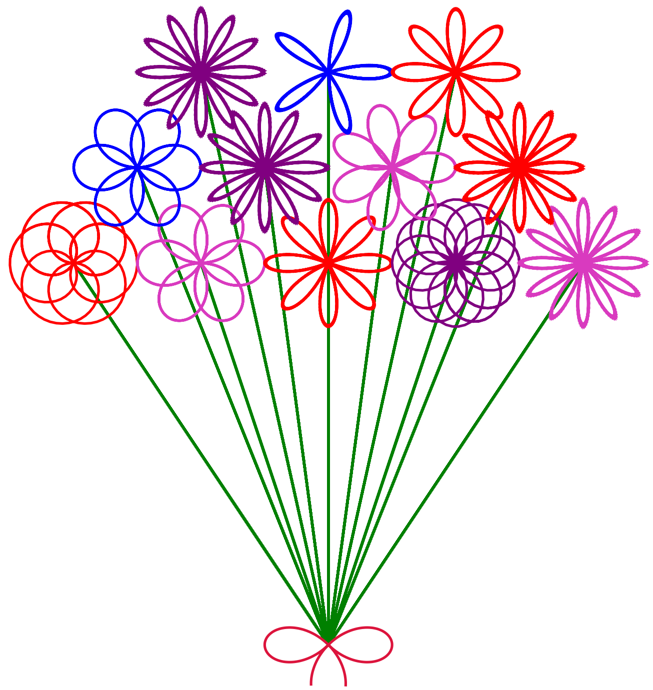
Happy Valentines Day

A Dozen Random Polar Roses



Polar Roses: r = cos(k*theta)
Generated with the SAS System 9.4
initial idea: http://blogs.sas.com/content/iml/2015/12/16/polar-rose.html

