FORTRAN IV ENHANCED CHARACTER GRAPHICS

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FORTRAN IV Enhanced Character Graphics

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FORTRAN IV ENHANCED CHARACTER GRAPHICS

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ABSTRACT. A FORTRAN IV subroutine is described which allows the drawing of six styles of alphabetic characters, three styles of numbers, and 48 special mathematical symbols from the enhanced graphic character set of Dr. A. V. Hershey. Twenty two symbols for graph plotting are also provided. Output is by linkage to an external subroutine PLOT. The program requires a computer which can accommodate a 30 bit word-length.

Key words: Alphabets; COM; computer graphics; computerized typesetting; digital plotting; plotting; type fonts; type setting; vectorized characters

I. INTRODUCTION. The enhanced graphic characters of Dr. A. V. Hershey (1), (2) are suitable for use on pen plotters or computer output microform devices using vector graphics. The subroutines presented here are an extension of those previously developed (3) to make the Hershey characters available with subroutines conforming as closely as possible to the American Standards Association FORTRAN IV Standard (4) so as to be useable on a variety of computers. The characters provided include the SIMPLEX ROMAN, SIMPLEX GREEK, DUPLEX ROMAN, COMPLEX ROMAN, COMPLEX GREEK, and COMPLEX ITALIC alphabets; SIMPLEX, COMPLEX, and DUPLEX numerals (as described in Refs (1) and (2)); and 48 special characters and mathematical symbols.

II. COMPUTER ORGANIZATION. The data to describe the characters and symbols are included in a BLOCK DATA subprogram of about a thousand cards. The data are in the form of decimal integers less than $2^{30}$ to accommodate a variety of computer word-lengths. The current 30 bit implementation allows the encoding of two (x,y) pen instructions per computer word. Each 15 bit pen instruction contains 3 bits of pen up or pen down information, 6 bits of x-coordinate information, and 6 bits of y-coordinate information. A zero instruction indicates the end of the character. In order to allow for textual input from various computers the input characters are limited to the 47 FORTRAN characters, that is A-Z, blank, 0-9, and + - / = ( ) * , . $. Eleven additional non-FORTRAN characters are used for control information; these characters may be varied by local option at each computer site.

Partial word accesses are provided for by means of an internal FORTRAN FUNCTION:

IFLD(N1,N2,WORD)
which retrieves bits N1 through N2 of WORD as an integer when the bits are numbered from the right (starting with 1).

Character (byte) access is provided by another internal function CHAR(J) which returns the J\textsuperscript{th} character of a textual string in the form of a binary integer. This function (which uses IFLD) will work on those computers which allow alphabetic characters to be manipulated as integers. This is the case with the IBM 360/370 and UNIVAC 1100 computers. For others the functions CHAR or IFLD may need to be rewritten.

The BLOCK DATA subprogram is written in an extension of FORTRAN IV which allows definition of arrays in DATA statements. This extension is compatible with most FORTRAN compilers.

All of the routines were run through the Pfort verifier (5), and no errors other than those of the FORTRAN extension were detected. To date the program has run successfully on the IBM 370, UNIVAC 1100, CDC 7600, and PDP-11 computers.

III. DESCRIPTION OF THE PROGRAMS

SYMBOLTEST - MAIN PROGRAM

This is a main program which draws all of the alphabets and plots all of the plotting symbols available.

LENGTH(XLEN,HEIGHT,TEXT,N)

This subroutine returns in XLEN the length in inches of a textual string TEXT comprising N characters. This information is useful for centering and alignment.

STRIN(I,TEXT)

This integer function returns the I\textsuperscript{th} computer word of the textual string 'TEXT'. It is used only internally in SYMBOL.

SYMBOL(X,Y,HEIGHT,TEXT,THETA,N)

This subroutine draws graphic characters and plot symbols. When N is positive, N characters from the textual string TEXT are drawn. When N is negative, and TEXT is a binary integer between 0 and 21, a centered symbol from the set of 22 plotting symbols is plotted at (X,Y). When N is nought, a single simplex alphameric character (right justified in TEXT) is plotted at (X,Y). When X and/or Y = 999., the annotation is continued following the X and/or Y termination in the previous call to SYMBOL. The conventions for N<0 and N = 0 were designed to be compatible with local vendor supplied software. Minor modifications to the programs will accommodate other conventions.
The BLOCK DATA subprogram contains the data to draw the Hershey characters and the plotting symbols. Variables which need to be saved and the initialization of the computer character set are also included in this subprogram.

IV. OPERATION OF THE SUBROUTINE SYMBOL. The subroutine is accessed by a FORTRAN subroutine call:

```fortran
CALL SYMBOL(X,Y,HEIGHT,TEXT,THETA,N)
```

For the case in which \( N > 0 \) or \( N = 0 \):
- \( X, Y \) = coordinates of lower left hand corner of text
- \( HEIGHT \) = character height (capital letters) in inches
- \( TEXT \) = ALPHAMERIC textual array or Hollerith argument
  - The data must be right justified in \( TEXT \) if a single character is desired and \( N = 0 \).
- \( THETA \) = Angle (degrees) of inclination of \( TEXT \) to the horizontal
- \( N \) = Number of characters in textual array.
  - If \( N = 0 \) a single character right justified in \( TEXT \) is plotted.

For the case in which \( N < 0 \):
- \( X, Y \) = Coordinates of a centered symbol
- \( HEIGHT \) = Size of symbol in inches
- \( TEXT \) = Integer between 0 and 21 designating the desired symbol
- \( THETA \) = Angle (degrees) of inclination of \( TEXT \) to the horizontal
- \( N \) = Code indicating whether or not to draw a line through points:
  - \( N = -1 \) A single centered symbol is plotted at \((X,Y)\);
  - \( N < -1 \) A line is drawn from current point to \((X,Y)\), and a centered symbol is plotted.

The input string \( TEXT \) may contain the 47 FORTRAN characters for text and 11 non-FORTRAN characters which are used for control information. The control characters may be varied at implementation time by changing the associated data card in the BLOCK DATA subprogram. The current significance of the control characters is as follows:

1 \( \backslash \) Next character subscript
2 " Next character superscript
3 @ Initiate upper case (default)
4 # Initiate lower case
5 & Initiate complex letters/numerals
6 ~ Next character greek or math symbol
7 % Initiate simplex letters (default)
8 ? Backspace (up to six backspaces allowed for)
9 ! Initiate italic letters/numerals
10 ; Initiate duplex letters/numerals
11 : Terminate scan
Mathematical and special symbols are accessed by the control code !^s. Since there are no italic greek characters this region of the table has been used to provide the 48 special characters and mathematical symbols. If no control information is provided in the input string, the default options of simplex upper case letters is supplied so that the program is 'downward compatible'. Up to six backspaces are allowed for in the program so that aligned subscripts and superscripts can be generated.

