Improving a Graph Using PROC GPLOT®

and the GOptions Statement

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ABSTRACT

Starting with a simple SAS® PLOT program, we will transfer this plot into PROC GPLOT and take a look at the many ways you can improve the look of the plot using SAS GRAPH statements. We will make the plot really shine by customizing titles, footnotes, symbols, legends, axes and even the reference line. At each step, a hands-on example will be presented where the user will choose their own features such as symbol colors and placement of the legend. In the end, you will have built your own personalized graph using the Title, Footnote, Symbol, Legend, and Axis statements.

INTRODUCTION

The data to be used in the plot is a SAS dataset that contains daily counts of hits on each of 3 websites for one month. The SAS dataset is sorted by date and has the following variables.
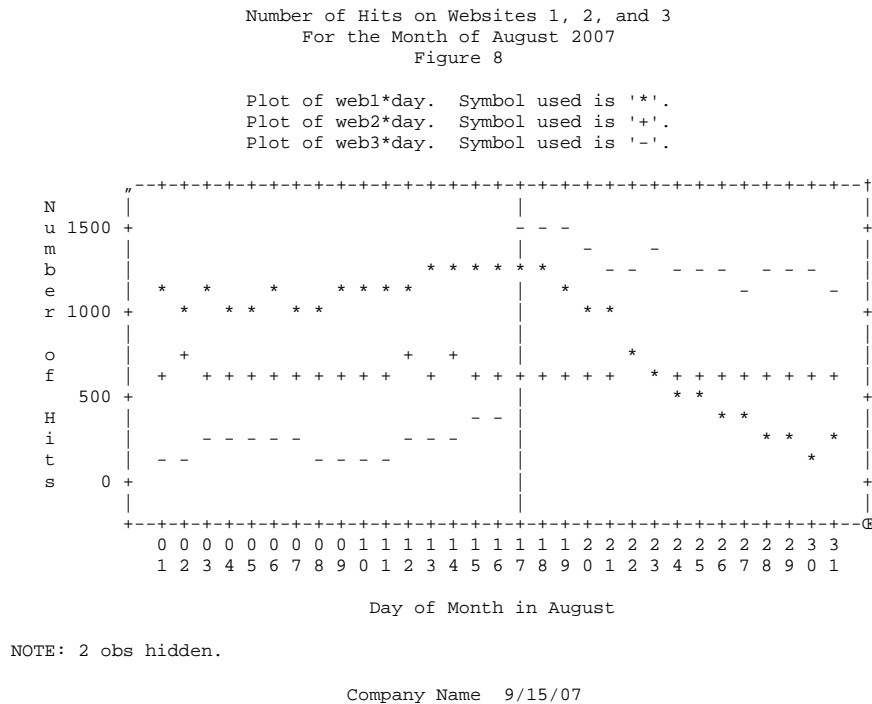
- Date – format yymmdd8.
- Day – day of month in $char2. format
- Web1 – hits on Website 1
- Web2 – hits on Website 2
- Web3 – hits on Website 3
- Total – total number of hits on all three websites

We are given a graph produced using a Proc Plot program and asked to improve the look of the graph. We start with the Proc Plot graph and take a look at the graph it produces.

PROC PLOT PROGRAM

```
DATA perm.hits;
    SET perm.hits;
    Day=substr (date,7,2);
    Label Day='Day of Month in August';
    Label Total='Total Number of Hits';
    Label web1='Number of Hits';
RUN;
TITLE 'Number of Hits on Websites 1, 2, and 3';
TITLE2 'For the Month of August 2007';
TITLE3 'Figure 8';
FOOTNOTE 'Company Name  9/15/07';
PROC PLOT DATA=perm.hits;
    PLOT   Web1 * day = '*'
        Web2 * day = '+'
        Web3 * day = '-'
        / OVERLAY  HREF = '17'  BOX;
RUN;
```

FINAL PROC PLOT GRAPH

```
                              Number of Hits on Websites 1, 2, and 3
                                    For the Month of August 2007
                                              Figure 8

                              Plot of web1*day.  Symbol used is '*'.
                              Plot of web2*day.  Symbol used is '+'.
                              Plot of web3*day.  Symbol used is '-'.

            „--+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+--†
     N      |                                 |                       |
     u 1500 +                                - - -                    +
     m      |                                 |    -     -            |
     b      |                      * * * * * *    - -   - - -   - - - |
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             1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

                                      Day of Month in August

          NOTE: 2 obs hidden.

                                   Company Name  9/15/07
```

PROC GPLOT

STEP 1 – Comparing Plot and GPlot

A review of the options used in the PLOT statement in the PROC PLOT program determined that the BOX option is not available for use in GPLOT, but the FRAME option is and they do very similar things. Note: another option that is available to GPLOT and not PLOT is the GRID option, which causes reference lines to be drawn at every major tick mark. However, a full grid on this plot would make the plot much too busy, so this option was not used. The OVERLAY and HREF options are valid in both PLOT and GPLOT, so those options were kept. Below is the code used to run the PROC GPLOT program with the change to the options on the PLOT statement from BOX to FRAME.

```
          TITLE 'Number of Hits on Websites 1, 2, and 3';
          TITLE2 'For the Month of August 2007';
          TITLE3 'Figure 9';
          PROC GPLOT DATA=perm.hits;
              PLOT Web1 * day = '*'
                  Web2 * day = '+'
                  Web3 * day = '-'
                  / OVERLAY  HREF = '17'  FRAME;
RUN;
```

