FOR KEY #READY TO PRINT
	656566 6566666	0335	2067	AO OO	LOP6	LDY #0	ACHD! IO ACEN!
	888888888	0340	2069	B1 02		LDA (BUF1),Y	
	00000000	0345	206B	C9 40		CMP #EOS	FEND?
866666	988	0350 0355	206D 206F	DO 03 4C 00 20		BNE LOP7	
222 <b>2222</b>	000000000000000000000000000000000000000	^7/^	2072	85 04	LOP7	JMP STAR Sta temp	
	000000000000000000000000000000000000000	A7/E	2074	20 C9 20		JSR FDCH	FFIND CHAR
000000000000000000000000000000000000000		0370	2077	20 BB 20		JSR PNTC	PRINT IT
		0375	207A	A9 OD		LDA #\$OD	;3 ROWS
		0380 0385 man	207C 207F	20 06 20 20 06 20		JSR OUTV JSR OUTV	
	98888888888888888888888888888888888888	~700	2082	20 06 20		JSR DUTV	
	566666		2085	20 10 21		JSR INCB	INC BUFFER
	8888888	0400	2088	4C 67 20		JMP LOP6	
	00000000	0405 0410	208B 208B	A0 00	PNTC	LDY #0	PRINT CHAR
380888	888	0415	208D	B1 00	FRIC	LDA (PNTL),Y	\$SUBROUTINE
2222222		0420	208F	C9 EE		CMP #\$EE	FTIME TO CARRIAGE RETURN?
	000000000000000000000000000000000000000		2091	DO OB		BNE LP10	
000000000000000000000000000000000000000	000000000000000000000000000000000000000	0430 0435	2093 2095	A9 OD 20 06 20		LDA #\$OD JSR DUTY	FOUTPUT C/R
		0440	2073	4C BF 20		JMP STOP	
		0445	209B	85 04	LP10	STA TEMP	∮GET DATA
			209D	29 80		AND ##80	#MARK OR SPACE
						BNE MARK	
		~ ^ ^ / ^	209F	DO OD		I DY TEMP	AMUST RE SPACE
		988 0460	20A1	A4 04	LP11	LDY TEMP LDA #\$20	#MUST BE SPACE #OUTPUT SPACE
00000	0.6566666666666666666666666666666666666	^^ ^			LP11	LDY TEMP LDA #\$20 JSR DUTV	
		0460 0465 0470 0475	20A1 20A3 20A5 20A8	A4 04 A9 20 20 06 20 88	LP11	LDA #\$20 JSR DUTV DEY	FOUTPUT SPACE
00000 00000 88800 88800	30000000000000000000000000000000000000	0460 0465 0470 0475 0480	20A1 20A3 20A5 20A8 20A9	A4 04 A9 20 20 06 20 88 F0 14	LP11	LDA #\$20 JSR DUTV DEY BEQ STOP	FOUTPUT SPACE
02008 02008 62003 80008 60000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0485	20A1 20A3 20A5 20A8 20A9 20AB	A4 04 A9 20 20 06 20 88 F0 14 4C A3 20		LDA #\$20 JSR OUTV DEY BEQ STOP JMP LP11	FOUTPUT SPACE  FANY MORE?  MUST BE
00008 00088 88808 88808 88808 888080888888	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0485 988 0490	20A1 20A3 20A5 20A8 20A9	A4 04 A9 20 20 06 20 88 F0 14 4C A3 20	LP11	LDA #\$20 JSR DUTV DEY BEQ STOP	FOUTPUT SPACE
00008 00088 88808 88808 88808 888080888888	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0495 0490 0495 0500	20A1 20A3 20A5 20A8 20A9 20AB 20AE 20B0 20B2	A4 04 A9 20 20 06 20 88 F0 14 4C A3 20 A5 04 29 7F A8	MARK	LDA #\$20 JSR DUTV DEY BEQ STOP JMP LP11 LDA TEMP AND #\$7F TAY	FOUTPUT SPACE  FANY MORE?  MUST BE  HUST BE MARK  MASK BIT 7
00008 00088 88808 88808 88808 888080888888	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0490 0495 0500 0505	20A1 20A3 20A5 20A8 20A9 20AB 20AE 20B0 20B2 20B3	A4 04 A9 20 20 06 20 88 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20		LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET	#OUTPUT SPACE  #ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR
00000 00000 00000 00000 00000000000 0000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0485 0480 0490 0495 0500 0505 0510	20A1 20A3 20A5 20A8 20A9 20AB 20AE 20B0 20B2 20B3 20B6	A4 04 A7 20 20 06 20 88 F0 14 4C A3 20 A5 04 27 7F A8 AB 0B 20 20 06 20	MARK	LDA #\$20 JSR DUTV DEY BEQ STOP JMP LP11 LDA TEMP AND #\$7F TAY	FOUTPUT SPACE  FANY MORE?  MUST BE  HUST BE MARK  MASK BIT 7
02008 00000 00000 00000 000000000000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0490 0495 0500 0505	20A1 20A3 20A5 20A8 20A9 20AB 20AE 20B0 20B2 20B3 20B6 20B9	A4 04 A7 20 20 06 20 88 F0 14 4C A3 20 A5 04 27 7F A8 AB 0B 20 20 06 20	MARK	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK #ANY MORE?