V. GRAPHICAL OUTPUT. The output of the test program is shown in Figs. 1 and 2. These figures show the range of characters and plotting symbols available. The program listings are in Appendix I. In Appendix II a special Fortran V version suitable for the UNIVAC 1100 is given.

For information on how to produce a desired character, reference should be made to the character repertory of Fig. 1. Each of the characters in the lines starting with numerics are produced by the corresponding FORTRAN character preceded by the appropriate control character(s) as shown to the right of the line. Characters in the lines beginning with alphabetic characters or mathematical and special symbols are produced by the control characters to the right of the line followed by the corresponding sequential alphabetic character. Thus for example the graphic sequence Σθ is produced by the string argument to SYMBOL of '!^S'T', since S and T are the 19th and 20th letters of the alphabet and Σ and θ are the 19th and 20th graphics in the line governed by control code !^.

Reference to the test program in Appendix I, which produced Figs. 1 and 2, will show in detail the calling sequence for the graphic and plotting symbols shown in the figures.

VI. STEPS FOR IMPLEMENTATION.

(1) Install the appropriate version of the function IFLD at line SYM00800 of SYMBOL and at line TST00090 of the test program. Univac 1100 machines have one's complement arithmetic, while the IBM 360/370, and DEC PDP-10 and PDP-11 have two's complement arithmetic.

(2) Install the selected special characters at line DAT0830 of BLOCK DATA.

(3) Change the DATA statement at line DAT00840 of BLOCK DATA appropriate to the computer in use. (IOUT is the Fortran unit for line printer output.) NWORD and NCHAR are in general the number of bits per word and number of bits per character respectively.

(4) Provide a subroutine PLOT to generate plotter output for your plotting device.

The following versions of the program have been tested and are included to assist user implementation.

UNIVAC 1100 FIELDATA FORTRAN

```
NWORD=36
NCHAR=6
```

```
IBM 360/370
NWORD=32
NCHAR=8
```
CDC 7600
    NWORD=60
    NCHAR=6
    IFLD(NSTART,NBITS,IWORD)=AND(SHIFT(MASK(NBITS),NBITS),
    2SHIFT(IWORD,NWORD-NSTART+NBITS))
REFERENCES


DISCLAIMER

Certain commercial products and instruments are identified in this paper in order to specify adequately the experimental procedure. In no case does such identification imply recommendation or endorsement by the National Bureau of Standards, nor does it imply that the products or equipment identified are necessarily the best available for the purpose.
SIMPLE CHARACTERS

ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABrAEZH0IKAMNZOnPITT4)X^I^Q
abcdefghijklmnopqrstuvwxyz
0123456789+-/=()*.,$

BOLD CHARACTERS

ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABrAEZH0IKAMNZOnPITT4)X^I^Q
abcdefghijklmnopqrstuvwxyz
0123456789+-/=()*.,$

INDEXICALS

VERTICAL

Fig. 1 CHARACTER REPERTORY
Fig. 2 SYMBOL REPERTORY
MAIN PROGRAM TO TEST THE SYMBOL ROUTINE

ABCD EFGHIJKLMNOPQRSTUVWXYZ 0123456789+-/=%(),.$

DIMENSION BUFFER(1000)
DIMENSION JJ(1)
DIMENSION OLDX(6),OLDY(6),IA(256),IB(58)
COMMON /SAVE/ XL,OLDX,OLDY,IA,IB,NWORD,NCHAR,NWD,D,IOUT,FIRST,LNGTH

LOGICAL FIRST, LNGTH

IFLD GETS N BITS STARTING AT NSTART TH BIT FROM RIGHT

IFLD(NSTART,NBITS,IWORD)=MOD(IWORD/(2**((NSTART-NBITS))),2**NBITS)+1

2**(-ISIGN(1,IWORD)/2)*(2**NBITS-1)

**USE ABOVE CARD IF YOUR MACHINE HAS ONES COMPLEMENT ARITHMETIC

2**(-ISIGN(1,IWORD)/2)*(2**NBITS-MIN0(1,NBITS))

**USE ABOVE CARD IF YOUR MACHINE HAS TWO'S COMPLEMENT ARITHMETIC

CALL PLOTS (BUFFER,1000,9)
CALL LENGTH (XST,,2,18H SIMPLE CHARACTERS:,50)
XST=2.5-XST/2.
CALL SYMBOL (XST,10.5,0.2,18H SIMPLE CHARACTERS:,0.,23)
CALL SYMBOL (0.,10.0,0.2,26H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,26)
CALL SYMBOL (0.,9.7,2,49H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,49)

CALL SYMBOL (0.,9.4,0.2,27H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,27)
CALL SYMBOL (0.,9.1,2,49H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,49)

CALL SYMBOL (0.,8.8,0.2,26H ABDEFGHIJKLMNOPQRSTUVWXYZ,0.,26)
CALL SYMBOL (0.,7.5,0.2,27H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,27)

CALL SYMBOL (0.,7.2,2,49H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,49)

CALL SYMBOL (0.,6.9,0.2,28H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,28)
CALL SYMBOL (0.,6.6,2,50H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,49)

CALL SYMBOL (0.,6.3,0.2,21H ABDEFGHIJKLMNOPQRSTUVWXYZ,0.,21)
CALL SYMBOL (0.,6.0,0.2,28H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,28)
CALL SYMBOL (0.,5.7,0.2,28H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,28)
CALL SYMBOL (0.,5.4,2,49H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,49)

CALL SYMBOL (0.,5.1,2,50H A B C D E F G H I J K L M N O P Q R S T

2**U\"V\"^W\"x,0.,50)

CALL SYMBOL (0.,4.8,2,21H ABDEFGHIJKLMNOPQRSTUVWXYZ,0.,21)
CALL SYMBOL (0.,4.5,0.2,28H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,28)
CALL SYMBOL (0.,4.2,0.2,28H ABCDEFGHIJKLMNOPQRSTUVWXYZ,0.,28)

CALL SYMBOL (0.,3.9,2,21H ABDEFGHIJKLMNOPQRSTUVWXYZ,0.,21)

CALL SYMBOL (0.,1.1,21,8H VERTICAL,90.,8)

CALL SYMBOL (2.,2.,21,28H HINDEXICALS #PR"2 &A\1\1,2,0.,28)

CALL SYMBOL (2.,1.6,21,28H @A\1\2,3,0.,28)

CALL PLOT (10.,0.,-3)

XMARG=1.
YMARG=9.
STEP=1.
XINC=1.
DO 50 J=1,4
DO 50 I=1,6
JJ(1)=I+(J-1)*6-1
XX=XMarg-4,*STEP
YY=YMarg-4,*STEP
XXX=XX
YYY=YY