Quick note on an alternative to the OVERLAY option. You can also get a similar effect with three variables by using the statement PLOT Y*X=Z. This will automatically turn on the LEGEND (off by default in GPLOT) and will plot one line for each value of Z.
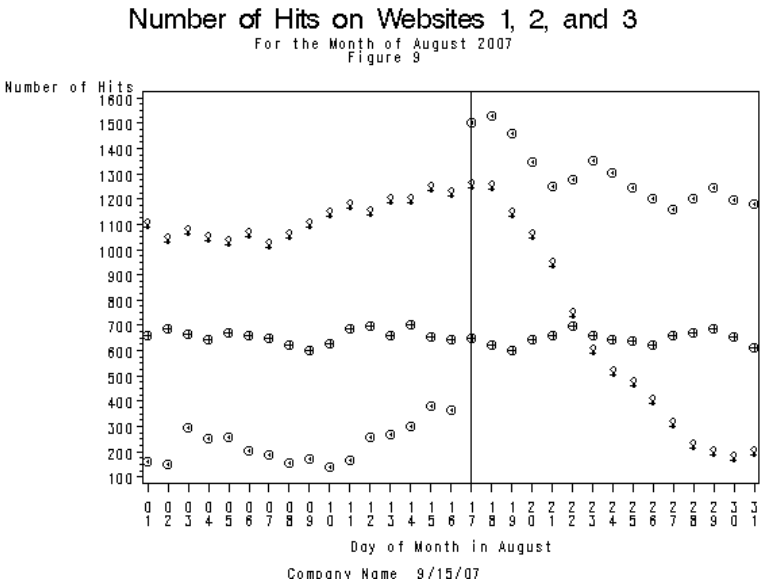
STEP 2 – Modifying the Titles and Footnotes

PROC GPLOT allows changes to font, height, and color of the text. PROC GPLOT also allows the placement of the title to be altered. Using PROC GPLOT, a box can be drawn around the title or the title can be underlined. Note these options are only available for certain SAS Graph procedures and are not available with PROC PLOT. All of these options work for text in titles, notes, and footnotes.

OPTION	WHAT IT DOES
COLOR =	Color of the text
BCOLOR =	Background color if using the box option
FONT =	Font of the text
HEIGHT =	Height of the letters
JUSTIFY = Left | Center | Right	Justifies portions of the text
ANGLE = *degrees*	Turns the entire line of text the number of degrees specified
ROTATE =*degrees*	Turns each letter in the text the number of degrees specified
BOX = 1 | 2 | 3 | 4	Creates a box around the text – 1 lightest line, 4 = darkest line
DRAW = (coordinate pairs)	Draws lines between the pairs of points
UNDERLINE = 0 | 1 | 2 | 3	Underlines text (0 = no underline, 3 = darkest underline)

All of these options take affect on the text AFTER the option appears. So if we want the first part of the line left justified and the second part right justified, use a command like this:

       TITLE **JUSTIFY=left** 'first part' **JUSTIFY=right** 'second part';

In our example below, the first change uses the FONT= option to specify a standard font for the entire title (by default, TITLE1 uses Swiss font and the others use the default hardware font). The second change, uses the HEIGHT= option to make the first title the same hieght as the other titles. In order to clearly label the month for this plot, the words 'August 2007' in the second line of the title were highlighted in red. Note that when the title is split in two sections, you must embed the spaces between the sections. SAS will not automatically put a space between them. (See the extra space after the word 'of' in TITLE2 below).

A modification of the footnote was added to separate the two parts of the text. The name of the company was left justified and the date was right justified using the JUSTIFY= option.

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TITLE **FONT='Times New Roman' HEIGHT=1.5**
        'Number of Hits on Websites 1, 2, and 3';
TITLE2 **FONT='Times New Roman' HEIGHT=1.5**
    'For the Month of ' **COLOR=red** 'August 2007';
TITLE3 **FONT='Times New Roman' HEIGHT=1.5** 'Figure 10';
FOOTNOTE JUSTIFY=left 'Company Name'
        JUSTIFY=right 'September 15, 2007';
PROC GPLOT DATA=perm.hits;
    PLOT Web1 * day = '*'
        Web2 * day = '+'
        Web3 * day = '-'
        / OVERLAY HREF = '17' FRAME;
RUN;
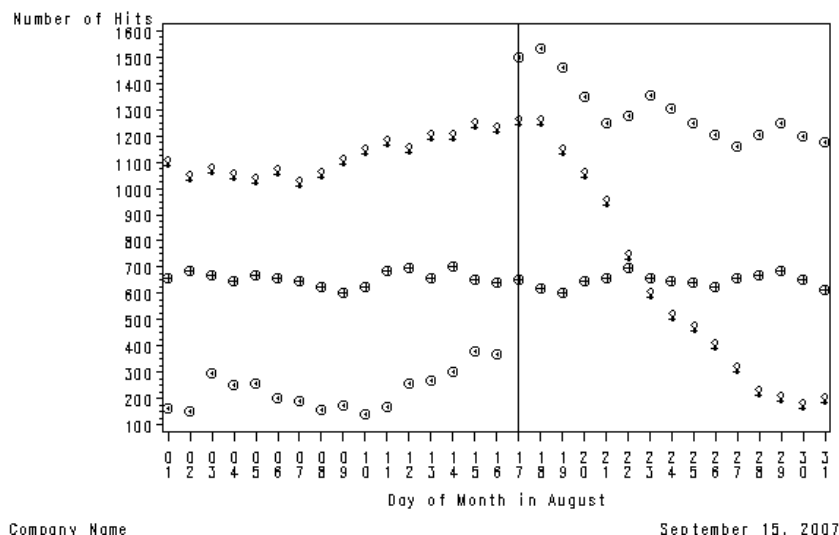
STEP 3 – Adjusting Symbols

PROC GPLOT allows symbols to be specified a couple of ways. The first is similar to the method used in PROC PLOT. However, the '*' symbol produces a different symbol in PROC GPLOT as compared to PROC PLOT. In order to use an asterisk, you must specify the "='star'" on the plot statement. Note that there is no way to use a dash as the symbol in PROC GPLOT. If you specify ='dash', you will get a circle with a dot in the middle (included here as an example). See Appendix A for a table of the different symbols available.