Approx 100 Sample Graphs

- SAS source

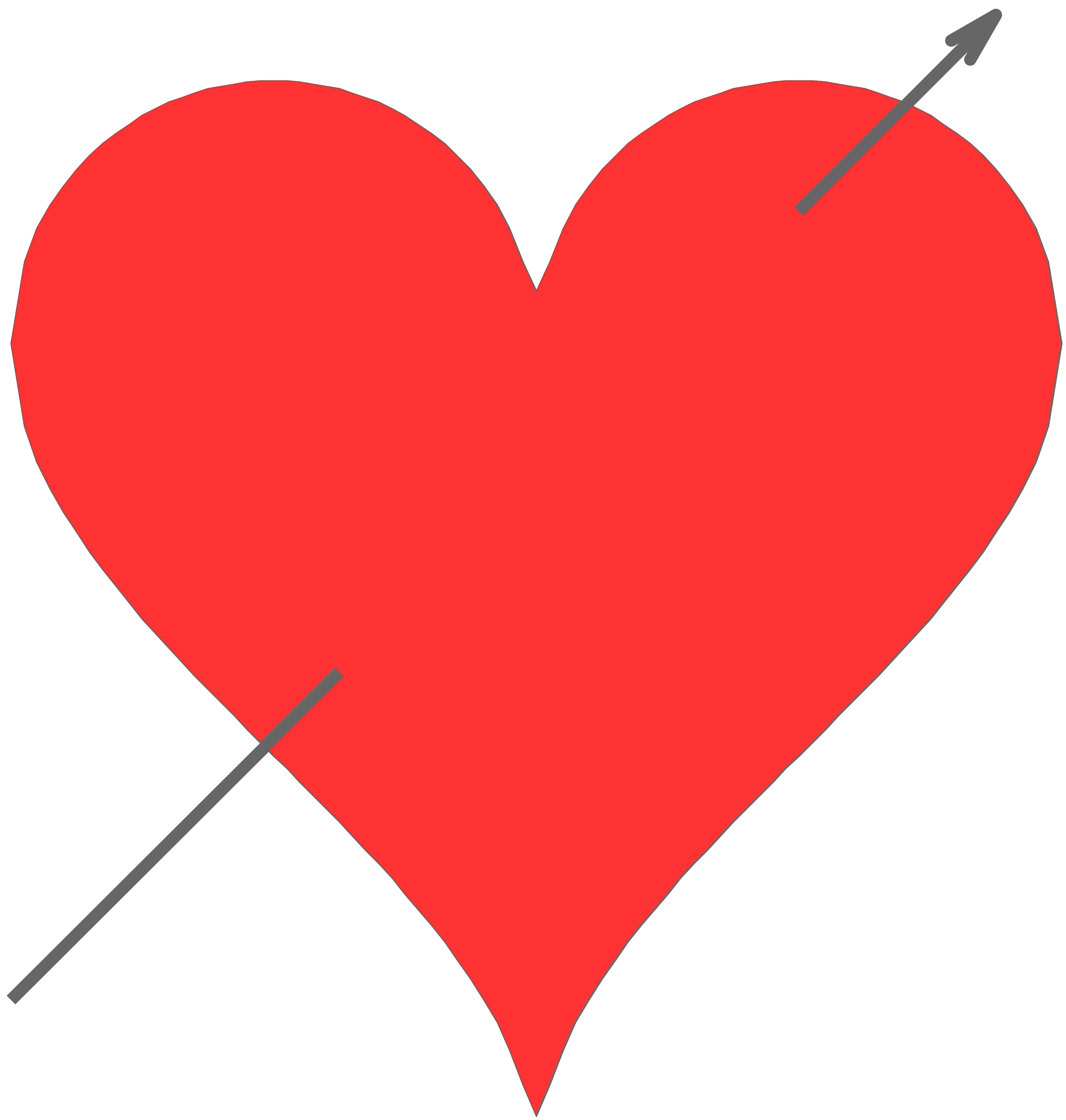
  tut_AddPdfSly.sas

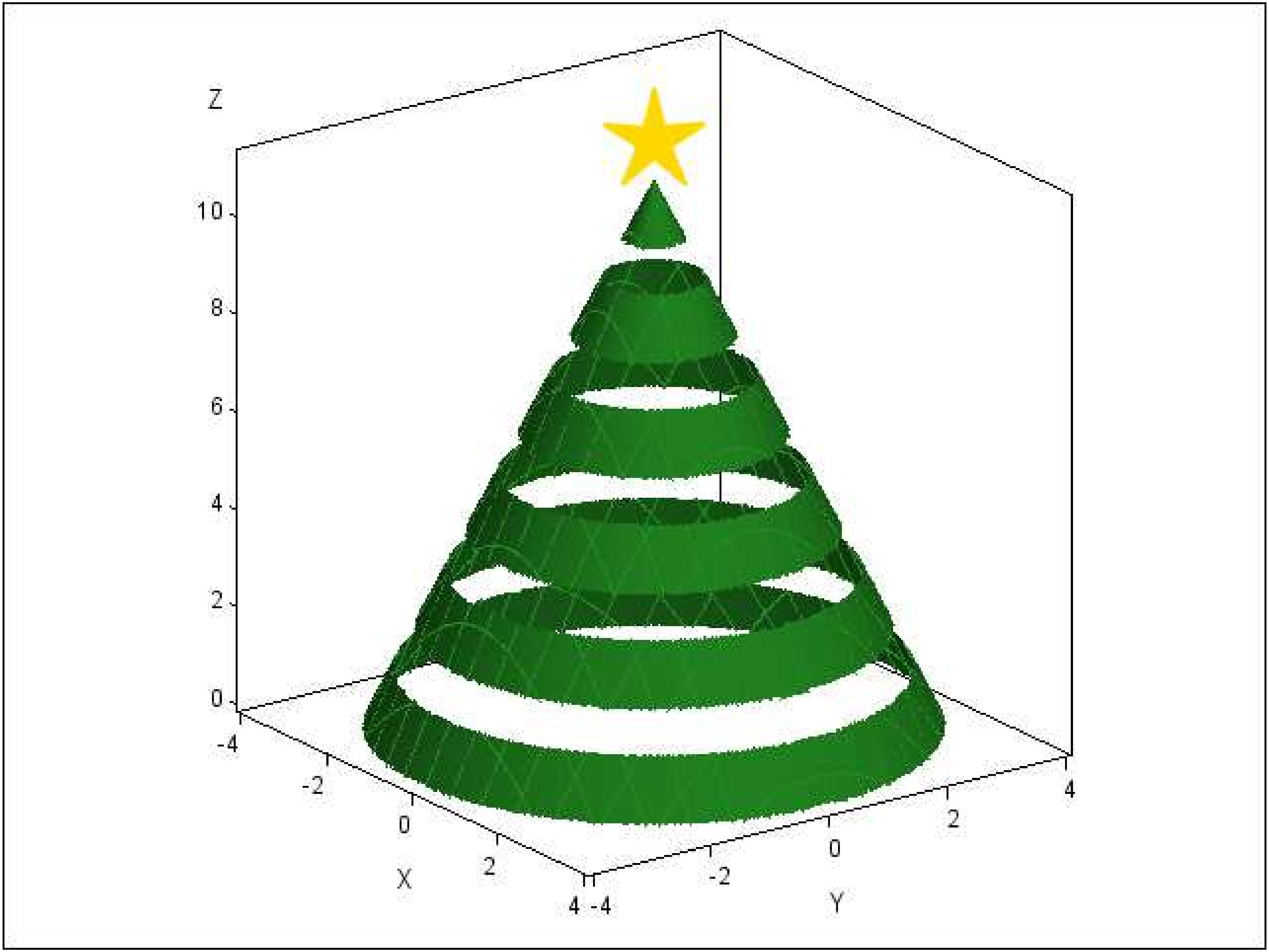
- SAS pdf output

  tut_AddPdfSly.pdf

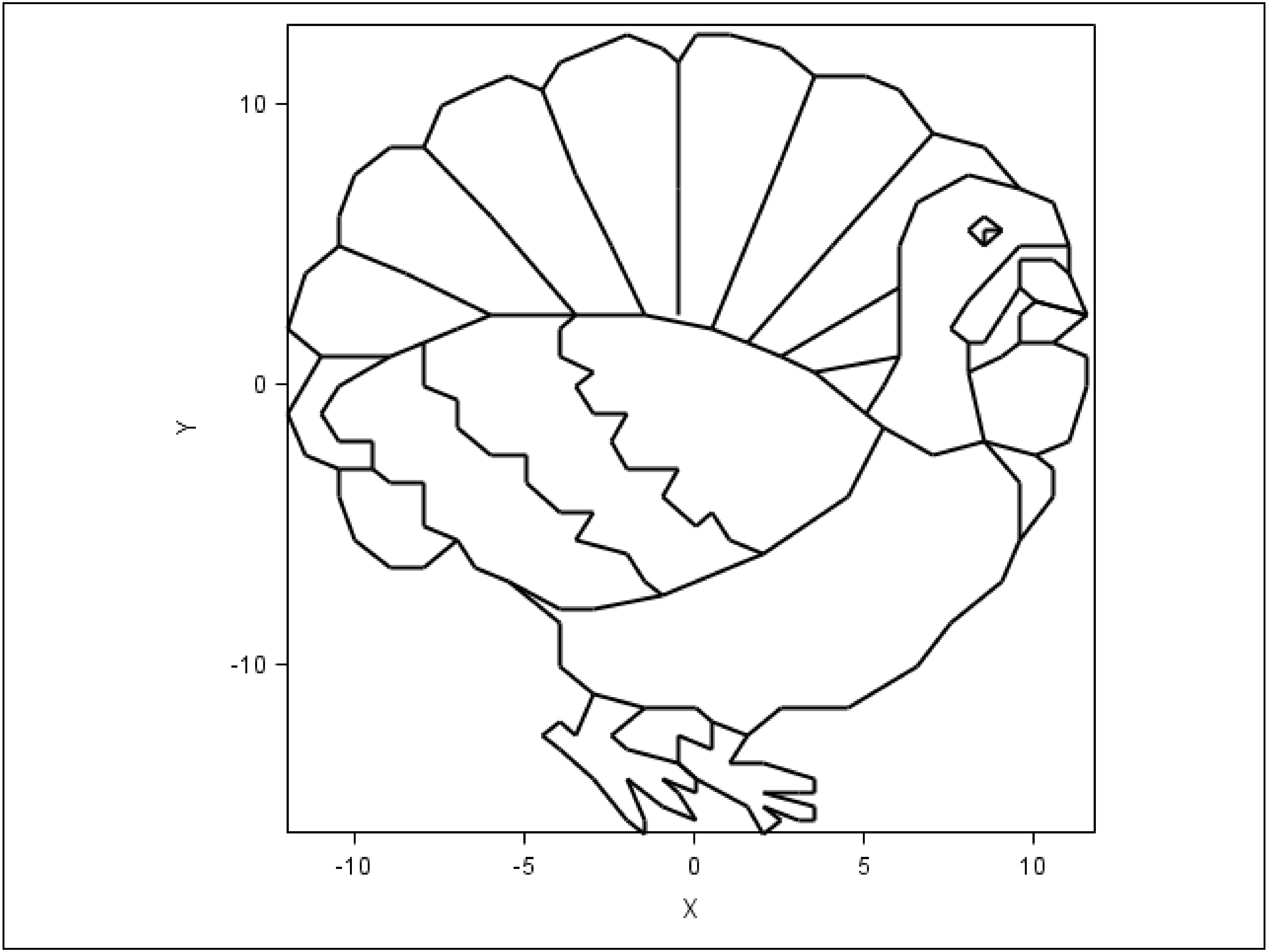
Most graphs use sashelp datasets

From Robert Allison Site





Z
10
8
6
4
2
0
-4
-2
0
2
4
X
-4
-2
0
2
4
Y


10
0
-10
Y
-10
-5
0
5
10
X

Cupids Arrow and
a Valentines Heart
Using Legacy SAS Graph

Create Heart using Trig Cartiods

```
&let pink=cxFF3333;;
&let darkgray=gray66;;
data heart_data;;
