ABSTRACT
You can create a custom font of symbols by using the GFONT procedure.

INTRODUCTION
For each character of the custom font, the symbol is plotted on a grid. The shape is described as x,y coordinates that make up the data set for the new font.

The MARKER font, used here as an example, is made up of triangles, arrows, male and female characters, and an assortment of symbols to be used with SAS/GRAPH® procedures (see Figure 1).

Creating a Symbol
Each symbol is drawn on the same grid. The horizontal coordinates for each symbol are independent of the horizontal coordinates for another symbol. The vertical coordinates, however, must be defined on the same baseline. By plotting each symbol on a grid with the x,y axes ranging from 0 to 64, the PROC GFONT option baseline is set to 0, while the two options CAPLINE= and MWIDTH= are set to 64. The center for each symbol becomes the coordinate of x=32, y=32.

When positioning each symbol on the grid, the centering becomes important for such symbols as the arrows (see Figure 2). For those characters that are asymmetrical, such as arrows where it is important that the point be positioned at the center, the addition of an unused point with a separate segment number is used to "trick" PROC GFONT into thinking the symbol is wider. The middle of the symbol is determined from the four extreme points. By setting a separate segment with only one point, a move is done, but no draw. In the case of the thin arrow pointing left, the extra segment 99 is added with the x,y value of 0,32. The extreme points for the x axis are 42 and 22, and the center then becomes 32,32.
The CHAR variable contains the alphabet letter used to correspond to the symbol being created. The symbol statements used with the GPLOT procedure to create the graph in Figure 4 below specify v='R' and 'Q' to indicate that the female and male symbols from the MARKER font are to be used. The code appears as Appendix 1.

Figure 4 Graph

For each symbol, the first observation contains the W-type point. This point gives the minimum and maximum x values for the symbol. Since all of these symbols were plotted on a 64-by-64 grid, the values for the first observation are always 0 and 64. The V-type points are digitized points of the character outline connected by straight lines. To draw an arc, you enter a consecutive sequence of V-G-V. The arc is drawn connecting the two V points with a center at the C point. Because arcs are limited to 106 degrees or less, the top of each half of the heart symbol, for example, is broken up into two arcs using the same center point (see Figure 5).

Figure 5 Heart

The segment variable describes how a symbol is broken into several strokes. For the female symbol (Figure 6), the first segment starts at the waist, draws the left arm, the head, and the right arm, and then completes the dress. Each leg is a separate segment. The male figure, however, can be drawn using one segment, that is, one continuous line.

Figure 6 Female

706
Each of the symbols in the MARKER font is defined as a polygon. The LP variable is set to P (polygon) for each observation.

The MARKER font (Figure 7) is an unfilled (empty) version of the MARKER font. It is produced by using the same PROGFONT statement used to create the MARKER font, except that the FILLED option is omitted.

Appendix 2 contains the entire data set and commands used to produce the MARKER and MARKERE fonts. Both fonts are available with SAS/GRAPH software.

CONCLUSION

Custom-designed fonts consisting of special symbols, characters, map outlines, flags, tools, or equipment are easily produced by sketching the symbol, digitizing the points, and using PROC GFONT.

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Appendix 1

data grades;
  input student $ sex $ score;
cards;
  Mary F 80
  Johnny M 85
  Sally F 100
  David M 95
run;

symbol1 f=marker v=K b=18 pct c=pink i=NONE; /* female */
symbol2 f=marker v=Q b=18 pct c=blue i=NONE; /* male */
data graph;
  retain;
  set grades;
  keep student sex hist;
  do hist=0 to score by 5;
  output;
  end;
run;
goptions rotate=landscape;
proc gplot data=graph;
  AXIS1 order={0 to 100 by 20} minor=(n=1) offset=(2,2) length=60 pct;
  AXIS2 offset=(6,6) length=60 pct;
  plot student * hist=sex , haxis='AXIS1' vaxis='AXIS2' frame nolegend;
run;

Appendix 2

libname gfont 'c:\';
data marker;
  length ptype char lp $ 1;
  input char ptype x y segment lp;
cards;
  A w A A A A A A A A A A A A A A A A A A A A
  c c c c c c c c c c c c c c c c c c c c
  D D D D D D D D D D D D D D D D D D D D
  E E E E E E E E E E E E E E E E E E E E
  F F F F F F F F F F F F F F F F F F F F
  G G G G G G G G G G G G G G G G G G G G
  H H H H H H H H H H H H H H H H H H H H
  I I I I I I I I I I I I I I I I I I I I
  L L L L L L L L L L L L L L L L L L L L
  M M M M M M M M M M M M M M M M M M M M
  N N N N N N N N N N N N N N N N N N N N
  O O O O O O O O O O O O O O O O O O O O
  Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q
  R R R R R R R R R R R R R R R R R R R R
  S S S S S S S S S S S S S S S S S S S S
  T T T T T T T T T T T T T T T T T T T T
  U U U U U U U U U U U U U U U U U U U U
  V V V V V V V V V V V V V V V V V V V V
  X X X X X X X X X X X X X X X X X X X X
  Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y
  a a a a a a a a a a a a a a a a a a a a
  b b b b b b b b b b b b b b b b b b b b
  c c c c c c c c c c c c c c c c c c c c
  d d d d d d d d d d d d d d d d d d d d
  e e e e e e e e e e e e e e e e e e e e
  f f f f f f f f f f f f f f f f f f f f
  g g g g g g g g g g g g g g g g g g g g
  h h h h h h h h h h h h h h h h h h h h
  i i i i i i i i i i i i i i i i i i i i
  j j j j j j j j j j j j j j j j j j j j
  k k k k k k k k k k k k k k k k k k k k
  l l l l l l l l l l l l l l l l l l l l
  m m m m m m m m m m m m m m m m m m m m
  n n n n n n n n n n n n n n n n n n n n
  o o o o o o o o o o o o o o o o o o o o
  q q q q q q q q q q q q q q q q q q q q
  r r r r r r r r r r r r r r r r r r r r
  s s s s s s s s s s s s s s s s s s s s
  t t t t t t t t t t t t t t t t t t t t
  u u u u u u u u u u u u u u u u u u u u
  v v v v v v v v v v v v v v v v v v v v
  w w w w w w w w w w w w w w w w w w w w
  x x x x x x x x x x x x x x x x x x x x
  y y y y y y y y y y y y y y y y y y y y
  z z z z z z z z z z z z z z z z z z z z
data graph;
  retain;
  set grades;
  keep student sex hist;
  do hist=0 to score by 5;
  output;
  end;
run;