PROC GPLOT DATA=perm.hits;
    PLOT Web1 * day = 'star'
        Web2 * day = 'plus'
        Web3 * day = '-'
        / OVERLAY HREF = '17' FRAME;
RUN;

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Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 11
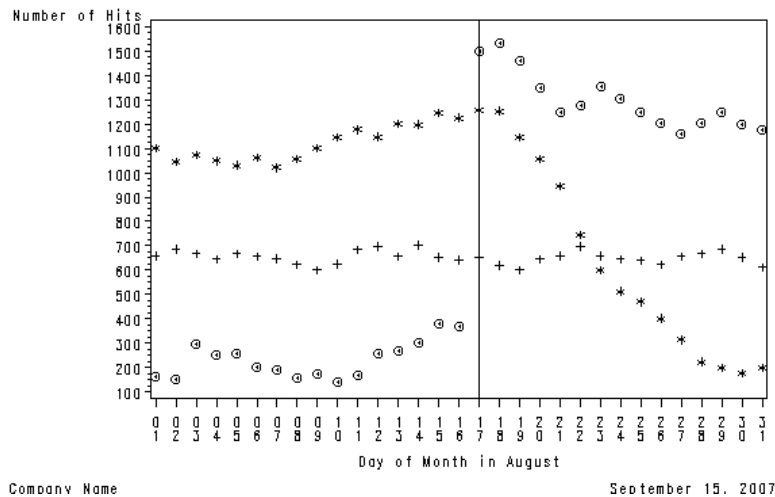
The SYMBOL Statement

Another way to specify the symbol is through the use of the SYMBOL statement. The symbol statement is a very powerful tool providing many other functions besides selecting a symbol. Using the symbol statement, the symbols on the plot can be connected, the types of lines used on the plot can be chosen and the colors of the symbols and lines can be selected. Here are some of the options you can use:

OPTION	WHAT IT DOES
COLOR =	To specify color (also can use CI, CV and CO for colors of the line, points, and outlines, respectively.
VALUE =	Selects the symbol printed on the plot (see Appendix A for the special symbols available)
HEIGHT =	To specify size of each symbol on the plot

INTERPOL
 	
= BOX
= HILO
= JOIN
= NONE
others
	Specifies if you want a line drawn and what type of line to use (also used to ask for regression plots)
	   For box plots
	   To draw a single line between min and max values of one axis
	   Connect the dots type of line
	   No line (default)
	   See SAS documentation for others

LINE =	Specifies the line to use (see Appendix B)
WIDTH =	Specifies the thickness of the line
POINTLABEL =	Labels the plot points

Symbol statements are numbered 1 through 99 and are used consecutively for each combination of plot variables. In this example, we have three separate plots (web1*day, web2*day and web3*day). If the symbol statement does not specify a color, then the SAS system uses that symbol statement repeatedly through all the colors in the color palette before going to the next symbol statement. It is therefore recommended that color be specified in each symbol statement so that the user is not just relying only on the symbol color to determine the meaning of the plot line or symbol. Color can be specified for both the line and the symbol (COLOR=), or can be specified separately for each (CL=line color and CV=symbol color). For this example, three symbol statements, each with a different color, were used.

To select the symbols, the VALUE= (V=) option is used. Refer to the SAS documentation for a table of the symbols available. To choose the size of the symbol, use the HEIGHT= (H=) option. Default height is 1.

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```
SYMBOL1 COLOR=blue VALUE=dot H=1;
SYMBOL2 COLOR=red VALUE=star H=1;
Symbol3 COLOR=green VALUE=circle H=1;
PROC GPLOT DATA=perm.hits;
     PLOT   Web1*day  Web2*day  Web3*day
          / OVERLAY  HREF = '17' FRAME;
RUN;
```

Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 12
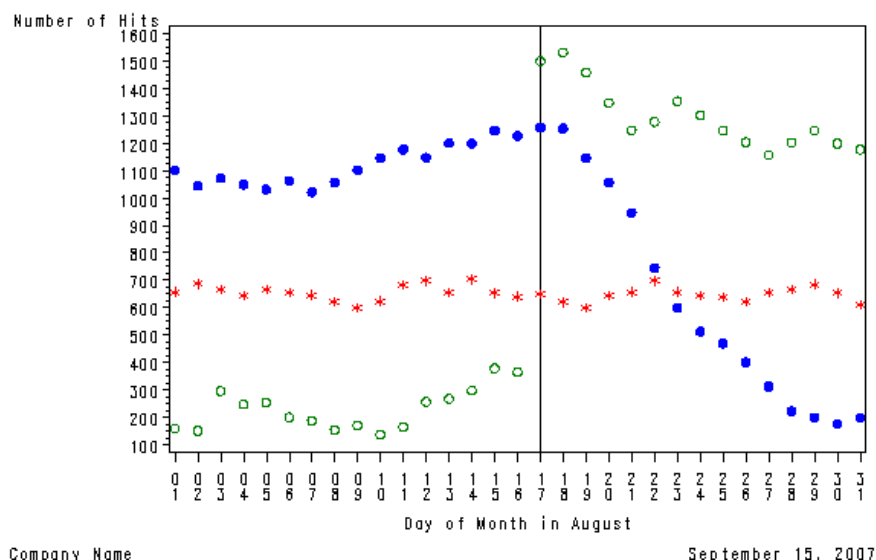
To specify that the points be connected, use the INTERPOL= (or I=) option. This feature offers many variations on connecting the symbols. For example, to use a straight "connect the dots" type of line, use 'I=join', or to get a regression line use 'I=R', or to get a step line use 'I=needle'. If you do not wish to connect the symbols, choose I=none. For this plot, a straight line between the points makes the plot much easier to understand, so 'I=join' was used.

To select what type of line to use, use the LINE= (L=) option. See Appendix B for a list of the lines that may be used. There are 46 different lines that can be selected. Line Type 1 is a solid line and Line Type 0 is no line. All the others are combinations of dashed lines of different sized dashes. To choose the thickness of the line use the Width= (W=) option.   The default is 1.