I-1
DO 10 II=1,9
CALL PLOT (XXX, YYY, 3)
CALL PLOT (XXX+.8, YYY, 2)
10 YYY=YYY+STEP
XXX=XX
YYY=YY
DO 20 II=1,9
CALL PLOT (XXX, YYY, 3)
CALL PLOT (XXX, YYY+.8, 2)
20 XXX=XXX+STEP
DO 30 K=1,2
IF (JJ(1).LE.22) CALL SYMBOL (XMARG, YMARG, .8, JJ, 0., -1)
IF (JJ(1).GT.14) CALL SYMBOL (XX, YY, .8, JJ, 0., -1)
30 XMARG=XMARG+XINC
CONTINUE
YMarg=YMarg-2.
XMARG=1.
CONTINUE
DO 60 I=1,22
JJ(1)=I-1
CALL SYMBOL (XMARG, YMARG, .15, JJ, 0., 0)
JJ(1)=IFLD (NWORD, NCHAR, IB(I+20))
CALL SYMBOL (XMARG, YMARG+.5, .15, JJ, 0., 0)
60 XMARG=XMARG+.5
XMARG=1.
YMARG=.5
CALL PLOT (XMARG, YMARG, 3)
DO 70 I=1,22
JJ(1)=I-1
70 CALL SYMBOL (XMARG, YMARG, .15, JJ, 0., -2)
XMARG=XMARG+.5
CALL PLOT (0., 0., 999)
STOP
END
SUBROUTINE SYMBOL (X,Y,HEIGHT,TEXT,THETA,N)  

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PROBLEMS ETCETERA CONTACT N.WOLCOTT,NBS,301-921-3384

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SIMILAR TO ROUTINE SYMBOL USED IN PEN PLOTTERS
INSTRUCTIONS FOR DRAWING CHARACTERS ARE IN ALFABET STORED
TWO INSTRUCTIONS PER WORD. A ZERO FOR PEN POSITION INDICATES
END OF A CHARACTER. INPUT TEXTUAL STRINGS MUST BE COMPOSED OF ONLY
THE FORTRAN CHARACTERS A-Z 0-9+-/=()*. AND THE NON-FORTRAN
SPECIAL CHARACTERS WHICH ARE DESCRIBED BELOW.
X,Y  = (X,Y) COORDINATE OF LOWER LEFT HAND CORNER OF TEXT
HEIGHT = HEIGHT (IN INCHES) OF UPPER CASE CHARACTERS
TEXT  = INPUT TEXTUAL ARRAY OR HOLLERITH STRING
THETA = ANGLE IN DEGREES OF TEXT FROM X-AXIS
N     = NUMBER OF CHARACTERS IN TEXT STRING

IF N IS NEGATIVE AND TEXT IS A BINARY INTEGER BETWEEN
1 AND 21 A CENTERED SYMBOL FROM THE SYMBOL SET IS PRODUCED
AT (X,Y).
IF N IS 0 A SINGLE SIMPLEX ALPHANUMERIC FORTRAN CHARACTER
(RIGHT JUSTIFIED IN TEXT) IS PRODUCED AT (X,Y).
IF X AND/OR Y EQUAL 999. THE ANNOTATION WILL BE CONTINUED
AFTER THE PREVIOUS X AND/OR Y TERMINATION.

ISTART(I) CONTAINS THE INDEX INTO ALFABET OF THE FIRST INSTRUCTION
OF CHARACTER NUMBER I WHOSE WIDTH IS STORED IN WIDTH(I)
CHARACTERS 1 TO 26 ARE ROMAN SIMPLEX UPPER CASE
CHARACTERS 27 TO 50 ARE GREEK SIMPLEX UPPER CASE
CHARACTERS 51 TO 76 ARE ROMAN SIMPLEX LOWER CASE
CHARACTERS 77 TO 100 ARE GREEK SIMPLEX LOWER CASE
CHARACTERS 101 TO 126 ARE ROMAN COMPLEX UPPER CASE
CHARACTERS 127 TO 150 ARE GREEK COMPLEX UPPER CASE
CHARACTERS 151 TO 176 ARE ROMAN COMPLEX LOWER CASE
CHARACTERS 177 TO 200 ARE GREEK COMPLEX LOWER CASE
CHARACTERS 201 TO 226 ARE ITALIC UPPER CASE
CHARACTERS 227 TO 250 ARE MATHEMATICAL AND SPECIAL SYMBOLS
CHARACTERS 251 TO 276 ARE ITALIC LOWER CASE
CHARACTERS 277 TO 300 ARE MATHEMATICAL AND SPECIAL SYMBOLS
CHARACTERS 301 TO 320 ARE SIMPLEX DIGITS AND SPECIAL SYMBOLS
CHARACTERS 321 TO 340 ARE COMPLEX DIGITS AND SPECIAL SYMBOLS
CHARACTERS 341 TO 360 ARE ITALIC DIGITS AND SPECIAL SYMBOLS
CHARACTERS 361 TO 380 ARE DUPLEX DIGITS AND SPECIAL SYMBOLS
CHARACTERS 381 TO 432 ARE DUPLEX UPPER AND LOWER CASE
ISPEC(11) ARE ELEVEN SPECIAL CHARACTERS CHOSEN FROM THE NON-FORTRAN
SET AT YOUR SITE. CURRENT IMPLEMENTATIONS FOLLOW
SP11 MAY BE SET TO THE COMPUTER STOP CODE IF ONE EXISTS.
SP11 IS SIMILAR TO ROUTINE SYMBOL USED IN PEN PLOTTERS.

SP1 \ NEXT CHARACTER SUBSCRIPT
SP2 " NEXT CHARACTER SUPERSCRIPT
SP3 # TURN ON UPPER CASE
SP4 # TURN ON LOWER CASE
SP5 & TURN ON COMPLEX LETTERS
SP6 ^ NEXT CHARACTER GREEK LETTER OR MATH SYMBOL
SP7 % TURN ON SIMPLEX LETTERS
SP8 ? BACK SPACE LAST CHARACTER
SP9 ! ITALIC LETTERS
SP10 ; DUPLEX LETTERS
SP11 : TERMINATE SCAN
** »* «* ** »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* »* }
\[ X_1 = X_1 + 20. \]
\[ Y_1 = Y_1 + 20. \]
GO TO 440

100 IX=IFLD(I5-3,6,ISYMO(I6))
   IY=IFLD(I5-9,6,ISYMO(I6))
   XI=SCALE*(FLOAT(IX-32))
   YI=SCALE*(FLOAT(IY-32))
   CALL PLOT (X1+R(XI,YI),Y1+R(YI,-XI),I8)
   IS=IC+15
   IF (I5.EQ.30) I6=I6+1
   GO TO 80

120 DO 130 I=1,6
   OLDX(I)=X
   OLDY(I)=Y
   ICHR=I
C CHARACTER
140 IC=6
C SIMPLEX CAPITAL LETTERS
   IP=0
   ICAP=0
   ICOMP=0
   IITALIC=0
   IDUPLE=0
C NOT GREEK LETTERS
150 IGREEK=0
C PRINT SYMBOL ON LINE (NOT SUBSCRIPT OR SUPERSCRIPT)
   L=1
   SCALE=HEIGHT/21.
   DO 430 I=1,NN
C EXTRACT CHARACTER FROM TEXT
   ICHR=ICHR+1
   IC=IA(IC+1)
   IF (ICR.GT.NN.AND.N.GT.0) GO TO 450
   IF (IC.LE.58) GO TO 160
   WRITE (IOUT,150) IC
   GO TO 430

