Converting SAS/GRAPH® Plots and Annotate to ODS Graphics

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Holland Numerics Ltd, UK
Part 1

Converting SAS/GRAPH Plots to ODS Graphics

(Paper: "Something for Nothing! Converting Plots from SAS/GRAPH to ODS Graphics")
Agenda

- Introduction
- Scatter Plots, Line Plots and Error Bars
- Regression Plots
- Box Plots
- Vertical and Horizontal Bar Charts
- Pie Charts
- Conclusions
A comparison of the output from the most commonly used SAS code for producing plots and charts using SAS/GRAPH and ODS Graphics:

- **Easy**: Replacing one SAS/GRAPH procedure statement with an ODS Graphics procedure. The conversion may also require some pre-processing of the input data.

- **Difficult**: Replacing one SAS/GRAPH procedure with code containing PROC TEMPLATE and PROC SGRENDER, or the conversion requires extensive pre-processing of the input data.

- **Impossible**: There is currently no corresponding ODS Graphics procedure in that version of SAS software to replicate the SAS/GRAPH graph.
Scatter Plots (Easy)

SAS 9.2: PROC GPLOT

SAS 9.2M3: PROC SGPLOT
Scatter Plots (Easy)

PROC SGPORT DATA = sashelp.class;
   SCATTER Y = weight X = height / GROUP = sex;
RUN;

Line Plots (Easy)

SAS 9.2: PROC GPLOT

SAS 9.2M3: PROC SGPLOT
PROC SORT DATA = sashelp.class OUT = class;
   BY sex height;
RUN;

PROC SGPLOT DATA = class;
   SERIES Y = weight X = height / GROUP = sex MARKERS MARKERATTRS = (SYMBOL=CIRCLE);
RUN;
Line Plots with Error Bars (Easy)

SAS 9.2: PROC GPLOT

SAS 9.2M3: PROC SGPLOT
PROC SORT DATA = sashelp.class OUT = class;
   BY sex height;
RUN;

PROC SUMMARY DATA = class NWAY;
   CLASS sex;
   VAR weight;
   OUTPUT OUT = class_se
       STDERR = weight_se;
RUN;

DATA class_odds (KEEP = sex height value value_upper value_lower);
   MERGE class class_se; BY sex;
   value = weight;
   value_upper = weight + weight_se;
   value_lower = weight - weight_se;
   OUTPUT;
RUN;

PROC SGPLOT DATA = class_odds;
   SCATTER Y = value X = height / GROUP = sex
       YERRORUPPER = value_upper
       YERRORLOWER = value_lower;
   SERIES Y = value X = height /
       GROUP = sex;
   LABEL value = "Weight";
RUN;
Regression Plots (Easy)

SAS 9.2: PROC GPLOT

SAS 9.2M3: PROC SGPLOT
Regression Plots (Easy)

PROC SORT DATA = sashelp.class OUT = class;
   BY sex height;
RUN;

PROC SGPLOT DATA = class;
   REG Y = weight X = height / GROUP = sex CLI MARKERATTRS = (SYMBOL=CIRCLE);
RUN;
Box Plots (Easy)

SAS 9.2: PROC GPLOT

SAS 9.2M3: PROC SGPLOT
Box Plots (Easy)

PROC SORT DATA = sashelp.class OUT = class;
   BY age;
RUN;

PROC SGPLOT DATA = class;
   VBOX height / CATEGORY = age;
RUN;
Vertical Bar Charts (Easy)

SAS 9.2: PROC GCHART

SAS 9.2M3: PROC SGPLOT
PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC SGPLOT DATA = class;
   VBAR age;
RUN;
Vertical Bar Charts (Easy)

SAS 9.2: PROC GCHART

SAS 9.2M3: PROC SGPLOT
Vertical Bar Charts (Easy)

PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC SGPLOT DATA = class;
   VBAR age / GROUP = sex;
RUN;
Vertical Bar Charts (Easy)

SAS 9.2: PROC GCHART

SAS 9.2M3: PROC SGPANEL
Vertical Bar Charts (Easy)

PROC SORT DATA = sashelp.class OUT = class;
  BY sex age;
RUN;