```
SYMBOL1 COLOR=blue INTERPOL=join LINE=1 VALUE=dot;
SYMBOL2 COLOR=red INTERPOL=join LINE=2 VALUE=star;
SYMBOL3 COLOR=green INTERPOL=join L=3 VALUE=circle;
PROC GPLOT DATA=perm.hits;
     PLOT   Web1*day  Web2*day  Web3*day
          / OVERLAY  HREF = '17' FRAME;
RUN;
```

Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 13

Company Name   September 15, 2007
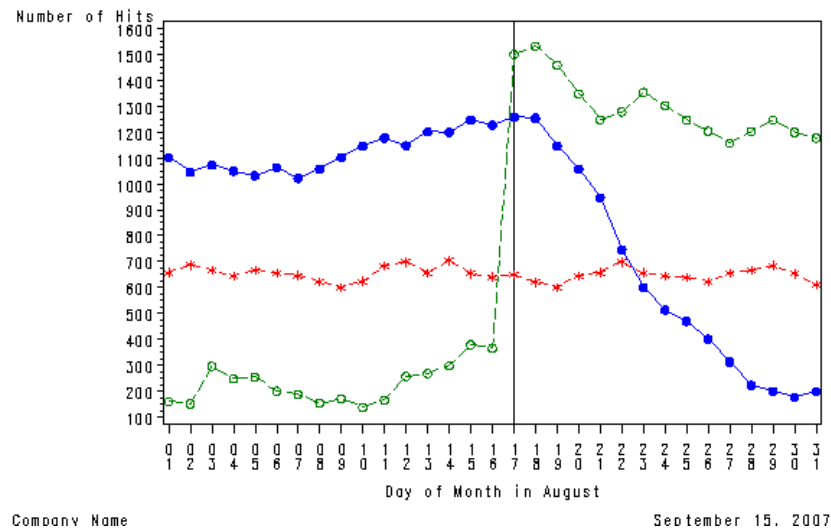
STEP 4 – Adjusting the Legend

Using overlay with the PROC GPLOT procedure does not automatically produce a legend. To produce a legend, use the LEGEND option in the Plot statement.

```
PROC GPLOT DATA=perm.hits;
    PLOT Web1*day  Web2*day  Web3*day
        / OVERLAY  HREF = '17' FRAME LEGEND;
RUN;
```

Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 14

Company Name   September 15, 2007

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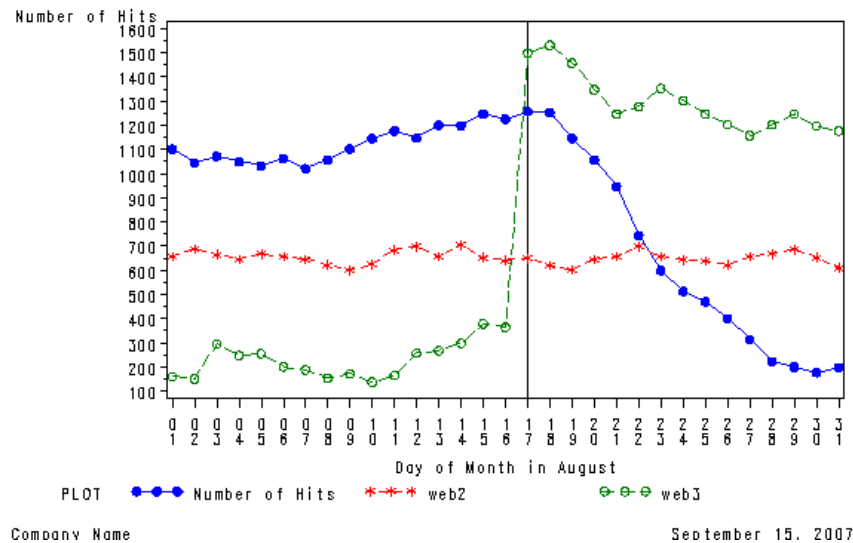
The LEGEND Statement

Note that in the plot above, the label for Web1 displays in the legend rather than the variable name. It is possible to specify your own legend labels using the LEGENDx statement and the VALUE= option. In the LEGENDx statement, the 'x' is a number from 1 to 99, which labels the different legend statements. Within the VALUE= option you can specify your own text, justify it, and/or specify different portions of the text different colors, fonts, or height. To change the name of the legend itself (in the example above, the default label was 'PLOT'), we can use the LABEL= option.

LEGEND statements specify the characteristics of the legend, but do not create the legend. The characteristics that can be specified include the position and appearance of the legend box, the text and appearance of the legend label, the appearance of the legend entries, including the size and shape of the legend values, and the text of the labels for the legend values.

OPTION	WHAT IT DOES
LABEL = (text edit options)	Modify/specify the legend title
VALUE = (text edit options)	Modify the legend value descriptions
SHAPE = BAR | LINE | SYMBOL	Specifies the size and shape of the legend values
POSITION = (<Bottom | Middle | Top> <Left | Center | Right> <Outside | Inside >)	Positions the legend on the graph. By default, POSITION=(Bottom Center Outside)
MODE = Protect | Reserve | Share	Defines how the legend interacts with the graphing area.
ORDER =	Orders the legend values
ACROSS = DOWN =	Specifies how legend entries will appear
FRAME	Draws a frame around the legend
FWIDTH =	Specifies the thickness of the frame
OFFSET = (x,y)	Moves the legend
CBLOCK =, CSHADOW =, CBORDER =, CFRAME	Specifies color of various parts of the legend or to get shadow effects.

Text Description Suboptions can be used whenever you want to modify the appearance of text (inside the label and value options, for example). Text description suboptions affect all the strings that follow unless the suboption is changed or turned off.

OPTION	WHAT IT DOES
COLOR =	Specifies color
FONT =	Specifies font
HEIGHT =	Specifies size of font
JUSTIFY = LEFT | CENTER | RIGHT	Justifies portions of the text
POSITION = (<Bottom | Middle |Top > <Left | Center | Right >)	Places the legend label in relation to the legend entries. Used only with the LABEL option. By default, POSITION=LEFT.
TICK =	Modifies one legend engtry

Unlike the symbol statements, which are automatically used as the plotting process needs them, you will need to explicitly specify which legend statement to use for your plot. To do this, specify legend=legendx (where x is which legend statement you are referring to) on the plot statement.