160 IP=ICOMP+ICAP+ITALIC+IDUPLE
   IF (IC.EQ.27) 170,410,270
C NUMBER OF SYMBOL
170 IC=IC+IP+IGREEK-ICAP-IDUPLE*24/(50*380)
180 I6=ISTART(IC)
190 IX=IFLD(I5,3,ALPBET(I6))
C TEST FOR END OF CHARACTER, I8=0
200 IF (I8.EQ.0) GO TO 240
   IX=IFLD(I5-3,6,ALPBET(I6))
   IY=IFLD(I5-9,6,ALPBET(I6))
C IF L=1, PRINT SYMBOL ON LINE, IF L=2, SUBSCRIPT, IF L=3, SUPERSCRIPT
210 RSCALE=SCALE
   YOFF=0.
   GO TO 230
C SUBSCRIPT
220 RSCALE=SCALE*0.5
   YOFF=HEIGHT/4.
   GO TO 230
C SUPERSCRIPT
230 RSCALE=SCALE*0.5
   YOFF=HEIGHT*3./4.
C ABOVE FACTORS NEEDED TO CORRECT OFFSET FOR DIFFERENT SIZE LETTERS

230 YI=FLOAT(IY-1)*RScale+YOFF
XI=FLOAT(IX-10)*RScale
CALL PLOT (X1+R(XI,YI),Y1+R(YI,-XI),I8)
I5=45-I5
IF (I5.EQ.30) I6=I6+1
GO TO 190

240 IGREEK=0

250 X1=X1+R(WIDTH(IC)*RScale,0.0)
Y1=Y1+R(0.,-WIDTH(IC)*RScale)
DO 260 I=1,5
OLDX(I)=OLDX(I+1)
OLDY(I)=OLDY(I+1)
OLDX(6)=X1
OLDY(6)=Y1
RScale=Scale
L=1
GO TO 430

260 IF (IC.GT.47) GO TO 280
IC=IC+273
IF (ICOMP.NE.0) IC=IC+20
IF (ITALIC.NE.0) IC=IC+40
IF (IDUPLE.NE.0) IC=IC+60
GO TO 180
L1=IC-47
GO TO 430

280 GO TO (290,300,310,320,330,340,350,360,380,390,400), L1

C SUBSCRIPT
290 L=2
GO TO 430
C
300 L=3
GO TO 430
C
310 ICAP=0
GO TO 430
C
320 ICAP=50
GO TO 430
C
330 ICOMP=100
ITALIC=0
IDUPLE=0
GO TO 430
C
340 IGREEK=26
IF (IDUPLE.NE.0) IGREEK=0
GO TO 430
C
350 ICOMP=0
ITALIC=0
IDUPLE=0
GO TO 430
C
360 DO 370 I=1,5
IK=6-I
OLDX(IK+1)=OLDX(IK)
OLDY(IK+1)=OLDY(IK)
X1=OLDX(6)
Y1=OLDY(6)
GO TO 430
C
370 ICOMP=200
ITALIC=200
GO TO 430
C
380 BACKSPACE
390 DO 370 I=1,5
IK=6-I
OLDX(IK+1)=OLDX(IK)
OLDY(IK+1)=OLDY(IK)
X1=OLDX(6)
Y1=OLDY(6)
GO TO 430
C
390 ITALIC=200
ICOMP=0
GO TO 430
IDUPLE=0
GO TO 430
C 390 IDUPLE=380
ICOMP=0
ITALIC=0
GO TO 430
C END OF SCAN
400 GO TO 450
END C
410 X1=X1+R(20.*RSCALE,0.)
Y1=Y1+R(0.,-20.*RSCALE)
DO 420 I=1,5
OLDX(I)=OLDX(I+1)
OLDY(I)=OLDY(I+1)
OLDX(6)=X1
OLDY(6)=Y1
L=1
430 CONTINUE
450 IF (LNGTH) XL=SQR((X1-X)**2+(Y1-Y)**2)
RETURN
END
SUBROUTINE LENGTH (XLEN,HEIGHT,TEXT,N)

***********************************************************************
LENGTH OF TEXT IS RETURNED IN XLEN
DIMENSION TEXT(1),IA(256),IB(58),OLDX(6),OLDY(6)
COMMON /SAVE/ XL,OLDX,OLDY,IA,IB,NWORD,NCHAR,NCWD,IOUT,FIRST,LNGTHLEN00070
LOGICAL LNGTH,FIRST
INTEGER TEXT
LNGTH=.TRUE.
CALL SYMBOL (0.,0.,HEIGHT,TEXT,0.,N)
XLEN=XL
LNGTH=.FALSE.
RETURN
END

INTEGER FUNCTION STRIN(I,TEXT)

***********************************************************************
DIMENSION TEXT(1)
INTEGER TEXT
STRIN=TEXT(I)
RETURN
END
**BLOCK DATA**

**DIMENSION ISY110(60), ISY111(60), ISY112(8), JSTSYM(22), ISYMB0(128)**

**DIMENSION IAL110(60), IAL111(60), IAL112(60), IAL113(60), IAL114(60), DAT00050**

2 IAL115(60), IAL116(60), IAL117(60), IAL118(60), IAL119(60), IAL120(60), DAT00070
3 IAL121(60), IAL122(60), IAL123(60), IAL124(60), IAL125(60), IAL126(60), DAT00080
4 IAL127(60), IAL128(60), DAT00090

**DIMENSION IAL129(60), IAL130(60), IAL131(60), IAL132(60), IAL133(60), DAT00100**

2 IAL134(60), IAL135(60), IAL136(60), IAL137(60), IAL138(60), IAL139(60), DAT00110
3 IAL140(60), IAL141(60), IAL142(60), IAL143(60), IAL144(60), IAL145(60), DAT00120
4 IAL146(60), IAL147(60), DAT00130

**DIMENSION IAL148(60), IAL149(60), IAL150(60), IAL151(60), IAL152(60), DAT00140**

2 IAL153(60), IAL154(60), IAL155(60), IAL156(60), IAL157(60), IAL158(60), DAT00150
3 IAL159(60), IAL160(60), IAL161(60), IAL162(60), IAL163(60), IAL164(60), DAT00160
4 IAL165(60), IAL166(60), DAT00170

**DIMENSION IAL167(60), IAL168(60), IAL169(60), IAL170(60), IAL171(60), DAT00180**

2 IAL172(60), IAL173(60), IAL174(60), IAL175(60), IAL176(60), IAL177(60), DAT00190
3 IAL178(60), IAL179(60), IAL180(60), IAL181(60), IAL182(60), IAL183(60), DAT00200
4 IAL184(60), IAL185(60), DAT00210

