Want Quick Results? An Introduction to SAS/GRAPH® Software

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KEY WORDS
GOPTIONS, GPLOT, GCHART, SYMBOL, AXIS, TITLE, FOOTNOTE

ABSTRACT
SAS/GRAPH software contains the tools and flexibility to produce high-resolution presentation quality graphs. With this flexibility comes a complexity that often discourages a new user from taking the plunge and learning SAS/GRAPH. Learning and using SAS/GRAPH does not need to be difficult. Nor are the more complex aspects of SAS/GRAPH always needed to produce graphic output that is just what your boss wants.

This workshop will introduce three of the primary procedures used by SAS/GRAPH, and introduce the options and statements that make them special. We will start with TITLEs and FOOTNOTEs. PROC GPLOT will be used to create a scatterplot which will be enhanced with SYMBOL statements and a number of options. Several variations of GCHART will be demonstrated and the creation of title slides using GSLIDE will be discussed briefly. Options specific to SAS/GRAPH and how and when they should be used will be handled with an introduction to the GOPTIONS statement.

GRAPHICS OPTIONS
Options specific to the graphics environment are defined using the GOPTIONS statement in much the same way as the OPTIONS statement is used to define system options. Typical GOPTION statements are shown in the following code. Remember SAS® is not case sensitive in open code.

```
goptions reset=all;
GOPTIONS CBACK=blue DEVICE=win
   prompt noborder;
GOPTIONS ftext=swiss
   colors=(white)
   ctext=white;
goptions htext=2;
```

As in the OPTION statement one or more options can be included in the GOPTIONS statement. In the above code all four SAS statements could have been written in a single statement. I like to group related options in their own statement so that I can comment out the ones that I don't want to apply.

The options shown above include:

reset=all	all goptions are reset to their default values
device=win	determines the type of device for graphics, in this case windows
cback	set background color
ftext, ctext, and htext	set the font, color and size of the text

The RESET= graphics option can also be used to reset specific groups of settings to their defaults e.g. `reset = symbols` resets any symbol statement definitions.

TITLES AND FOOTNOTES
SAS/GRAPH procedures also use TITLE and FOOTNOTE statements. Unlike in Base SAS, however, options are available to change the text color, font, size, justification, and orientation. The option is applied to the text string following option. Options (with examples) include:

- text color
  `c=blue`
- size of the text

```
          h=2
```
- font selection
```
          f=simplex
```
- angle (of text string)
```
          a=90
```
- rotation (angle of individual characters)
```
          r=45
```
- justification of the string
```
          j=center
```

In Figure 1 three titles are defined and presented using PROC GSLIDE.

```
proc gslide;
title1 'Figure 01';
title2 h=3 font=swissb 'swissb'
     color=yellow f=cartog
       'J K L M N';
title3 h=1 f=simplex
     'H1' h=2 'H2' h=4 'H4';
run;
```

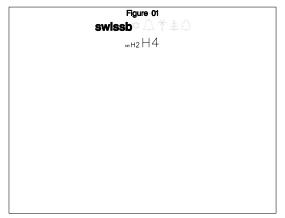Notice that options can be redefined within a given TITLE or FOOTNOTE.

Figure 1

PROC GSLIDE is used to display titles, notes, and footnotes, and does not use data. This procedure is especially useful when you want to produce pictures, drawings, or title slides for a presentation.

USING PROC GPLOT
The syntax for PROC GPLOT is very similar to that used in PROC PLOT. Typical syntax will include the following statements:

```
proc gplot options;
plot yvar * xvar / options;
run;
```

where the PLOT statement defines the vertical (yvar) and horizontal (xvar) variables and any options associated with the axes. PLOT statement options might include:

HREF & VREF
Used to define vertical and horizontal reference lines. The following statement causes vertical lines to be drawn at the values of x=2, 4, and 6.

```
plot y*x/href=2 4 6;
```

HREF creates vertical lines and these are tied to the noted values on the **h**orizontal axis.

HAXIS & VAXIS
Used to assign options and control parameters to an axis. The first of the two statements below constrains the horizontal axis to the values between 10 and 100 and causes a major tick mark at 10, 20, 30, ... The second indicates that the horizontal axis will be controlled by an AXIS statement.

```
plot y*x/haxis=10 to 100 by 10;
plot y*x/haxis=axis1;
```

When specifying values to the axis and tick marks the syntax is very similar to that used in DO statements.

The following code is a GPLOT that utilizes TITLES and a FOOTNOTE as well as axis control options. The variable defining the vertical axis is BMCRUS while DATE is the horizontal plot variable. The HAXIS= option instructs GPLOT to make major tick marks on the first of each month between 01Jun85 and 01Sep85.

```
proc gplot data=quick.biomass;
plot bmcrus * date /
     haxis='01jun85'd to
           '01sep85'd by month;
title1 'Crustacean Biomass';
title2 a=90 h=1.5
       'grams wet weight';
```

```
footnote1 j=l h=1.5 f=simplex
      'Figure 2';
run;
```

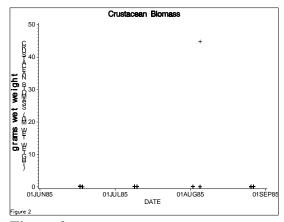TITLE2 uses the a= option to rotate the text line from horizontal to vertical (along the left side).