```
   LEGEND1   LABEL=(HEIGHT=1 'Web Sites')
     VALUE=('Web Site 1' 'Web Site 2' 'Web Site 3');
   PROC GPLOT DATA=perm.hits;
       PLOT   Web1*day  Web2*day  Web3*day
             / OVERLAY  HREF = '17' FRAME LEGEND=legend1;
   RUN;
```
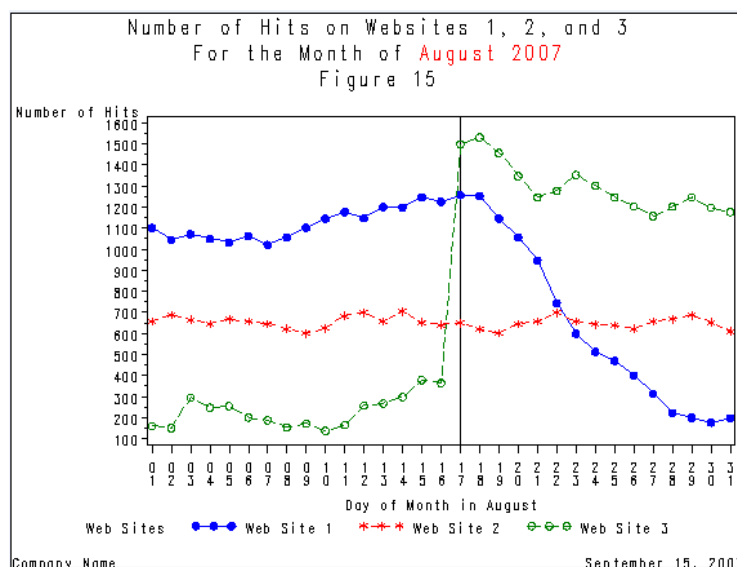

In addition to specifying the text for the legend entries, the entries may be repositioned within the legend itself. Using the ACROSS= and DOWN= options, I specified that the legend should be listed vertically rather than horizontally.

The legend may also be moved either inside or outside (default) the plotting area using the POSITION= option. If the legend is placed outside the plot, this will limit how much plotting space is actually given to the plot. If you wish to save plotting space, move the legend inside the plotting area. The default position is (Bottom Center Outside). I chose to move it to (Top Left Inside).

If the legend is moved to the inside of the plotting area, the option MODE must be changed to either 'PROTECT' or 'SHARE'. With Protect, the legend covers any points that would otherwise appear in the same place as the legend. With Share, the legend and the points are both printed (on top of each other). For this example, PROTECT was used.

To move the legend label to the top of the list of legend entries, use the LABEL= option and its suboptions POSITION and JUSTIFY to move it above the entries and center it.

```
   LEGEND1   LABEL=(HEIGHT=1 POSITION=top JUSTIFY=center
             'Web Sites')
         VALUE=('Web Site 1' 'Web Site 2' 'Web Site 3')
         ACROSS=1 DOWN=3
         POSITION= (top left inside)
         MODE=protect;
   PROC GPLOT DATA=perm.hits;
       PLOT   Web1*day  Web2*day  Web3*day
            / OVERLAY  HREF = '17' FRAME LEGEND=legend1;
   RUN;
```

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Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 16
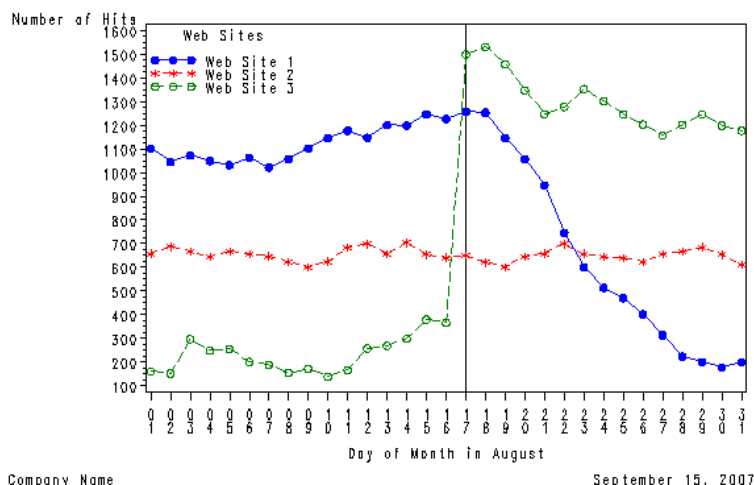
Two additional options to make the legend stand out are FRAME, to add a frame around the legend and CFRAME to shade it. These two options are mutually exclusive in GPLOT. To add a frame, use the FRAME option in the legend statement. To shade the legend, use the CFRAME option and specify the color you want. I preferred the CFRAME option for this example.

In order to improve the placement of the legend, it was moved slightly to the right rather than against the vertical axis. To move the legend to the right, use the option OFFSET=(x,y). The x specifies the amount of space to move horizontally, and y specifies the amount of space to move the legend vertically. With the OFFSET option, you can specify the units you want used for the x and y values. I chose to use percent of the plotting space (pct). You can also specify to use inches (in), or centimeters (cm).   If the x or y value is not specified, it is assumed to be zero.