**DIMENSION IAL186(60), IAL187(60), IAL188(60), WID110(100), WID111(100), DAT00220**

2 WID12(100), WID13(100), WID14(32), IST110(100), IST111(100), DAT00230
3 IST112(100), IST113(100), IST114(32), DAT00240

**DIMENSION IFORT(47), IA(256), IB(58), ISPEC(11), OLDX(6), OLDY(6), DAT00250**

**DIMENSION IALFBE(4711), WIDTH(432), ISTART(432), DAT00260**

**COMMON /IALPH/ WIDTH, IALFBE, ISTART, ISYMBO, JSTSYM**

**COMMON /SAVE/ XL, OLDX, OLDY, IA, IB, NWORD, NCHAR, NCWD, IOUT, FIRST, LNGTH**

**LOGICAL FIRST, LNGTH**

**EQUIVALENCE (IB(1), IFORT(1)), (IB(48), ISPEC(1))**

**EQUIVALENCE (IALFBE(1), IAL110(1)), (IALFBE(61), IAL111(1)), DAT00300**

**EQUIVALENCE (IALFBE(121), IAL112(1)), (IALFBE(181), IAL113(1)), (IALFBE(241), DAT00320**

3 IAL114(1), (IALFBE(301), IAL115(1)), (IALFBE(361), IAL116(1)), DAT00330
4 IAL117(1), (IALFBE(421), IAL118(1)), (IALFBE(481), IAL119(1)), DAT00340
5 IAL120(1), (IALFBE(601), IAL121(1)), (IALFBE(661), IAL122(1)), DAT00350
6 IAL123(1), (IALFBE(721), IAL124(1)), (IALFBE(781), IAL125(1)), (IALFBE(841), DAT0036
7 IAL126(1), (IALFBE(901), IAL127(1)), (IALFBE(961), IAL128(1)), (IALFBE(1081), DAT0037
8 IALFBE(1021), IAL129(1)), (IALFBE(1081), IAL128(1))

**EQUIVALENCE (IALFBE(1141), IAL130(1)), (IALFBE(1201), IAL130(1)), DAT00390**

2 IALFBE(1261), IAL131(1), (IALFBE(1321), IAL132(1)), (IALFBE(1381), DAT00400
3 IAL133(1), (IALFBE(1441), IAL134(1)), (IALFBE(1501), IAL135(1)), DAT00410
4 IAL136(1), (IALFBE(1621), IAL137(1)), (IALFBE(1681), IAL138(1)), DAT00420
5 IAL139(1), (IALFBE(1741), IAL139(1)), (IALFBE(1801), IAL140(1)), DAT00430
6 IAL141(1), (IALFBE(1921), IAL142(1)), (IALFBE(1981), IAL143(1)), DAT00440
7 IAL143(1), (IALFBE(2041), IAL144(1)), (IALFBE(2101), IAL145(1)), DAT00450
8 IALFBE(2161), IAL146(1), (IALFBE(2221), IAL147(1)), (IALFBE(2281), DAT00460
9 IALFBE(2381), IAL148(1), (IALFBE(2341), IAL149(1)), (IALFBE(2341), DAT00470
2 IALFBE(2401), IAL150(1), (IALFBE(2461), IAL151(1)), (IALFBE(2512), DAT00480
3 IAL152(1), (IALFBE(2581), IAL153(1)), (IALFBE(2641), IAL154(1)), DAT00490
4 IALFBE(2701), IAL155(1), (IALFBE(2761), IAL156(1)), (IALFBE(2821), DAT00500
5 IAL157(1), (IALFBE(2881), IAL158(1)), (IALFBE(2941), IAL159(1)), DAT00510
6 IALFBE(3001), IAL160(1), (IALFBE(3061), IAL161(1)), (IALFBE(3121), DAT00520
7 IAL162(1), (IALFBE(3181), IAL163(1)), (IALFBE(3241), IAL164(1)), DAT00530
8 IALFBE(3301), IAL165(1), (IALFBE(3361), IAL166(1)), (IALFBE(3421), DAT00540
9 IAL167(1), (IALFBE(3481), IAL168(1)), (IALFBE(3481), DAT00550
2 IALFBE(3541), IAL169(1), (IALFBE(3601), IAL170(1)), (IALFBE(3661), DAT00560
3 IAL171(1), (IALFBE(3721), IAL172(1)), (IALFBE(3781), IAL173(1)), DAT00570
4 IALFBE(3841), IAL174(1), (IALFBE(3901), IAL175(1)), (IALFBE(3961), DAT00580
5 IAL176(1), (IALFBE(4021), IAL177(1)), (IALFBE(4081), IAL178(1)), DAT00590
6 IALFBE(4141), IAL179(1), (IALFBE(4201), IAL180(1)), (IALFBE(4261), DAT00600
7 IAL181(1), (IALFBE(4321), IAL182(1)), (IALFBE(4381), IAL183(1)), DAT00610
8 IALFBE(4441), IAL184(1), (IALFBE(4501), IAL185(1)), (IALFBE(4621), IAL187(1)), DAT00620

**EQUIVALENCE (IALFBE(4561), IAL186(1)), (IALFBE(4621), IAL187(1)), DAT00630**
THE IMPLEMENTOR MUST SUPPLY THE FOLLOWING TWO CARDS TO SUIT THE INSTALLATION.

DATA ISPEC /1H,1H",1H0,1H*,1H?,1H!;1H:/
DATA NWORD /36/, NCHAR /6/, IOUT /6/
| Database   | DAT07610 | DAT07840 | DAT08030 | DAT07570 | DAT07580 | DAT07590 | DAT07600 | DAT07610 | DAT07620 | DAT07630 | DAT07640 | DAT07650 | DAT07660 | DAT07670 | DAT07680 | DAT07690 | DAT07700 | DAT07710 | DAT07720 | DAT07730 | DAT07740 | DAT07750 | DAT07760 | DAT07770 | DAT07780 | DAT07790 | DAT07800 | DAT07810 | DAT07820 | DAT07830 | DAT07840 | DAT07850 | DAT07860 | DAT07870 | DAT07880 | DAT07890 | DAT07900 | DAT07910 | DAT07920 | DAT07930 | DAT07940 | DAT07950 | DAT07960 | DAT07970 | DAT07980 | DAT07990 | DAT08000 | DAT08010 | DAT08020 | DAT08030 | DAT08040 | DAT08050 | DAT08060 | DAT08070 | DAT08080 | DAT08090 | DAT08100 | DAT08110 | DAT08120 | DAT08130 | DAT08140 | DAT08150 | DAT08160 | DAT08170 | DAT08180 | DAT08190 |
|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
APPENDIX II. FORTRAN V VERSION FOR UNIVAC 1108/1110