02008 00000 8600 00000 00000000000000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0495 0500 0500 0510 0510 0510 0520 0520	20A1 20A3 20A5 20A8 20A9 20AE 20B0 20B2 20B3 20B6 20B6 20B9 20BA 20BC	A4 04 A7 20 20 06 20 88 F0 14 4C A3 20 A5 04 27 7F A8 AD 0B 20 20 06 20 88 F0 03 20	MARK LP12	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12	#OUTPUT SPACE  #ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE
00000000000000000000000000000000000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0490 0500 0500 0510 0510 0510 0520 0520 052	20A1 20A3 20A5 20A8 20A9 20AE 20B0 20B2 20B3 20B6 20B6 20BA 20BC 20BF	A4 04 A7 20 20 06 20 88 FO 14 4C A3 20 A5 04 29 7F AB OB 20 20 06 20 88 FO 03 20 CA	MARK	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK #ANY MORE?
00000000000000000000000000000000000000	00000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0490 0590 0505 0510 0515 0520 0520 0525 0530 0533	20A1 20A3 20A5 20A8 20A9 20AE 20B0 20B2 20B3 20B6 20B6 20B9 20BA 20BC	A4 04 A7 20 20 06 20 88 F0 14 4C A3 20 A5 04 27 7F A8 AD 0B 20 20 06 20 88 F0 03 20	MARK LP12	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12	#OUTPUT SPACE  #ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE
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00000 00000 00000 00000000000000000000		04460 04455 0470 0475 0480 0480 0480 0490 0500 0500 0510 0510 0510 0520 0520 052	20A1 20A3 20A5 20A8 20A9 20AB 20B2 20B3 20B6 20B9 20B9 20BC 20BF 20C0	A4 04 A7 20 20 06 20 88 F0 04 29 7F A8 AD 0B 20 20 88 FO 03 4C B3 20 CA FO 06 20 88 20 20 20 88 20 20 20 20 20 20 20 20 20 20 20 20 20	MARK LP12 STOP	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC	JANY MORE? JANY MORE? JMUST BE JMUST BE MARK JMASK BIT 7  PRINT CHAR JOUTPUT MARK JANY MORE? JMUST BE JCHECK END
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0490 0500 0500 0510 0510 0510 0520 0520 052	20A1 20A3 20A5 20A9 20AB 20AE 20B0 20B2 20B3 20B6 20B9 20BA 20BC 20BF 20C0	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06	MARK LP12	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER
00000 00000 00000 000000000000 00000000	00000000000000000000000000000000000000	04460 04455 0470 0475 0480 0485 0490 0500 0500 0515 0510 0515 0520 0530 0535 0638 0638 0638 0638 0638 0638 0638 0638	20A1 20A3 20A8 20A9 20AB 20AB 20B0 20B2 20B3 20B6 20B9 20BA 20BC 20BF 20C0 20C2 20C5 20C8 20C9	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06	MARK LP12 STOP LP13	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC RTS	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0480 0490 0500 0500 0510 0510 0510 0520 0520 052	20A1 20A3 20A5 20A8 20A9 20AB 20B2 20B3 20B6 20B9 20BA 20BC 20BF 20C0 20C2 20C5 20C8 20C9 20C9	A4 04 A7 20 20 06 20 88 F0 04 20 06 20 88 AD 0B 20 20 CA FO 06 20 88 20 20 60 20 88 20 20 20 88 20 20 20 20 20 20 20 20 20 20 20 20 20	MARK LP12 STOP	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PHTC RTS  JSR INTP LDY \$0	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0490 0490 0505 0510 0510 0515 0520 0525 0520 0530 0525 0530 0535 0530 0545 0545 0545 0550 0560 0560 0560 0570	20A1 20A3 20A5 20A8 20A9 20AB 20B2 20B3 20B6 20B9 20B6 20BF 20C0 20C2 20C5 20C8 20C9 20CC 20CC	A4 04 A7 20 20 06 20 88 14 AC A3 20 A5 04 29 7F AB 0B 20 20 06 20 88 FO 03 4C B3 20 CA FO 06 20 1E 21 4C BB 20 60 E	MARK LP12 STOP LP13 FDCH	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC RTS  JSR INTP LDY \$0 LDA (PNTL),y	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #FINC POINTER #GO BACK  #FIND CHARACTER
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	988 04460 0445 0475 0475 0480 0485 0490 0500 0500 0515 0510 0515 0520 0535 988 0535 988 0535 988 0550 0588 988 0550 0560 0560 0560 0560 0560 0560 0560	20A1 20A3 20A8 20A9 20AB 20B0 20B2 20B3 20B6 20B7 20B6 20B7 20C0 20C2 20C5 20C9 20C9 20C9 20C0 20C0 20C0 20C0 20C0	A4 04 A9 20 20 06 20 BB FO 14 4C A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 BB FO 03 4C B3 20 CA ED 20 4C BB 20 4C BB 20 4C BB 20 60 CF FF	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR DUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR DUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	0460 0465 0470 0475 0480 0480 0490 0490 0505 0510 0510 0515 0520 0525 0520 0530 0525 0530 0535 0530 0545 0545 0545 0550 0560 0560 0560 0570	20A1 20A3 20A8 20A9 20AB 20AE 20B2 20B3 20B6 20B6 20B6 20B6 20B6 20C0 20C2 20C5 20C9 20C9 20C9 