```
LEGEND1   LABEL=(HEIGHT=1 POSITION=top JUSTIFY=center
           'Web Sites')
        VALUE=('Web Site 1' 'Web Site 2' 'Web Site 3')
        ACROSS=1  DOWN=3
        POSITION = (top left inside)
        MODE=protect
        OFFSET = (3 pct)
        CFRAME = yellow;
PROC GPLOT DATA=perm.hits;
    PLOT   Web1*day  Web2*day  Web3*day
        / OVERLAY  HREF = '17' FRAME LEGEND=legend1;
RUN;
```

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Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 17
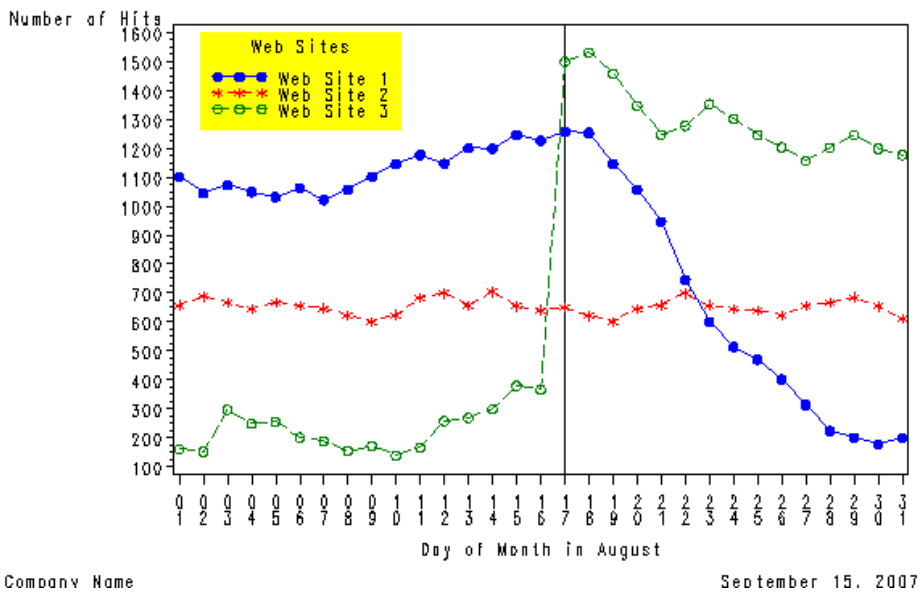
STEP 5 – The Axes

The axes can be modified in two ways. You may use the options on the PLOT statement in the GPLOT procedure or you may use the AXIS statement and then assign the particular AXIS definition in the PLOT statement.

In this example, modifying the vertical axis so there are fewer numbers displayed will make the plot look cleaner and easier to read. To do this use the VAXIS= option. Since these numbers were numeric it is possible to specify the axis using a range. During a test run, I noticed SAS placed four tick marks between each major tick mark. I thought that three would look better and be easier to understand (to represent every 50 hits). To do this, use the VMINOR= option.

```
PROC GPLOT DATA=perm.hits;
    PLOT   Web1*day  Web2*day  Web3*day
        / OVERLAY  HREF = '17' FRAME LEGEND=legend1
        VAXIS=0 to 1800 by 200   VMINOR=3;
Run;
```

Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 18
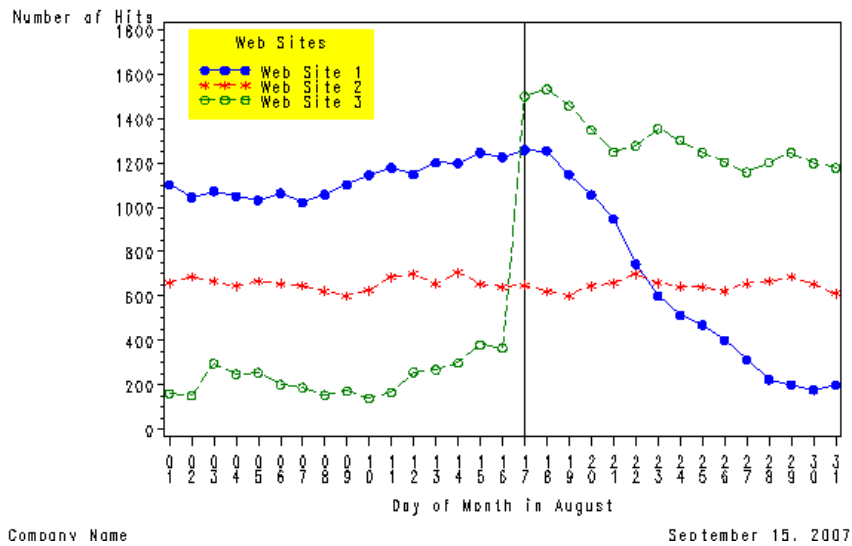
The AXIS Statement

The second way to modify the axes is to use the AXIS statement. Here we are using it to modify the placement of the axis labels (not available in the options on the plot statement).   The AXIS statement is similar to the LEGEND and SYMBOL statements. You can specify up to 99 different AXIS statements by specifying AXISx where x can be any number from 1 to 99. To choose which axis definition to use, use the VAXIS= and/or the HAXIS= options on the PLOT statement. This will replace the range of numbers in the previous example.

AXIS statements specify the characteristics of an axis, including the way the axis is scaled, how the data values are ordered, the location and appearance of the axis lines and tick marks, and the text and appearance of the axis label and major tick marks. Many of the options that can be used in the AXIS statement are the same as the TITLE statement options (i.e., ANGLE and ROTATE suboptions).

OPTION	WHAT IT DOES
COLOR =	Color of the axes
LENGTH =	Specify axis length
STYLE =	Specify line type to use for the axis
WIDTH =	Specify the thickness of the axis line
MAJOR = (tick mark suboptions)	Specify the major tick marks
MINOR = (tick mark suboptions)	Specify the minor tick marks
ORDER =	Value list
LABEL = (text arguments)	Specify the label on the axis
REFLABEL = (text arguments)	Add a label to a reference line on the plot
VALUE = (text arguments)	Specify replacement values for the tick marks

Use the ANGLE and ROTATE suboptions in the LABEL option to change the angle of the vertical axis label to display it down the side instead of across the top. Note the suboptions on the AXIS statement are applied to any text that comes *after* the options. If you put the text before the suboptions, the suboptions will be ineffective. The ANGLE suboption causes the entire label to be turned. The ROTATE suboption will turn each letter separately.   Note: the direction of –90 degrees will turn the same amount as specifying 270 degrees. The size of the label was increased using the HEIGHT suboption in the label option.

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In this example, two changes were made to the horizontal axis. First, a label was added to the reference line, using the REFLABEL= option. Second, removal of the leading zeroes from the tick mark labels for the 1st through the 9th of August using the VALUE= option. Note that these values are character, so the text must be specified in quotes and a range could not be used (as is possible with numeric variables). The SAS system assigns the values from the first point consecutively for as many labels as provided, and then uses the default label for the rest of the points.