SUBROUTINE SYMBOL (X,Y,HEIGHT,TEXT,THETA,N) SYMO0010
SYMO0020
SYMO0030
SYMO0040
SYMO0050
SYMO0060
SYMO0070
SYMO0080
SYMO0090
SYMO0100
SYMO0110
SYMO0120
SYMO0130
SYMO0140
SYMO0150
SYMO0160
SYMO0170
SYMO0180
SYMO0190
SYMO0200
SYMO0210
SYMO0220
SYMO0230
SYMO0240
SYMO0250
SYMO0260
SYMO0270
SYMO0280
SYMO0290
SYMO0300
SYMO0310
SYMO0320
SYMO0330
SYMO0340
SYMO0350
SYMO0360
SYMO0370
SYMO0380
SYMO0390
SYMO0400
SYMO0410
SYMO0420
SYMO0430
SYMO0440
SYMO0450
SYMO0460
SYMO0470
SYMO0480
SYMO0490
SYMO0500
SYMO0510
SYMO0520
SYMO0530
SYMO0540
SYMO0550
SYMO0560
SYMO0570
SYMO0580
SYMO0590
SYMO0600

DIMENSION ISY110(60),ISY111(60),ISY112(8),JSTSYM(22),ISYMO(128)
DIMENSION IAL110(60),IAL111(60),IAL112(60),IAL113(60),IAL114(60)
IAL115(60),IAL116(60),IAL117(60),IAL118(60),IAL119(60),IAL120(60)
IAL121(60),IAL122(60),IAL123(60),IAL124(60),IAL125(60),IAL126(60)
IAL127(60),IAL128(60)

DIMENSION IAL129(60),IAL130(60),IAL131(60),IAL132(60),IAL133(60)
IAL134(60),IAL135(60),IAL136(60),IAL137(60),IAL138(60),IAL139(60)
IAL140(60),IAL141(60),IAL142(60),IAL143(60),IAL144(60),IAL145(60)
IAL146(60),IAL147(60)

DIMENSION IAL148(60),IAL149(60),IAL150(60),IAL151(60),IAL152(60)
IAL153(60),IAL154(60),IAL155(60),IAL156(60),IAL157(60),IAL158(60)
IAL159(60),IAL160(60),IAL161(60),IAL162(60),IAL163(60),IAL164(60)
IAL165(60),IAL166(60)

DIMENSION IAL167(60),IAL168(60),IAL169(60),IAL170(60),IAL171(60)
IAL172(60),IAL173(60),IAL174(60),IAL175(60),IAL176(60),IAL177(60)
IAL178(60),IAL179(60),IAL180(60),IAL181(60),IAL182(60),IAL183(60)
IAL184(60),IAL185(60)

DIMENSION IAL186(60),IAL187(60),IAL188(31),WID110(100),WID111(100)

2, WID112(100),WID113(100),WID114(32),IST110(100),IST111(100)

3, IST112(100),IST113(100),IST114(32)

DIMENSION IFORT(47),IA(256),IB(58),ISPEC(11),OLDX(6),OLDY(6)

DIMENSION IALFBE(4711),WIDTH(432),ISTART(432)

COMMON /IALFBE/ WIDTH,IALFBE,ISTART,ISYMO,STSYM

COMMON /SAVE/ XL,OLDX,OLDY,IA,IB,NWORD,NCHAR,NCWD,IOUT,FIRST,LNGTH

LOGICAL FIRST,LNGTH

EQUIVALENCE (IB(1),IFORT(1)), (IB(48),ISPEC(1))

EQUIVALENCE (IALFBE(1),IAL110), (IALFBE(61),IAL111), (IALFBE(121),SYM0010)
IAL112), (IALFBE(181),IAL113), (IALFBE(241),IAL114), (IALFBE(301),SYM0020)
IAL115), (IALFBE(361),IAL116), (IALFBE(421),IAL117), (IALFBE(481),SYM0030)
IAL118), (IALFBE(541),IAL119), (IALFBE(601),IAL120), (IALFBE(661),SYM0040)
IAL121), (IALFBE(721),IAL122), (IALFBE(781),IAL123), (IALFBE(841),SYM0050)
IAL124), (IALFBE(901),IAL125), (IALFBE(961),IAL126), (IALFBE(1081),SYM0060)
IAL127), (IALFBE(1081),IAL128), (IALFBE(1141),IAL129), (IALFBE(1201),SYM0070)
IAL130), (IALFBE(1261),IAL131), (IALFBE(1321),IAL132), (IALFBE(1381),SYM0080)
IAL133), (IALFBE(1441),IAL134), (IALFBE(1501),IAL135), (IALFBE(1561),SYM0090)
IAL136), (IALFBE(1621),IAL137), (IALFBE(1681),SYM0100)
IAL138), (IALFBE(1741),IAL139), (IALFBE(1801),IAL140), (IALFBE(1861),SYM0110)
IAL141), (IALFBE(1921),IAL142), (IALFBE(1981),SYM0120)
IAL143), (IALFBE(2041),IAL144), (IALFBE(2101),IAL145), (IALFBE(2161),SYM0130)
IAL146), (IALFBE(2221),IAL147), (IALFBE(2281),IAL148), (IALFBE(2341),IAL149),
IAL150), (IALFBE(2461),IAL151), (IALFBE(2521),SYM0140)
IAL152), (IALFBE(2581),IAL153), (IALFBE(2641),IAL154), (IALFBE(2701),SYM0150)
IAL155), (IALFBE(2761),IAL156), (IALFBE(2821),SYM0160)
IAL157), (IALFBE(2881),IAL158), (IALFBE(2941),IAL159), (IALFBE(3001),SYM0170)
IAL160), (IALFBE(3061),IAL161), (IALFBE(3121),SYM0180)
IAL162), (IALFBE(3181),IAL163), (IALFBE(3241),IAL164), (IALFBE(3301),SYM0190)
IAL165), (IALFBE(3361),IAL166), (IALFBE(3421),IAL167), (IALFBE(3481),IAL168),
IAL169), (IALFBE(3601),IAL170), (IALFBE(3661),SYM0200)
IAL171), (IALFBE(3721),IAL172), (IALFBE(3781),IAL173), (IALFBE(3841),SYM0210)
IAL174), (IALFBE(3901),IAL175), (IALFBE(3961),SYM0220)
IAL176), (IALFBE(4021),IAL177), (IALFBE(4081),IAL178), (IALFBE(4141),SYM0230)
IAL179), (IALFBE(4201),IAL180), (IALFBE(4261),SYM0240)
IAL181), (IALFBE(4321),IAL182), (IALFBE(4381),IAL183), (IALFBE(4381),SYM0250)

II-1
THE IMPLEMENTOR MUST SUPPLY THE FOLLOWING TWO CARDS TO SUIT THE INSTALLATION. NWORD=BIT/WORD,NCHAR=BIT/CHARACTER
DATA ISPEC /1",1H",1H","1H","1H",1H",1H",1H",1H",1H":
DATA NWORD /36/,NCHAR /6/,IOUT /6/