20C0 20C0 20C0 20C0 20C0	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06 20 1E 21 4C BB 20 60 20 05 21 A0 00 B1 00 C9 FF F0 1B	MARK LP12 STOP LP13 FDCH	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC RTS  JSR INTP LDY \$0 LDA (PNTL),y	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	0460 0445 0475 0475 0480 0480 0480 0505 0500 0505 0515 0520 0520 0520 0530 0530 0530 0530 053	20A1 20A3 20A8 20A9 20AB 20AE 20B2 20B3 20B6 20B6 20B6 20B6 20B6 20C0 20C2 20C5 20C9 20C9 20C9 20C0 20C0 20C0 20C0 20C0	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06 20 1E 21 4C BB 20 60 20 05 21 A0 00 B1 00 C9 FF F0 1B	MARK LP12 STOP LP13 FDCH	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PNTC RTS  JSR INTP LDY \$0 LDA (PNTL),Y CMP \$\$FF BEQ OUT1	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	988 04460 0445 0475 0475 0480 0485 0490 0500 0500 0515 0520 0515 0520 0535 0888 0535 988 0535 988 0550 0560 0560 0560 0560 0560 0560 0570 057	20A1 20A3 20A8 20A9 20AB 20B0 20B2 20B3 20B6 20B7 20B6 20B7 20C0 20C2 20C5 20C9 20C9 20C6 20C2 20C9 20C0 20D2 20D4 20D4 20D4 20D4 20D4 20D4 20D	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06 20 1E 21 4C BB 20 60 20 05 21 A0 00 C9 FF F0 1B C5 04 F0 18 C8	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF BEQ OUT LNY BEQ OUT LNY	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE? #MUST NOT BE
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04455 0470 0475 0480 0480 0480 0588 0590 0500 0515 0520 0535 0535 0530 0530 0530	20A1 20A3 20A8 20A9 20AB 20AB 20B0 20B2 20B3 20B6 20B6 20B6 20B7 20C0 20C2 20C5 20C9 20C9 20C9 20C0 20C2 20C9 20C0 20C0	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06  20 1E 21 4C BB 20 60  20 05 21 A0 00 B1 00 C9 FF F0 1B C5 04 F0 1B C8 B1 00	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##57F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF BEQ OUT1 INY LDA (PNTL),Y	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04455 0470 0475 0480 0480 0480 0580 0500 0510 0510 0520 0520 0520 0520 052	20A1 20A3 20A8 20A8 20A8 20AE 20B2 20B3 20B6 20B6 20B6 20BC 20C5 20C5 20C8 20C9 20CC 20CC 20CC 20CC 20D2 20D4 20D4 20D8	A4 04 A7 20 20 06 20 B8 F0 14 AC A3 20 A5 04 27 7F AB AD 0B 20 20 06 20 B8 FO 03 AC B3 20 CA FO 06 20 1E 21 AC BB 20 60 20 05 21 AO 00 B1 00 C7 FF C5 04 FO 18 C8 B1 00 18	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF BEQ OUT LNY BEQ OUT LNY	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE? #MUST NOT BE
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04455 0470 0475 0480 0480 0480 0588 0590 0500 0515 0520 0535 0535 0530 0530 0530	20A1 20A3 20A8 20A9 20AB 20AB 20B0 20B2 20B3 20B6 20B9 20BA 20BC 20C0 20C2 20C5 20C9 20C9 20C9 20C2 20C2 20C9 20C9 20C9	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06  20 1E 21 4C BB 20 60  20 05 21 A0 00 B1 00 C9 FF F0 1B C5 04 F0 1B C8 B1 00	MARK LP12 STOP LP13 FDCH	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PHTC RTS  JSR INTP LDY \$0 LDA (PNTL),Y CMP \$\$fF BEQ OUT CMP TEMP BEQ OUT1 INY LDA (PNTL),Y CLC	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04465 0470 0475 0480 0480 0480 0588 0590 0515 0510 0515 0520 0515 0520 0516 0530 0535 0530 0535 0538 0538 0538 0538	20A1 20A3 20A8 20A9 20AB 20AB 20B0 20B2 20B3 20B6 20B6 20B6 20B7 20C9 20C9 20C9 20C9 20C9 20C9 20C9 20D4 20D8 20D9 20D8 20D9 20D8 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A9 20 20 06 20 B8 F0 14 AC A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 B8 F0 03 AC B3 20 CA F0 06  20 1E 21 AC BB 20  20 05 21 AO 00 B1 00 C9 FF F0 1B C5 04 F0 1B C5 04 F0 1B C8 B1 00 B1 00 A9 00	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF BEQ OUT LNY LDA (PNTL),Y CLC ADC PNTL STA PNTL LDA #0	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04455 0470 0475 0480 0480 0480 0505 0505 0515 0520 0520 0520 0520 052	20A1 20A3 20A8 20A8 20A8 20A8 20B2 20B3 20B6 20B6 20B6 20B6 20B7 20C0 20C2 20C5 20C8 20C9 20CC 20C2 20D4 20D4 20D6 20D6 20D6 20D6 20D6 20D6 20D7 20D8 20D8 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A9 20 20 06 20 B8 F0 14 AC A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 B8 FO 03 AC B3 20 CA FO 06 20 1E 21 AC BB 20 AO 05 21 AO 00 B1 00 C9 FF F0 1B C5 04 F0 1B C5 04 F0 1B C8 00 B1 00 C9 FF T0 1B C5 04 F0 1B C5 00 A9 00 A5 01	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PHTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP TEMP