```
AXIS1      LABEL=(ANGLE=270 ROTATE=90 HEIGHT=1.5
                'Number of Hits')
        ORDER=(0 to 1800 by 200)
        MINOR=(NUMBER=3)
        ;
    AXIS2 REFLABEL=(POSITION=top JUSTIFY=center 'Email Ad')
        VALUE=('1' '2' '3' '4' '5' '6' '7' '8' '9');
PROC GPLOT DATA=perm.hits;
    PLOT   Web1*day  Web2*day  Web3*day
        / OVERLAY  HREF = '17' FRAME LEGEND=legend1
        VAXIS=axis1 HAXIS=axis2;
RUN;
```


Number of Hits on Websites 1, 2, and 3
For the Month of August 2007
Figure 19
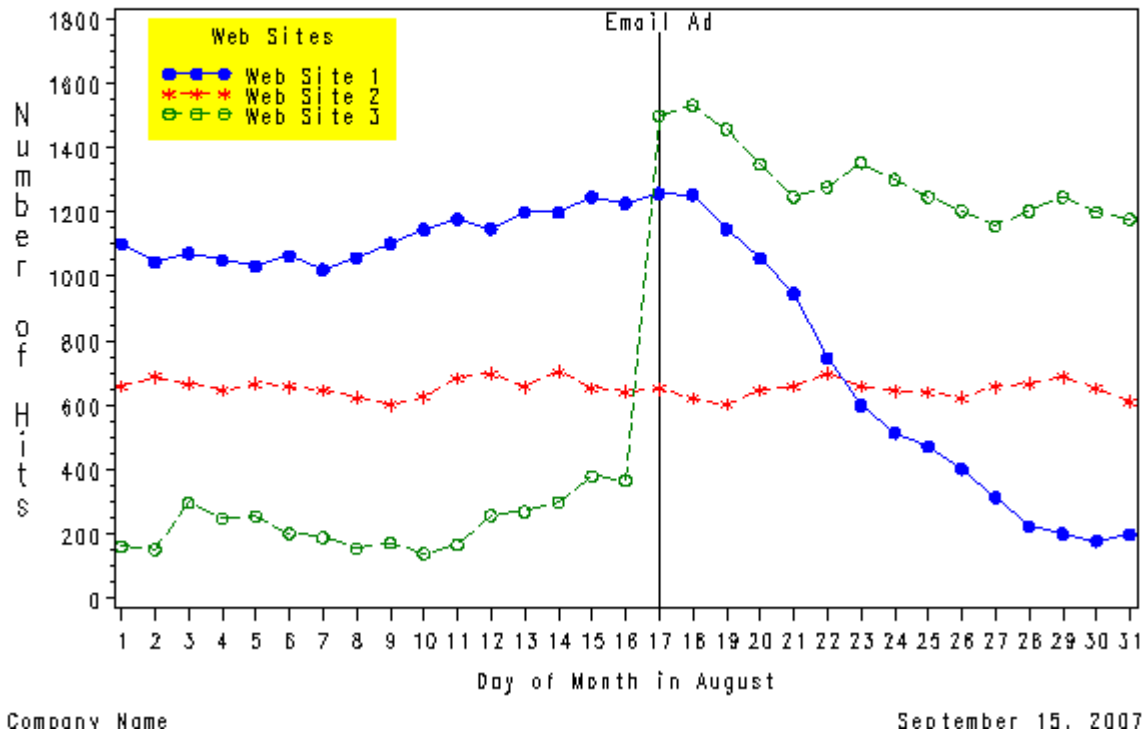
GOPTIONS STATEMENT

The GOPTIONS statement can help you improve your graph even further as well as preparing the graph to be saved in a file. There are over 125 options to choose from – only a few will be described here. Some of the options will set global values of font selection and text appearance, others affect color, and yet others affect the overall size and positioning of the graph

OPTION NAME	DESCRIPTION
RESET	To reset all GOPTIONS back to the default values
DEVICE / TARGET	Specifies what file type the graph should be created in
GSFNAME	To associate a graph to a file set up with a FILENAME statement.
GSFMODE	REPLACE or APPEND to the output file
HPOS / VPOS	Specify number of columns and rows, respectively, in the graphics output area does not affect the width or height of the graphics area, but merely divides it into cells.
FTEXT / HTEXT / CTEXT	Font, height, and color for the text in the graph, respectively
FTITLE / HTITLE /CTITLE	Font, height, and color for the title, respectively
FBY / HBY / CBY	Font, height, and color for the BY-line
HSIZE / VSIZE	Specify size of graph in inches or centimeters
XMAX / YMAX	Specify maximum size of graph in inches or centimeters
HORIGIN / VORIGIN	The horizontal and vertical offset of the graph
BORDER	Will draw a border around the graphics output area

SAVING A PLOT TO A FILE

The first use of the GOPTIONS statement that we will take a look at is to save a plot to a file. There are several options used for this. To get a list of the possible DEVICE types that can be used, run the following code (there are very many devices available).

```
PROC GDEVICE
        CATALOG=sashelp.devices NOFS;
        LIST;
RUN; QUIT;
```

Following is one example that uses some of the options listed above to create a graph in a file.