**************************************************************************

DATA FIRST /TRUE/, LNGTH /FALSE/
DATA ISYI110 /471149226,357246358,315959338,336592896,470820906,
3 345320100,357443862,32786236,315762474,336920576,470820906,
3 3 355313115,336920576,470493226,449850016,0,455911911,456370649,0,
3 4 471149216,336279684,336930848,0,470493226,357574048,356920576,0,
3 4 445922346,315959958,0,470820906,356561947,336279497,317892650,0,
3 5 456370280,336279584,351502336,481470811,325952353,34726234,0,
3 5 326284639,325958294,346921848,357892096,449850016,470493226,0,
3 5 455911911,4558217143,0,450177706,315304598,315949056,470493226,0,
3 5 470820906,355313115,336935525,336279417,356631104,470853600,
3 5 470820906,355313115,336935525,336279417,356631104,470853600,
3 5 338831587,435024799,342796380,334664762,466265814,319563163,
3 5 313468258,315979484,326444971,341158250,356364173,359738078,
3 5 357411352,346761365,320308144,465905227,312910991,300491605,
3 5 292321920,295030023,297116654,302799411,322611126,341518837,
3 5 360293545,357171473,380874146,38267813,37069868,356406925,
3 5 350595210,331677696,468592477,328181537,330409956,338831587,
3 5 435024799,342796380,334378847,330344289,465650930,468625379,
3 5 470722595,472481881,474949794,477079777,0,462300964,435123103,
3 5 470722595,472481881,474949794,477079777,0,462300964,435123103,
3 5 470722595,472481881,474949794,477079777,0,462300964,435123103,
3 5 * 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
3 5 328087389,330413981,325111977,334608413,336705629,338802845,
II-6
FORTRAN V UNIVAC 1108 VERSION 3.0 AUGUST 1977

PROBLEMS ETCETERA CONTACT N. WOLCOTT, NBS, 301-921-3384

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SIMILAR TO ROUTINE SYMBOL USED IN PEN PLOTS

INSTRUCTIONS FOR DRAWING CHARACTERS ARE IN ALPHABET STORED

TWO INSTRUCTIONS PER WORD. A ZERO FOR PEN POSITION INDICATES

END OF A CHARACTER. INPUT TEXTUAL STRINGS MUST BE COMPOSED OF ONLY

THE FORTRAN CHARACTERS A-Z 0-9-=/*,-$. AND THE NON-FORTRAN

SPECIAL CHARACTERS WHICH ARE DESCRIBED BELOW.

X, Y = (X, Y) COORDINATE OF LOWER LEFT HAND CORNER OF TEXT

HEIGHT = HEIGHT (IN INCHES) OF UPPER CASE CHARACTERS

TEXT = INPUT TEXTUAL ARRAY OR HOLLERITH STRING

THETA = ANGLE IN DEGREES OF TEXT FROM X-AXIS

N = NUMBER OF CHARACTERS IN TEXT STRING

IF N IS NEGATIVE AND TEXT IS A BINARY INTEGER BETWEEN

1 AND 21 A CENTERED SYMBOL FROM THE SYMBOL SET IS PRODUCED

AT (X, Y).

IF N IS 0 A SINGLE SIMPLEX ALPHANUMERIC FORTRAN CHARACTER

(RIGHT JUSTIFIED IN TEXT) IS PRODUCED AT (X, Y).

IF X AND/OR Y EQUAL 999, THE ANNOTATION WILL BE CONTINUED

AFTER THE PREVIOUS X AND/OR Y TERMINATION.

ISTART(I) CONTAINS THE INDEX INTO ALPHABET OF THE FIRST INSTRUCTION

OF CHARACTER NUMBER I WHOSE WIDTH IS STORED IN WIDTH(I)

CHARACTERS 1 TO 26 ARE ROMAN SIMPLEX UPPER CASE

CHARACTERS 27 TO 50 ARE GREEK SIMPLEX UPPER CASE

CHARACTERS 51 TO 76 ARE ROMAN SIMPLEX LOWER CASE

CHARACTERS 77 TO 100 ARE GREEK SIMPLEX LOWER CASE

CHARACTERS 101 TO 126 ARE ROMAN COMPLEX UPPER CASE

CHARACTERS 127 TO 150 ARE GREEK COMPLEX UPPER CASE

CHARACTERS 151 TO 176 ARE ROMAN COMPLEX LOWER CASE

CHARACTERS 177 TO 200 ARE GREEK COMPLEX LOWER CASE

CHARACTERS 201 TO 226 ARE ITALIC UPPER CASE

CHARACTERS 227 TO 250 ARE MATHEMATICAL AND SPECIAL SYMBOLS

CHARACTERS 251 TO 276 ARE ITALIC LOWER CASE

CHARACTERS 277 TO 300 ARE MATHEMATICAL AND SPECIAL SYMBOLS

CHARACTERS 301 TO 320 ARE SIMPLEX DIGITS AND SPECIAL SYMBOLS

CHARACTERS 321 TO 340 ARE COMPLEX DIGITS AND SPECIAL SYMBOLS

CHARACTERS 341 TO 360 ARE ITALIC DIGITS AND SPECIAL SYMBOLS

CHARACTERS 361 TO 380 ARE DUPS DIGITS AND SPECIAL SYMBOLS

CHARACTERS 381 TO 432 ARE DUPLEX UPPER AND LOWER CASE

ISPEC(I) ARE ELEVEN SPECIAL CHARACTERS CHosen FROM THE NON-

FORTRAN SET AT YOUR SITE. CURRENT IMPLEMENTATIONS FOLLOW

SP11 MAY BE SET TO THE COMPUTER STOP CODE IF ONE EXISTS.