PROC SGPANEL DATA = class;
  PANELBY age / COLUMNS = 6;
  VBAR sex / GROUP = sex;
RUN;
Vertical Bar Charts (Easy)

**SAS 9.2: PROC GCHART**

**SAS 9.3M1: PROC SGPLOT**
Vertical Bar Charts (Easy)

PROC SORT DATA = sashelp.class OUT = class;
    BY sex age;
RUN;

PROC SGPLOT DATA = class;
    VBAR age / GROUP = sex GROUPDISPLAY = CLUSTER;
RUN;
Horizontal Bar Charts (Easy)

SAS 9.2: PROC GCHART

<table>
<thead>
<tr>
<th>Age</th>
<th>FREQ.</th>
<th>CUM. FREQ.</th>
<th>PCT.</th>
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SAS 9.2M3: PROC SGPLOT

Age

11
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13
14
15
16

Frequency

0 1 2 3 4 5
PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC SGPLOT DATA = class;
   HBAR age;
RUN;
Horizontal Bar Charts (Difficult)

SAS 9.2: PROC GCHART

<table>
<thead>
<tr>
<th>Age</th>
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SAS 9.4M1: PROC SGPLOT

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<td>100.00</td>
</tr>
</tbody>
</table>
PROC SORT DATA = sashelp.class OUT = class;
   BY age;
RUN;

PROC FREQ DATA = class;
   TABLES age / OUT = class_summ NOPRINT;
RUN;

DATA class_summ;
   SET class_summ;
   RETAIN cum_freq cum_pct .;
   freq = count;
   cum_freq + count;
   cum_pct + percent;
   FORMAT freq cum_freq 6. percent cum_pct 6.2;
RUN;
PROC SGPLOT DATA = class_summ;
    HBAR age / STAT = FREQ;
    YAXISTABLE freq cum_freq percent cum_pct /
        LOCATION = INSIDE POSITION = RIGHT LABELPOS = TOP;
RUN;
Horizontal Bar Charts (Easy)

SAS 9.2: PROC GCHART

SAS 9.2M3: PROC SGPLOT
Horizontal Bar Charts (Easy)

PROC SORT DATA = sashelp.class OUT =
   class;
   BY sex age;
RUN;

PROC SG PLOT DATA = class;
   HBAR age / GROUP = sex;
RUN;
Horizontal Bar Charts (Difficult)

**SAS 9.2: PROC GCHART**

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**SAS 9.4M1: PROC SGPLOT**

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</tr>
</tbody>
</table>
PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC FREQ DATA = class;
   TABLES sex * age / OUT = class_stack_summ NOPRINT;
RUN;
DATA class_stack_summ;
  SET class_stack_summ;
  BY sex age;
  RETAIN cum_freq cum_pct .;
  freq = count;
  cum_freq + count;
  cum_pct + percent;
  FORMAT freq cum_freq 3. percent cum_pct 6.2;
RUN;

DATA class_stack_summ;
  SET class_stack_summ;
  BY sex age;
  IF NOT LAST.age THEN DO;
    freq = .;
    cum_freq = .;
    percent = .;
    cum_pct = .;
  END;
RUN;
Horizontal Bar Charts (Difficult)

PROC SGPLOT DATA = class_stack_summ;
   HBAR age / GROUP = sex;
       YAXISTABLE freq cum_freq percent cum_pct /
           LOCATION = INSIDE POSITION = RIGHT LABELPOS = TOP;
RUN;
Horizontal Bar Charts (Easy)

SAS 9.2: PROC GCHART

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</table>

SAS 9.2M3: PROC SGPANEL

SAS 9.2M3: PROC SGPANEL
Horizontal Bar Charts (Easy)

PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC SGPANEL DATA = class;
   PANELBY age / ROWS = 6;
   HBAR sex / GROUP = sex;
RUN;
Horizontal Bar Charts (Easy)

**SAS 9.2: PROC GCHART**

<table>
<thead>
<tr>
<th>Age</th>
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**SAS 9.3M1: PROC SGPLOT**

[Bar charts showing frequency distribution by age and gender]
PROC SORT DATA = sashelp.class OUT = class;
   BY sex age;
RUN;

PROC SGPLOT DATA = class;
   HBAR age / GROUP = sex GROUPDISPLAY = CLUSTER;
RUN;
Horizontal Bar Charts (Impossible)