BEQ OUT CMP TEMP BEQ OUT1 INY LDA (PNTL),Y CLC ADC PNTL STA PNTL LDA #0 ADC PNTH	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04465 0470 0475 0480 0480 0480 0588 0590 0515 0510 0515 0520 0515 0520 0516 0530 0535 0530 0535 0538 0538 0538 0538	20A1 20A3 20A8 20A9 20AB 20B0 20B2 20B3 20B6 20B9 20BC 20B2 20C0 20C2 20C5 20C9 20C9 20C9 20C9 20C9 20D0 20D2 20D4 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A9 20 20 06 20 B8 F0 14 AC A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 B8 F0 03 AC B3 20 CA F0 06 20 1E 21 AC BB 20 AC BB 20 CO DE	MARK LP12 STOP LP13 FDCH	LDA \$\$20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND \$\$7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13 JSR INCP JMP PHTC RTS  JSR INTP LDY \$0 LDA (PNTL),Y CMP \$\$fF BEQ OUT INY LDA (PNTL),Y CLC ADC PNTL STA PNTL LDA \$0 ADC PNTH STA PNTH	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04455 0470 0475 0480 0480 0480 0505 0505 0515 0520 0520 0520 0520 052	20A1 20A3 20A8 20A9 20AB 20B0 20B2 20B3 20B6 20B6 20B6 20B7 20C0 20C2 20C5 20C9 20C6 20D0 20D2 20D4 20D4 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A9 20 20 06 20 B8 F0 14 AC A3 20 A5 04 29 7F AB AD 0B 20 20 06 20 B8 FO 03 AC B3 20 CA FO 06 20 1E 21 AC BB 20 AO 05 21 AO 00 B1 00 C9 FF F0 1B C5 04 F0 1B C5 04 F0 1B C8 00 B1 00 C9 FF T0 1B C5 04 F0 1B C5 00 A9 00 A5 01	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PHTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP TEMP BEQ OUT CMP TEMP BEQ OUT1 INY LDA (PNTL),Y CLC ADC PNTL STA PNTL LDA #0 ADC PNTH	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	988 04460 0465 0470 0475 0480 0495 0590 0515 0520 0535 988 0535 988 0550 0550 0550 0550 0550 0550 0550	20A1 20A3 20A8 20A9 20AB 20B0 20B0 20B2 20B3 20B6 20B6 20B6 20B7 20C0 20C2 20C5 20C9 20C9 20C9 20C0 20D2 20D4 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D8 20D9 20D9 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A9 20 20 06 20 B8 F0 14 4C A3 20 A5 04 29 7F A8 AD 0B 20 20 06 20 B8 F0 03 4C B3 20 CA F0 06 20 1E 21 AC BB 20 CO 10 1B CS 11 00 CS 12 1 CS 13 1 00 CS 14 1 00 CS 15 04 CS 16 00 CS 17 00 CS 18 00	MARK LP12 STOP LP13 FDCH LOP1	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##57 TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PHTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP TEMP BEQ OUT CMP TEMP BEQ OUT LMP (PNTL),Y CLC ADC PNTL STA PNTL LDA #0 ADC PNTH STA PNTH JSR INCP	#ANY MORE? #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE?  #MUST NOT BE #BYTE COUNT
00000 00000 00000 000000000000 00000000	20000000000000000000000000000000000000	04460 04465 0470 0475 0480 0480 0480 0588 0590 0500 0515 0520 0530 0535 0880 0535 0880 0535 0880 0535 0880 0535 0530 0536 0536 0536 0536 0536 053	20A1 20A3 20A8 20A8 20A8 20A8 20A8 20B2 20B3 20B6 20B6 20B6 20B6 20C0 20C2 20C5 20C8 20C9 20CC 20CC 20C0 20D2 20D4 20D4 20D6 20D9 20D0 20D2 20D4 20D6 20D6 20D6 20D6 20D7 20D8 20D8 20D9 20D8 20D9 20D9 20D9 20D9 20D9 20D9 20D9 20D9	A4 04 A7 20 20 06 20 B8 F0 14 AC A3 20 A5 04 27 7F A8 AD 0B 20 20 06 20 B8 CO 33 AC B3 20 CA 60	MARK LP12 STOP LP13 FDCH	LDA ##20 JSR OUTV DEY BEQ STOP JMP LP11 LDA TEMP AND ##7F TAY LDA PRCH GET JSR OUTV DEY BEQ STOP JMP LP12 DEX BEQ LP13  JSR INCP JMP PNTC RTS  JSR INTP LDY #0 LDA (PNTL),Y CMP ##FF BEQ OUT LMP ##FF BEQ OUT LMP ##FF BEQ OUT LNY LDA (PNTL),Y CLC ADC PNTL STA PNTL LDA #0 ADC PNTH STA PNTH JSR INCP JSR INCP JSR INCP	#ANY MORE? #MUST BE #MUST BE #MUST BE MARK #MASK BIT 7  PRINT CHAR #OUTPUT MARK  #ANY MORE? #MUST BE #CHECK END  #INC POINTER #GO BACK  #FIND CHARACTER #SUBROUITNE #PICK UP ILLEGAL?  #RIGHT ONE? #MUST NOT BE #BYTE COUNT  #ADD TO POINTER

```
0655
       20F0
               20 1E 21
                             OUT1
                                     JSR INCP
                                                        FLOOK AT DATA
0660
        20F3
               B1
                  00
                                     LDA
                                          (PNTL),Y
        20F5
0665
               AA
20
                                     TAX
                                                        BYTE IN X
0670
        20F6
                  1E 21
                                     JSR
                                         INCP
0675
       20F9
               60
                                     RTS
0480
        20FA
       20FA
0685