Figure 2

In Figure 2 the label for the vertical variable (BMCRUS) is redundant with TITLE2 and should be removed (see Figure 3). Control over the axis labels and other aspects of the axis can most easily be accomplished through the use of AXIS statements.

AXIS STATEMENTS
The AXIS statement allows you to maintain very specific control for all aspects for each individual axis in the plot. You may have up to 99 AXIS statements defined at any given time, although due to performance considerations it is usually wiser to only define those that will be used during the current execution.

```
axis<1...99> options=optionvalues;
```

Axis options can be grouped into four primary areas according to how they effect the axis. The four areas and some sample options include:

- axis scale options control axis scaling. Those below use log scales.

  ```
  logbase=10
  logstyle=expand
  ```

- appearance options are used to change text and line characteristics such as color, font, size and line type.

  ```
  color=black
  style=3
  ```

- tick mark options specify the characteristics of the tick marks. This includes removing tick marks altogether or changing their frequency, size, or color.

  ```
  major=none
  major=(h=1.5 c=blue)
  minor=(n=3 h=1.0 c=blue)
  ```

- text options control text associated with tick marks (VALUE) or axis labels (LABEL). Most of the options used with TITLES can also be used here.

  ```
  label=mean weight in grams
  value=(a=45 h=1.5)
  ```

The following is an AXIS statement that requests LOG scaling using base 10, eight minor tick marks between each major tick mark. Minor tick marks will have a length of 1 and major ticks will be half again as large. Simplex will be used for the tick mark text font.

```
axis1 logstyle=expand logbase=10
      minor = (n=8 h=1)
      major = (h=1.5)
      value = (f=simplex h=1.5)
      label = none;
```

In Figure 2 the HAXIS= option was used to control the date tick marks. The following AXIS statement accomplishes the same thing using the ORDER= option.

```
axis2 order = '01jun85'd to
             '01sep85'd by month
      value = (f=simplex h=1.5);
```

These two AXIS statements can be used together with the following code to redisplay Figure 2 and create Figure 3.

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```
proc gplot data=quick.biomass;
plot bmcrus * date / vaxis=axis1
                     haxis=axis2;
symbol v='*' f=simplex;
title1 'Crustacean Biomass';
title2 a=90 h=1.5 'grams wet weight';
footnote1 j=l h=1.5 f=simplex
          'Figure 3';
run;
```

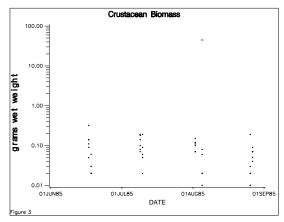Notice that with the expanded vertical axis a great deal of detail lost in Figure 2 becomes apparent.

Figure 3

SYMBOL STATEMENTS
The SYMBOL statement provides control over the characters to be printed on the scatter plot.

```
symbol<1...99> option=optionvalue;
```

Symbol options are used to control various aspects of the symbol. Text control options are similar to those used in TITLE and AXIS statements h=, f=, and c= apply to the height, font, and color respectfully. Other useful SYMBOL statement options include:

- value is used to designate the plot symbol.
  ```
  v=star
  v='*'
  ```
- line is used to designate the type of line (line=1 is solid while line=2 is dashed)
  ```
  l=33
  ```
- interpolation determines the method used to connect plot points
  ```
  I=box
  ```

Like the options in the TITLE and FOOTNOTE statements most of the options can be abbreviated by their first letter.

The following SYMBOL and AXIS statements where used to produce Figure 4. The font (f=), plot character (v=), and its size (h=) are selected. A solid line (l=) is used to join (I=) the plot points.

```
axis1 label=(h=1.5 a=90 f=swiss 'V'
         f=simplex 'olume (X1000)');
axis2 order=('03aug81'd to
         '31aug81'd by week)
      value=(h=1.5);

proc gplot data=quick.dow;
plot volume*date=1 / vaxis=axis1
                     haxis=axis2;
symbol1 v='V' h=2 f=simplex l=1
      I=join c=black;
format date date7.;
title1
    'Stock Market Analysis of the Dow';
title2 h=2 f=simplex 'Daily Volume';
note h=1.5 move=(20,25)pct 'Volumes';

footnote1 j=l h=1.5 f=simplex
         'Figure 4';
run;
```
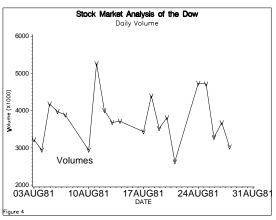

Figure 4

The vertical axis label for this figure is supplied through the AXIS1 statement rather than with the TITLE statement in Figure 3. The NOTE statement is used to write the word 'Volumes' directly under the line. It is placed on the graph manually using the MOVE= option. The major tick marks for the horizontal axis are dates and are specified using BY WEEK in the AXIS2 ORDER= option.

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USING PROC GCHART

The general syntax for using PROC GCHART is shown below. The primary statement that you need to be able to use is the one that selects the type of chart you wish to create.