SAS 9.2: PROC GCHART

Not possible before SAS 9.4 Maintenance 2
Pie Charts (Difficult)

SAS 9.2: PROC GCHART

SAS 9.4M1: PROC TEMPLATE
Pie Charts (Difficult)

PROC SORT DATA = sashelp.class OUT = class;
   BY age;
RUN;

PROC TEMPLATE;
   DEFINE STATGRAPH pie;
   BEGINGRAPH;
      LAYOUT REGION;
         PIECHART CATEGORY = age / DATALABELLOCATION = OUTSIDE
            CATEGORYDIRECTION = CLOCKWISE START = 180 NAME = 'pie';
            DISCRETELEGEND 'pie' / TITLE = 'Age';
      ENDLAYOUT;
   ENDPGRAPH;
END;
RUN;

PROC SGRENDER DATA = class TEMPLATE = pie;
RUN;
3D Pie Charts (Impossible)

- This chart is one that I have never really liked. My opinion of this graph is that, rather than being a way to inform the viewer, they are frequently used to mislead the viewer instead.
- It is with great delight that I have discovered that 3D pie charts will not be supported in any release of ODS Graphics in the near future.
- This does not prevent SAS users who wish to create these charts from doing so, but they will be required to license SAS/GRAPH first.
Conclusions

- Do you only create plots, and no charts at all? This probably means that your programs could be converted from SAS/GRAPH to ODS Graphics in SAS 9.2 or 9.3.

- If you create bar charts, do you draw horizontal bar charts that require large amounts of text added alongside the chart? It should still be possible to convert your programs from SAS/GRAPH to ODS Graphics in SAS 9.2 or 9.3.

- If you require horizontal clustered bar charts with large amounts of text added, 2D or 3D pie charts, then keep your SAS/GRAPH license for now, as PROC GCHART is not going away in the foreseeable future!
Generating Graph Templates from PROC SGPLOT

Using PROC SGPLOT

ODS RTF FILE="sgplot.rtf"
   STYLE=serifprinter;
ODS GRAPHICS ON;
PROC SGPLOT DATA=plotdata_ods
   (WHERE=(product='CHAIR'))
   TMPLOUT="sgplot.sas";
SERIES X=visitnum Y=price /
   MARKERATTRS=(SIZE=10PX)
   LINEATTRS=(THICKNESS=3PX)
   GROUP=product;
SCATTER X=visitnum Y=price /
   YERRORUPPER=price_upper
   YERRORLOWER=price_lower
   MARKERATTRS=(SIZE=10PX)
   GROUP=product;
REFLINE 1100 / AXIS=Y
   LINEATTRS=(PATTERN=DOT);
REFLINE 1300 / AXIS=Y
   LINEATTRS=(PATTERN=DOT);
RUN;
ODS GRAPHICS OFF;
ODS RTF CLOSE;
Using PROC SG PLOT: sgplot.sas

This is the SAS code saved to sgplot.sas:

```sas
proc template;
   define statgraph sgplot;
   begingraph;
      EntryTitle "Sales" /;
      EntryTitle "Bed and Chair" /
         textattrs=(size=GraphLabelText:fontsize);
      layout overlay;
         SeriesPlot X='visitnum'n Y='price'n / Group='PRODUCT'n
            Markerattrs=( Size=10px)
            Lineattrs=( Thickness=3px) LegendLabel="Sales ($)"
            NAME="series";
         ScatterPlot X='visitnum'n Y='price'n / primary=true
            Group='PRODUCT'n Markerattrs=( Size=10px)
            YErrorUpper='price_upper'n YErrorLower='price_lower'n
            LegendLabel="Sales ($)" NAME="SCATTER";
      DiscreteLegend "series"/ title="Product";
      endlayout;
      EntryFootnote "Program: v92_sgplot_lineplot.sas" /;
   endgraph;
end;
run;
```

This code uses PROC SGPLOT to create a graph with two plots. One is a line plot showing sales and another is a scatter plot with error bars. The code includes titles and legend labels for better visualization.
Part 3