               AD OC 20
                             INTB
                                     LDA BUFL
                                                        #INITIALIZE
       20FD
0690
               85 02
                                     STA BUF1
                                                        BUFFER SUB
0695
       20FF
               AD OD 20
                                     LDA BUFH
0700
       2102
               85 03
                                     STA BUF2
0705
       2104
               60
                                     RTS
       2105
0710
       2105
2108
                            INTP
0715
              AD 09 20
                                     LDA TBLL
                                                        INITIALIZE
0720
              85 00
                                     STA PNTL
                                                        *POINTER SUB
0725
       210A
              AD 0A 20
                                    LDA TBLH
STA PNTH
0730
       210D
              85
                  01
0735
       210F
              60
                                     RTS
0740
0745
       2110
       2110
              18
                            INCB
                                    CLC
                                                        FINCREMENT
0750
              A5 02
                                    LDA BUF1
       2111
                                                        #BUFFER SUB
0755
       2113
              69
                                     ADC ##1
                  01
0760
       2115
              85
                  02
                                     STA BUF1
       2117
2119
0765
              A5 03
                                         BUF2
                                    LDA
0770
0775
              69
                 00
                                     ADC
                                         #0
       211B
                                    STA BUF2
              85 03
0780
       211D
              60
                                    RTS
0785
0790
0795
       211E
       211E
              18
                            INCP
                                    CLC
                                                        INCREMENT
              A5 00
69 01
       211F
                                    LDA PNTL
0800
       2121
                                    ADC #1
                                                        POINTER SUB
              85 00
0805
       2123
                                    STA PNTL
       2125
              A5
0810
                 01
                                    LDA PNTH
0815
       2127
              69
                 00
                                    ADC
                                        #0
0820
       2129
              85
                 01
                                        PNTH
                                    STA
0825
0830
       212B
212C
              60
       212C
0835
              84
                 06
                            INPT
                                    STY
                                        TEMPY
                                                       FSAVE Y
0840
       212E
              20 5A 1E
                                                       #GET A CHAR
                                    JSR
                                        GETCH
0845
       2131
              A4
                 06
                                    LDY
                                        TEMPY
0850
       2133
              60
                                    RTS
       2134
0855
0860
       2134
              48
                            DUTC
                                    PHA
                                                       SAVE CHAR
       2135
                                         TEMPX
0865
              86 05
                                    STX
                                                       FAND X AND Y
0870
       2137
              84
                 06
                                    STY
                                        TEMPY
0875
       2139
213B
              0.9
                 OD
                                    CMP
                                        #$0D
                                                       FIS IT A C/R?