```
proc gchart data=datasetname;
charttype varlist / options;
run;
```

The possible types of charts include:

- vbar   vertical histograms
- hbar   horizontal histograms
- block   tower or block chart
- pie   pie diagram
- star   star or spine chart
- donut   donut charts

Each type of chart has its own options, however several apply to most of the charts. These include:

- sumvar   summary variable (numeric)
- type   summary statistic
- midpoints   specific midpoint values
- discrete   numeric variable to be treated as categorical

The following code creates Figure 5 as a vertical histogram (VBAR). The variable DATE is used to define vertical bars. Since the summary statistic (TYPE) was specified as MEAN the average total biomass (BMTOTL) for the date will be displayed.

```
axis1 value=(h=1.5 f=simplex a=45 r=0)
      label=(h=1.5 f=simplex);

proc gchart data=biomass;
vbar date / discrete sumvar=bmtotl
            type=mean maxis=axis1;
title1 'Average Total Biomass';
footnote1 j=l h=1.5 f=simplex
          'Figure 5';
run;
```

The AXIS1 statement is tied to the horizontal or midpoint axis through the use of the MAXIS option. This statement changes the orientation

of the labels of the bars (DATEs). Notice the use of R=0, this should not be needed but is sometimes required with the A= option.
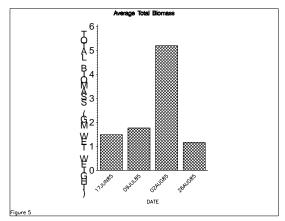

Figure 5

The label for the vertical axis is coming from the label for the summary variable (BMTOTL) and looks messy because SAS has selected a software font. You can control this label as was done in Figures 2 & 3 using a TITLE with the A= option or by using an axis statement with the vertical axis as is done in Figures 4 & 6.

The following code also creates a vertical histogram. The variable BMTOTL is used to define vertical bars. Since no summary statistic (TYPE) was specified the frequency (number of observation falling into each group) is displayed.

Unless directed otherwise GCHART will determine the midpoints or size of the groupings used to determine the bars. The MIDPOINT option is used explicitly define the groups, one of which has an extreme value (30). It is also possible to use AXIS statements with GCHART. The RAXIS and MAXIS options refer to the response axis and the midpoint axis respectfully.

```
axis1 value=(h=1.5 f=simplex)
      label=none;

axis2 value=(h=1.5 f=simplex)
      label=(h=1.5 f=simplex);

* one observation has a large value
* of BMTOTL;
proc gchart data=quick.biomass;
vbar bmtotl /
     midpoints=.5 to 6 by .5, 30
```

5

```
        raxis=axis1
        maxis=axis2;
title1 'Total Biomass Frequency';
title2 h=1.5 f=simplex
        'Using uneven midpoints';
title3 h=1.5 f=simplex a=90
        'Frequency';
footnote1 j=l h=1.5 f=simplex
        'Figure 6';
run;
```
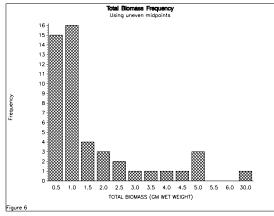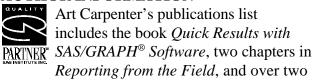

Figure 6

Figure 6

It should be noted that when using midpoints with unequal interval widths the values noted are not necessarily the true midpoint of the interval. In the above example the interval labeled as 6.0 ranges from 5.5 to 18 while the interval labeled 30.0 ranges from 19 and up.

SUMMARY
This has been a very brief introduction to some of the features of SAS/GRAPH. Although only a very few of the available options are included here, even these are sufficient to produce respectable graphs and charts rather quickly. Refinements are available in the form of many more options and supporting statements. These additional options and statements are further described in *Quick Results with SAS/GRAPH Software*. You may also be interested in the book by Thomas Miron *The How-To Book for SAS/GRAPH Software*.

AUTHOR INFORMATION

Art Carpenter's publications list includes the book *Quick Results with SAS/GRAPH® Software*, two chapters in *Reporting from the Field*, and over two dozen papers and posters presented at SUGI and WUSS. Art has served as a steering committee chairperson of both the Southern California SAS User's Group, SoCalSUG, and the San Diego SAS Users Group, SANDS; a conference cochair of the Western Users of SAS Software regional conference, WUSS; and Section Chair at the SAS User's Group International conference, SUGI.

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TRADEMARK INFORMATION