Converting SAS/GRAPH Annotate to ODS Graphics

(Paper: "Converting Annotate to ODS Graphics. Is It Possible?")
Agenda

• Introduction
• Error Bars
• Point Labels
• Bar Labels
• Information Boxes
• Conclusions
PROC SORT DATA = sashelp.class
  OUT = class_error;
  BY sex height;
RUN;

PROC SUMMARY DATA = class_error NWAY;
  CLASS sex;
  VAR weight;
  OUTPUT OUT = class_error_se
              STDERR = weight_se;
RUN;

DATA class_error_ods
  (KEEP = sex height value
              value_upper value_lower);
  MERGE class_error class_error_se;
  BY sex;
  value = weight;
  value_upper = value + weight_se;
  value_lower = value - weight_se;
  OUTPUT class_error_ods;
RUN;

PROC SGPLOT DATA = class_error_ods;
  SCATTER Y = value X = height /
              GROUP = sex
              YERRORUPPER = value_upper
              YERRORLOWER = value_lower;
  SERIES Y = value X = height /
              GROUP = sex;
  LABEL value = "Weight";
RUN;
Point Labels - 1

SAS GPLOT + Annotate 9.2

SAS SG PLOT 9.2 (Easy)
Point Labels - 1.1

PROC SORT DATA = sashelp.class OUT = class_point;
   BY sex height;
RUN;

DATA class_point_ods;
   SET class_point;
   If sex = 'F' THEN weight2 = weight + 10;
      ELSE weight2 = weight - 10;
RUN;

PROC SGPLOT DATA = class_point_ods;
   SCATTER Y = height X = weight / GROUP = sex;
      SCATTER Y = height X = weight2 / GROUP = sex MARKERCHAR = name;
RUN;
Bar Labels - 1

SAS GPHLOT + Annotate 9.2

SAS SGPHLOT 9.3 (Easy)
PROC SUMMARY DATA = sashelp.class NWAY;
   CLASS age sex;
   VAR height;
   OUTPUT OUT = class_bar N = count;
RUN;

DATA class_bar_ods;
   SET class_bar; BY age sex;
   LENGTH ccount $1;
   RETAIN total_count .;
   ccount = STRIP(PUT(count, 1.));
   IF FIRST.age THEN DO;
      total_count = 0;
      count_ods = count - 0.5;
   END;
   ELSE count_ods = count;
   total_count + count;
   total_count_ods = total_count - 0.5;
   IF sex = 'F' THEN
      total_count_odsf = total_count_ods;
   ELSE total_count_odsm = total_count_ods;
RUN;

PROC SGPLOT DATA = class_bar_ods;
   VBAR age /
      GROUP = sex
      GROUPORDER = ASCENDING
      RESPONSE = count STAT = SUM;
   VLINE age /
      GROUP = sex
      GROUPORDER = ASCENDING
      RESPONSE = total_count_ods
      STAT = SUM DATALABEL = ccount
      DATALABELPOS = DATA
      DATALABELATTRS = (COLOR = WHITE WEIGHT = BOLD)
      LINEATTRS = (THICKNESS = 0);
RUN;
Bar Labels - 2

SAS GPLOT + Annotate 9.2

SAS SGPLOT 9.4 (Easy)
Bar Labels - 2.1

PROC SGPLOT DATA = class_bar_ods;
   VBARPARM CATEGORY = age RESPONSE = count /
   GROUP = sex GROUPORDER = ASCENDING GROUPDISPLAY = STACK
   DATALABEL = count DATALABELPOS = DATA SEGLABEL
   SEGLABELATTRS = (COLOR = WHITE WEIGHT = BOLD);
RUN;
Information Boxes - 1

SAS GPlot + Annotate 9.2

SAS SGPlot 9.3 (Difficult)
PROC SORT DATA = sashelp.class OUT = class_info;
   BY height weight;
RUN;

PROC SUMMARY DATA = class_info NWAY;
   VAR height weight;
   OUTPUT OUT = class_info_range MIN = min_height min_weight
                 MAX = max_height max_weight;
RUN;
DATA class_info_sganno (DROP = min_: max_: _:);
    SET class_info_range;
    LENGTH label $50;
    drawspace = 'DATAPERCENT';
    width = 40;
    anchor = 'TOPLEFT';
    function = 'RECTANGLE';
    Height = 15; x1 = 5; y1 = 95; linecolor = 'BLACK'; linethickness = 1;
    OUTPUT;
    anchor = 'LEFT';
    Textsize = 8; height = .;
    function = 'TEXT';
    label = "Max height=" || STRIP(PUT(max_height, 8.1)); X1 = 10; y1 = 90;
    OUTPUT;
    function = 'TEXT';
    label = "Max weight=" || STRIP(PUT(max_weight, 8.1)); X1 = 10; y1 = 85;
    OUTPUT;
RUN;