0880
              DO
                                        CONT
                 06
                                    BNE
                 2F 1E
0885
       213D
              20
                                        CRLF
                                    JSR
0890
       2140
              4C
                 46 21
                                    JMP
                                        RESTOR
                                                       FRET BACK THE REGS AND RETURN
0895
       2143
              20
                 A0
                    1E
                            CONT
                                    JSR
                                        DUTCH
                                                       FOTHERWISE USE KIM OUTPUT.
0900
       2146
              A6
                 05
                            RESTOR LDX
                                        TEMPX
                                    LDY
0905
       2148
              A4
                 06
                                         TEMPY
0910
       214A
              68
                                    PLA
                                                       FRETORE THE ACC.
0915
      214B
              60
                                    RTS
                                                       FAND RETURN
                            FINISH .END
0920
      2140
```

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20 07 EE EE EE EE EE EE EE 41 20 A3 EE A3 EE A3 EE OF 85 0A 85 EE A3 EE A3
2200
                                                                                          84 EE 84 1B 84 EE A3 EE A3 EE 50 23 A3 EE A3 EE
                                                                                 2400
                                                                                 2410
2420
                                                                                                                       11
92
84
2210
2220
                                                                                          A3 EE
                                                                                                  11
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                                                                                                                            85 08
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                                                                                              11 85
A3 EE
                                                                                                       08 85
A3 EE
                                                                                                               EE 11
84 1B
                                                                                          FF
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                                                                                                                                 11
                                                                                                                                     92
                                                                                                                                         EE
                                       85
                                           ĒΕ
                                               85
                                                    0A
                                                        85
                                                            OA
                                                                 85
                                                                                 2430
2230
         ΕE
                 EE
                          OA
                                  0A
                                                                                          20
                                                                                                                            FF 84 1R
                                                                                                                                         84
                                                                                                                                             EE
                                                                                                                                                  84
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2240
         0A
             85 OA
                     85 EE 85 OA 85 OA 85 EE
                                                        01
                                                            A1 EE 03
                                                                         8D
                                                                                 2440
                                                                                                       84
                                                                                                           15
                                                                                                               84 EE
                                                                                                                        A3 EE A3 EE 04
                                                                                                                                             84
                                                                                                                                                  EE
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                                                                                                                                                       02
                     04 8B 05 8B EE
EE 85 19 85 EE
        03 BD EE
85 19 85
                                           43
85
                                               22
19
                                                       EE
                                                                                          EE 52 21
08 85 EE
2250
                                                   A3
                                                            Α3
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11 92 EE 53 36 04 81 OF 8B EE 03 82 0E
2260
2270
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             13 88 EE
                         88 13 88 EE 88
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EE 02 9F EE 03 9D EE 04 9B
A3 EE 85 0A 85 0A 85 EE 85
2280
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            EE
                 A3
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         85 19 85 EE
EE A3 EE A3
2290
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24A0
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                                                                                                                                                           0A
                                                            OA
                                                                 85
                                                                                             EE 03 8F 0C 82 EE 04 8D 0D 81 EE 54
EE 1E 85 EE 1E 85 EE A3 EE A3 EE A3
1E 85 EE 1E 85 EE 55 14 A3 EE A3 EE
85 EE 85 EE 85 EE A3 EE A3 EE A3 EE
EE 11 8A EE 0B 89 EE 05 89 EE 88 EE
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22A0
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                     85 0A 85 EE 85 0A
                                               85 QA
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                                                                                 24B0
         EE
             85
                 OA
22B0
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                     85 19 85 EE 85 19 85 EE 46 25 A3 EE A3 OF 85 OA 85 EE OF 85 OA 85 EE OF 85 OA
             85 EE
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         ΕE
            A3 EE
                                                                                          ΕE
22D0
                                                                                                                                                  56