SP 1 \ NEXT CHARACTER SUBSCRIPT
DIMENSION TEXT(1)
EQUIVALENCE(ALFBET,IALFBE)
DIMENSION ALFBET(471)
INTEGER STRIN,CHAR,TEXT,ALFBET,ISTART
EQUIVALENCE(I,BF(I),IFORT(I),I(ISP(I)),I(ISP(1)))
RX=CX-SY
RY=SX+CY
RX(X,Y)=RY(Y,-X)
RY(X,Y)=RX(Y,-X)
IFLD GETS N BITS STARTING AT NSTART TH BIT FROM RIGHT
IFLD(NSTART,NBITS,IWORD)=MOD(IWORD/(2**(NSTART-NBITS)),2**NBITS)+
(1-ISIGN(1,+IWORD))/2)*(2**NBITS-1)
***USE ABOVE CARD IF YOUR MACHINE HAS ONES
COMPLEMENT ARITHMETIC
2
(1-ISIGN(1,IWORD))/2)*(2**NBITS-MINO(1,
XMOD(-IWORD,2**(NSTART-NBITS))))
***USE ABOVE CARD IF YOUR MACHINE HAS
TWO'S COMPLEMENT ARITHMETIC
CHAR(J) GETS THE J TH CHARACTER OF NCHAR
BITS FROM A STRING
DEFINE STRIN(I,TEXT)=TEXT(I)
CHAR(J)=IFLD((NWORD-MOD(J-1,NCWD)*NCHAR),NCHAR,STRIN((J+NCWD-1)/NCWD,TEXT))
R(xx,yy)=CO*xx-SI*yy
IF (.NOT.FIRST) GO TO 20
NCWD=NWORD/NCHAR
DO 10 I=1,58
LL=IFLD(NWORD,NCHAR,IB(I))
IA(LL+1)=I
CONTINUE
FIRST=..FALSE.
XX=THE*355/(180.*113.)
YY=SI*THE
SCALE=HEIGHT/21.
OFFSET OF 11 UNITS
X1=X
Y1=Y
IF (X1.GT.998.5) X1=OLDX(6)
IF (Y1.GT.998.5) Y1=OLDY(6)
NN=N
IF (NN) 50,30,120
ICHR=NCWD-1
IG=CHAR(ICHR+1)
IC=IA(IG+1)
IF (IC.LE.47) GO TO 40
WRITE(IOUT,40) IG
GO TO 440
N1=1
GO TO 140
IF (N.EQ.-1) GO TO 60
CALL PLOT(X1,Y1,2)
60 IG=TEXT(1)+1
C IF (IG.LE.22) GO TO 70
WRITE(IOUT,41) IG
GO TO 440
70 I6=JSTSYM(IG)
I5=30
80 I8=IFLD(I5,3,ISYMB0(I6))
C GO TO CENTER OF SYMBOL
IF (I8) 100,90,100
C CALL PLOT (X1,Y1,3)
X1=X1+20.
Y1=Y1+20.
GO TO 440
100 IX=IFLD(I5-3,6,ISYMB0(I6))
IY=IFLD(I5-9,6,ISYMB0(I6))
XI=SCALE*(FLOAT(IX-32))
YI=SCALE*(FLOAT(IY-32))
C CALL PLOT (X1+R(XI,Y1),Y1+R(Y1,-XI),I8)
I5=45-15
IF (I5.EQ.30) I6=I6+1
GO TO 80
120 DO 130 I=1,6
OLDX(I)=X
OLDY(I)=Y
130 H=1
WRITE(IOUT,150) IG
FORMAT(IX,19HILLEGAL INPUT CHAR,112)
GO TO 430
160 IP=ICOMP+ICAP+ITALIC+IDUPLE
IF (IC-27) 170,410,270
C NUMBER OF SYMBOL
170 IC=IC+IP+IGREEK-ICAP*IDUPLE*24/(50*380)
180 I6=ISTART(IC)
I5=30
IF (LENGTH) GO TO 250
C PRINT ALPHABETICAL CHARACTER
190 I8=IFLD(I5,3,ALFBET(I6))
C TEST FOR END OF CHARACTER, I8=0
IF (I8.EQ.0) GO TO 240
C IF L=1, PRINT SYMBOL ON LINE, IF L=2, SUBSCRIPT, IF L=3, SUPERSCRIPT
GO TO (200,210,220), L
200 RSCALE=SCALE
YOFF=0.
GO TO 230
C SUBSCRIPT
210 RSCALE=SCALE*0.5
YOFF=-HEIGHT/4.
GO TO 230
C SUPERSCRIPT
220 RSCALE=SCALE*0.5
YOFF=HEIGHT*3./4.
C ABOVE FACTORS NEEDED TO CORRECT OFFSET FOR DIFFERENT SIZE LETTERS
230 Y1=FLOAT(IY-11)*RSCALE+YOFF
X1=FLOAT(IX-10)*RSCALE
CALL PLOT(X1+R(XI,Y1),Y1+R(YI,-XI),18)
I5=45-15
IF (I5.EQ.30) I6=I6+1
GO TO 190
240 IGREEK=0
250 X1=X1+R(WIDTH(IC)*RSCALE,0.0)
Y1=Y1+R(0.,-WIDTH(IC)*RSCALE)
DO 260 I=1,5
OLDX(I)=OLDX(I+1)
260 OLDY(I)=OLDY(I+1)
OLDX(6)=X1
OLDY(6)=Y1
RSASLE=SCALE
L=1
GO TO 430
270 IF (IC.GT.47) GO TO 280
IC=IC+273
IF (ICOMP.NE.0) IC=IC+20
IF (ITALIC.NE.0) IC=IC+40
IF (IDUPLE.NE.0) IC=IC+60
GO TO 180
280 L1=IC-47
GO TO (290,300,310,320,330, 340,350,360,380,390, 400), L1
C SUBSCRIPT
290 L=2
GO TO 430
C SUPERSCRIPT
300 L=3
GO TO 430
C UPPER CASE
310 ICAP=0
GO TO 430
C LOWER CASE
320 ICAP=50
GO TO 430
C COMPLEX LETTERS
330 ICOMP=100
ITALIC=0
IDUPLE=0
GO TO 430
C GREEK LETTERS
340 IGREEK=26
IF (IDUPLE.NE.0) IGREEK=0
GO TO 430
C SIMPLEX LETTERS
350 ICOMP=0
ITALIC=0
IDUPLE=0
GO TO 430
C BACKSPACE
DO 370 I=1,5
   IK=6-I
   OLDX(IK+1)=OLDX(IK)
   OLDDY(IK+1)=OLDDY(IK)
   X1=OLDX(6)
   Y1=OLDDY(6)
   GO TO 430
C  ITALIC
380  ITALIC=200
    ICOMP=0
    IDUPLE=0
    GO TO 430
C  DUPLEX
390  IDUPLE=380
    ICOMP=0
    ITALIC=0
    GO TO 430
C
C
400  GO TO 450
C  BLANK SPACE
410  X1=X1+R(20.*RSCALE,0.,)
    Y1=Y1+R(0.,-20.*RSCALE)
   DO 420 I=1,5
    OLDX(I)=OLDX(I+1)
    OLDDY(I)=OLDDY(I+1)
    OLDX(6)=X1
    OLDDY(6)=Y1
    L=1
430  CONTINUE
440  CONTINUE
   IF(LNGTH) GO TO 450
   OLDX(6)=X1
   OLDDY(6)=Y1
450  IF (LNGTH) XLEN=SQR((X1-X)**2+(Y1-Y)**2)
   IF(LNGTH) GO TO LX
   RETURN
C  ENTRY LENGTH(XLEN,HEIGHT,TEXT,N)
C  LENGTH OF TEXT RETURNED IN XLEN
   LNGTH=.TRUE.
   ASSIGN 460 TO LX
   GO TO 5
460  XLEN=XLEN
   LNGTH=.FALSE.
   RETURN
END
A FORTRAN IV subroutine is described which allows the drawing of six styles of alphabetic characters, three styles of numbers, and 48 special mathematical symbols from the enhanced graphic character set of Dr. A. V. Hershey. Twenty-two symbols for graph plotting are also provided. Output is by linkage to an external subroutine PLOT. The program requires a computer which can accommodate a 30 bit word-length.

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