PROC SGPLOT DATA = class_info SGANNO = class_info_sganno;
    SCATTER X = weight Y = height / GROUP = sex;
RUN;
Information Boxes - 2

SAS GGPLOT + Annotate 9.2

Weight
50 60 70 80 90 100 110 120 130 140 150

Max height=72.0
Max weight=150.0

Sex
+++F  +++M

SAS SGGPLOT 9.2 (Difficult)

Height
50 55 60 65 70

Max height=72.0
Max weight=150.0

Weight
60 80 100 120 140

Sex
○ F  + M  —
DATA class_info_box (DROP = min_: max_: _:);
   SET class_info_range;
   LENGTH text $50;
   xbox = 5; ybox = 95; OUTPUT;
   xbox = 45; ybox = 95; OUTPUT;
   xbox = 45; ybox = 80; OUTPUT;
   xbox = 5; ybox = 80; OUTPUT;
   xbox = 5; ybox = 95; OUTPUT;
   xbox = .; ybox = .; xtext = 25; ytext = 90;
   text = "Max height=" || STRIP(PUT(max_height, 8.1)); OUTPUT;
   xtext = 25; ytext = 85;
   text = "Max weight=" || STRIP(PUT(max_weight, 8.1));
   OUTPUT;
RUN;

DATA class_info_ods;
   SET class_info class_info_box;
RUN;
PROC SGPLOT DATA = class_info_ods;
    SCATTER X = weight Y = height / GROUP = sex;
    SERIES X = xbox Y = ybox / LINEATTRS = (COLOR = BLACK) X2AXIS Y2AXIS;
    SCATTER X = xtext Y = ytext /
        MARKERCHAR = text MARKERCHARATTRS = (COLOR = BLACK)
        X2AXIS Y2AXIS;
    XAXIS OFFSETMIN = 0.02 OFFSETMAX = 0.02;
    X2AXIS OFFSETMIN = 0 OFFSETMAX = 100 MIN = 0 MAX = 100
        DISPLAY = (NOLABEL NOTICKS NOVALUES);
    Y2AXIS MIN = 0 MAX = 100 DISPLAY = (NOLABEL NOTICKS NOVALUES);
RUN;
Conclusions - 1

Generating plots using ODS Graphics is based on the very simple application of graph layers, where individual graphs are drawn on top of each other to create the finished plot:

- Error Bars can be generated by plotting a SCATTER plot with YERRORUPPER= and YERRORLOWER= options on top of, or below, a SERIES plot from SAS 9.2.
Conclusions - 2

Generating plots using ODS Graphics is based on the very simple application of graph layers, where individual graphs are drawn on top of each other to create the finished plot:

- Point Labels can be generated by plotting the labels with a second SCATTER plot with MARKERCHAR options for the text, where the x-coordinates have been offset to improve readability from SAS 9.2.
Generating plots using ODS Graphics is based on the very simple application of graph layers, where individual graphs are drawn on top of each other to create the finished plot:

- Bar Labels can be generated by plotting the labels with a VLINE plot on top of a VBAR chart in SAS 9.3, although the positioning of the labels can be offset slightly. In SAS 9.4 Bar Labels can be generated more precisely by using SEGLABEL options with a VBARPARM chart.
Conclusions - 4

Generating plots using ODS Graphics is based on the very simple application of graph layers, where individual graphs are drawn on top of each other to create the finished plot:

- Information Boxes can be generated with the SGANNO= option of PROC SGPLOT in SAS 9.3, which is the ODS Graphics equivalent of Annotate. However, by calculating the location of the box corners and the text, a similar Information Box can be drawn with more flexibility in SAS 9.2 using a simple input data set containing extra data coordinates, an extra SERIES statement for the box, and an extra SCATTER statement with MARKERCHAR options for the text.
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