                                                                                                                                                      1C
EE
                                                                                                                                                          18
05
                     85 0A 85 EE 0F 85 0A 85 EE
26 A3 EE A3 EE A3 EE 85 19
                                                                 85
                                                                                              EE 11 BA EE 0B 89 EE 05 89 EE
EE 0B 89 EE 11 8A EE 18 8B EE
                                                            1E
85
22E0
         85 EE 0F
                                                                     EE
                                                                         1E
                                                                                 24E0
                                                                                          BB EE
         85 EE 47
                                                                                 24F0
                                                                                          89
22F0
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2300
                                  91 0A 88 EE 48
85 EE 0F 85 EE
                                                        18
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            EE
                 91
                     0A 88 EE
                                                            A3 EE A3 EE
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                                                                                 2550
             EE 84 EE 84 EE 84 EE 02 A1 EE 03 A8 2A A3 EE A3 EE 0F 85 EE 0D 84 05 84 EE 07 84 0D
                                                        03 A0 FF 04
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         ΕE
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8B EE 85 16 88 EE
                                                                                                                       85 EE 85 10
30 1C A3 EE
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                              15 84 EE
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                                                                 4C
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         11
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                     A3 EE 85 EE 85 EE 85 EE 85 EE 85
                                                                                                      85
23A0
         EE
                                                                                 25A0
                                                                                          19
                                                                                                  EE
                                                                                                                   EE
             A3
                                                                                              85
                                                                                                               85
                                                            OC BE EE BF
                         18 A3 EE A3 EE 17 8C EE
         ΕE
             85 EE
                      40
                                                                                 25B0
                                                                                          EΕ
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                                                                                                  ΕE
                                                                                                           ΕE
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                                                                                                                        ΕE
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                                                                                                                                    A3
                                                                                                                                         EE
23B0
                                                                                                      A3
                                                                                                               31
                                                                                                                                ΕE
                                                                                                                                             A3
                                                                                                                                                 EE
                                                                                                                                                      A3
                                                                                                                                                           EΕ
                     OC 8E EE 17 8C EE A3 EE A3
1A 89 EE 13 8A EE OD 89 EE
                                                            ΕE
                                                                 4E 19 A3
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85 EE 85
                                                                                                      EE 32 30 94 0A 85 EE 94 0A 0A 85 0A 85 0A 85 EE 85 0A 85 OA EE 85 0A 85 OA
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23C0
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             A3 EE
                                                            OD 89 EE 06
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         ΕE
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                                           4F
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         89
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         84 EE 84 1B 84 EE 84 1B 84 EE 84 1B 84 EE 84 1B
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             5410
                                                                         85 EE A3 EE A3 EE A3 EE 34 1B 10 93 EE 10 93 EE 10 93 EE 10 93 EE 10 85 EE 10 85 EE 10 85 EE A3 
               3420
             3430
             3440
3450
                                                                            OA 85 OA 85 EE 85 OA 85 OA 85 EE 94 OA 85 EE
             3460
                                                                         OA 85 EE 94 OA 85 EE 36 CA A3 EE A3 EE A3 EE 85 O8 85 OC 85 EE 85 O8 85 OC 85 EE 92 OC 85 
             3470
             3480
             3490
34A0
             34B0
                                                                       38 24 A3 EE A3 EE A3 EE B5 OA B5 OA B5 EE A3 EE B5 OA B5 EE B1 B5 OB B5 EE B1 B5 OB B5 EE
             34C0
             34D0
             34E0
             34F0
                                                                         11 85 08 85 EE A3 EE A3 EE A3 EE 0D 07 EE 2A 34 EE 09 82 06 82 06 82 EE 0B 82 04 82 04 82 EE 0D 82 02 82 82 EE 0F 86 EE 09 92 EE 0F 86 EE 0D 82 02 82 82 EE 0B 82 04 82
             3800
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             3530
                                                                     04 82 EE 09 82 06 82 06 82 EE 2E 0D EE EE EE EB EE B5 EE 85 EE 85 EE EE EE EE ED DE B5 EE 0F 85 EE 0F
             3540
             3550
             3560
             3570
```

EDITORS NOTE: The disassembler program was originally written for the Apple and appeared in Doctor Dobbs Journal (Sept 76). It has been modified for KIN by Bob Kurtz and your editor. Bob Kurtz wrote the article.

## KIM-1 "DISASSEMBLER" PROGRAM

Bob Kurtz Micro-Z Co P O Box 2426 Rolling Hills Ca 90274

## PRELIMINARY:

The purpose of the disassembler is to take any program that has been entered into memory in the KIM-1, and to print-out an "object" code and a "source" code listing of this program - to permit analysis and modification, if desired. In a sense, it takes a completed program and reconstructs the assembly language format - or "disassembles" the program.