```
FILENAME  OUTPLOT 'C:\PLOT.GIF';
GOPTIONS DEVICE=GIF570
              GSFNAME=OUTPLOT
              GSFMODE=REPLACE
              HPOS=83
              VPOS=43
              ;
PROC GPLOT …;
        ….
RUN;
```

CREATING MULTIPLE GRAPHS IN ONE FILE USING ODS

Using ODS, we can create a single file that includes multiple graphs. Output files can be in HTML, RTF, PDF, and Printer (and others as well) . Most devices can be used, however, some of the more common ones are: GIF, JPEG, PNG, ActiveX, SASPRTC and EMF.

Here is one example of how to produce a PDF file with multiple graphs.

```
ODS PDF File = "c:\graphs.pdf";
GOPTIONS
        DEVICE  = SASPRTC
        TARGET  = SASPRTC
        FTEXT   = 'helvetica'
        FTITLE  = 'helvetica/bold';


        … … PROC GPLOT code (that produces many graphs) … …


ODS PDF CLOSE;
```

ODS AND CHANGING GRAPH ATTRIBUTES

You can modify the graph's overall size by using the XMAX and YMAX options. These values affect the final size of the graphics display area, ergo, the size of the graph. This is a nice way to control how large the file is that is placed into your file. Following is one example of how this is done:

```
GOPTIONS
        RESET=all
        DEVICE=png
        TARGET=png
        XMAX=7 in
        YMAX=9 in
        FTEXT='Arial';

ODS RTF file='c:\graph.rtf';
        SAS Graph statements to create one or many graphs.
ODS RTF close;
```

CHANGING PAGE LAYOUT

GOPTIONS are not the only SAS statement you can use to improve how your graph is stored in the output file, there are also some very useful options in the SAS OPTIONS statement:

OPTION NAME	DESCRIPTION
ORIENTATION	Landscape or Portrait
TOPMARGIN	Sets the top margin in the output file
BOTTOMMARGIN	Sets the bottom margin in the output file
LEFTMARGIN	Sets the left margin in the output file
RIGHTMARGIN	Sets the right margin in the output file

Following is an example using these options:

```
OPTIONS
        ORIENTATION=landscape
        TOPMARGIN=1.5
        BOTTOMMARGIN=1
        LEFTMARGIN=1
        RIGHTMARGIN=1;
GOPTIONS
        RESET=all
        DEVICE=sasprtc
        BORDER;

ODS PRINTER SAS PRINTER='PostScript EPS Color'  FILE='c:\graph.eps';
        …SAS Graph statements to create one or more graphs…
ODS printer close;
```

FINAL PROC GPLOT PROGRAM

As there is only one graph that we are producing, it was decided to produce a single output GIF file to hold this graph. However, it could easily have also been placed in an RTF or PDF file using ODS and some of the options on the OPTIONS statement as well as different options from those chosen below on the GOPTIONS statement. Please feel free to experiment.

```
 FILENAME  OUTPLOT 'C:\PLOT.GIF';
 GOPTIONS DEVICE=GIF570
           GSFNAME=OUTPLOT
           GSFMODE=REPLACE
           HPOS=83
           VPOS=43
           ;
 LEGEND1   LABEL=(HEIGHT=1 POSITION=top JUSTIFY=center
            'Web Sites')
       VALUE=('Web Site 1' 'Web Site 2' 'Web Site 3')
       ACROSS=1  DOWN=3 MODE=protect
       POSITION = (top left inside)
       OFFSET = (3 pct)  CFRAME = yellow;
 AXIS1      LABEL=(angle=270 ROTATE=90 HEIGHT=1.5
                'Number of Hits')
       ORDER=(0 to 1800 by 200)
       MINOR=(number=3);
 AXIS2 REFLABEL=(POSITION=top JUSTIFY=center 'Email Ad')
       VALUE=('1' '2' '3' '4' '5' '6' '7' '8' '9');
 SYMBOL1 COLOR=blue INTERPOL=join LINE=1 VALUE=dot;
 SYMBOL2 COLOR=red INTERPOL=join LINE=2 VALUE=star;
 SYMBOL3 COLOR=green INTERPOL=join LINE=3 VALUE=circle;
 TITLE FONT='Times New Roman' HEIGHT=1.5
           'Number of Hits on Websites 1, 2, and 3';
 TITLE2 FONT='Times New Roman' HEIGHT=1.5
           'For the Month of '  COLOR=red 'August 2007';
 FOOTNOTE JUSTIFY=left 'Company Name'
      JUSTIFY=right 'September 15, 2007';
 PROC GPLOT DATA=perm.hits;
      PLOT   Web1*day  Web2*day  Web3*day
          / OVERLAY  HREF = '17' FRAME LEGEND=legend1
          VAXIS=axis1 HAXIS=axis2;
 RUN;
```

CONCLUSION AND TRADEMARKS

The options described here are by no means exhaustive of what the SAS GRAPH system can do. Please refer to the documentation to learn what else is possible to improve the quality of your graphs.

AUTHOR CONTACT

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Appendix A

Special Symbols for Plotting Data Points

VALUE=	Plot Symbol	VALUE=		Plot Symbol
PLUS	+	%	(percent)	♧
X	✕	&	(ampersand)	♧
STAR	✳	'	(single quote)	⚜
SQUARE	☐	=	(equals)	☆
DIAMOND	◇	-	(hyphen)	⊙
TRIANGLE	△	@	(at)	☿
HASH	♯	'	(asterisk)	♀
Y	Y	+	(plus)	⊕
Z	Z	>	(greater than)	♂
PAW	∴∵	.	(period)	♃
POINT	·	<	(less than)	♄
DOT	●	,	(comma)	⚇
CIRCLE	○	/	(slash)	♆
_	(underscore) ⌂	?	(question mark)	♇
"	(double quote) ♤	(	(left parenthesis)	☾
#	(pound sign) ♡	)	(right parenthesis)	⚷
$	(dollar sign) ◇	:	(colon)	✳

Appendix B

Line Types