The following is a sample of the print-out format:

Address	Object Code	Source Code
23BC-	E8	INY
23BD-	A9 53	LDA #53
23BF-	85 01	STA 01
23C1	91 7E	STA (7E),Y
23C3-	4C 64 1C	JMP 1C64

```
DISASSEMBLER PROGRAM FOR THE 6502
0020
      2000
               #WRITTEN BY STEVE WOZNIAK & ALLEN BAUM
               FAND PUBLISHED IN DOCTOR DOBBS JOURNAL
0030
      2000
               #SEPT 1976
0040
       2000
0050
      2000
0060
      2000
0070
       2000
                                   *=$0
0072
                           PCL
                                   *=*+1
       0000
                           PCH
                                   *=*+1
0073
       0001
                           COUNT *=*+1
FORMAT *=*+1
0075
      0002
0080
      0003
                           LENGTH *= *+1
0090
      0004
0100
                           LMNEM *=*+1
RMNEM *=*+1
YSAVE *=*+1
      0005
0110
      0006
0142
0150
      0007
      0008
      000B
                           #KIM I/O TO FOLLOW
0160
                           PRTBYT =$1E3B
0170
       0008
0180
      0008
                           OUTCH =$1EA0
0190
      0008
                           CRLF
                                   =$1E2F
0191
      0008
                           CLEAR
                                  ≈$1C64
0192
      0008
                           OUTSP
                                   =$1E9E
0200
      000B
0210
0211
      0008
                                   *=$2000
             20 OF 20
                           START
                                   JSR DSMBL
      2000
0212
      2003
             20 9E 1E
                                    JSR OUTSP
             20 9E 1E
0213
      2006
                                    JSR OUTSP
0214
      2009
             20 9E 1E
                                    JSR OUTSP
             4C 64 1C
A9 0D
0215
      200C
                                   JMP CLEAR
0220
                           DSMBL
                                   LDA #13
      200F
             85 02
                                   STA COUNT
0230
      2011
```

2.7 3880 85 EE OF 85 EE O5 99 EE 05 99 EE 05 99 EE OF 85 EE OF 85 EE 3A 16 EE EE EE EE 05 85 OD 85 EE 05 85 0D 85 EE 05 85 0D 85 EE EE EE EE 21 13 EE EE EE EE 85 03 9B EE 85 03 9B EE 85 03 9B EE EE EE EE 3B 16 EE EE EE EE 05 85 0E 85 EE 04 35A0 35B0 35C0 86 OE 85 EE 02 88 OE 85 EE EE EE EE 3F 27 17 8C 35D0 EE 17 8C EE 17 8C EE 1E 85 EE 85 02 8B OC 85 EE 35E0 85 02 8B OC 85 EE 85 02 8B OC 85 EE OD 96 EE OD 35F0 96 EE OD 96 EE 24 30 02 85 08 92 EE 02 85 08 92 EE 02 85 08 92 EE 02 85 08 85 08 85 EE A3 EE A3 EE 02 85 08 85 08 85 EE 02 92 08 85 EE 02 92 08 3600 3610 3620 3630 3640 3650 3660 3670 3680 3690 36A0 36B0 36C0 47 5D 44 01 76 23 04 61 47 D3 02 01 96 97 E6 62 3600 97 F6 12 A0 F7 D7 40 00 97 6C 82 40 E7 F6 00 88 36E0 B7 64 44 21 BA 0E 02 01 0F FD 00 01 A9 C1 00 00 36F0 FF FE 06 C0 76 F5 C6 D0 FF D6 00 40 A7 FC 42 60

The Address and Object Code columns are the standard listings for the program under scrutiny. You will notice that the disassembler has arranged the code listing by one, two, or three byte commands and has printed the address column accordingly.

The Source Code columns contain the MOS Technology 650X Mnemonic abbreviations for the command - and the Operand listing. The following is an explanation of the address mode for the various operands:

Uperand	Address mode
blank	Accumulator, Implied
#53	Immediate
01	Zero Page
01,X 01,Y	Zero Page, indexed by X or Y
(7E),Y	Indirect Indexed
(7E,X)	Indexed Indirect
1C64	Absolute of Branch
(1C64)	Indirect
1C64,X	Absolute (indexed by X)
1C64,Y	Absolute (indexed by Y)

## PROCEDURE:

- Load the starting address of the program to be disassembled into locations 0000 (Low byte) and 0001 (High byte).
- 2. Go to location 2000
- 3. Press "G" on terminal

The "disassembler" will now print-out the first 13 commands of the program under scrutiny. At the end of this print-out, simply press "G" again and the next 13 commands will be printed out. Continuing to press "G" whenever the program stops, will step you through the entire program under investigation.

The program stops after each 13 commands. If you wish to modify this, change the byte in location 2010 from \$0D (13 decimal) to any number up to \$FF (256 decimal).

If portions of the disassembled program do not appear to make sense, these may be "look-up" tables within the program. As an example, the disassembler can be used to "disassemble" the disassembler program! Addresses \$2000 to \$211A will print out properly since these contain the body of the program commands. However, locations \$211B to \$21F9 contain the tables for all the mnemonics and symbols and will print-out gibberish.

COUNT FOR 13 INSTR. DSMBLY.