do x=-2 to 2 by .05;;
 y=sqrt(1-(abs(x)-1)**2);;
 output;;
 end;;
do x=2 to -2 by -.05;;
 y=arcos(1-abs(x))-3.14;;
 output;;
 end;;
run;;
```

Adjustment heart bottom and Arrrow

```
data heart_data; set heart_data;
if y=. then y=0;
if round(x*100)=0 then y=y+.2;
idvar="heart";run;
data anno_arrow;
length function $8;
xsys="2"; ysys="2"; hsys="3"; when="a";color="gray66";
function="move"; x=-2; y=-2.5; output;
function="draw"; x=-.75; y=-1.25; output;
function="move"; x=1; y=.5; output;
function="arrow"; x=1.75; y=1.25; line=4; output;
run;
```

Using GMAP to display heart

```
goptions gunit=pct ftitle="albany amt/bold"
ftext="albany amt" htitle=4.8 htext=2.5 ctext=gray66;
symbol1 value=dot h=1.0 interpol=none c=cxFF3333;
axis1 order=(-3.5 to 1.5 by .5)
 minor=none value=(c=grayaa) offset=(0,0);
axis2 order=(-4.5 to 4.5 by .5)
minor=none value=(c=grayaa) offset=(0,0);
title1 ls=1.5 "From Robert Allison Site" ;
title2 h=8 " ";
pattern1 v=s c=cxFF3333;
proc gmap data=heart_data map=heart_data anno=anno_arrow;
id idvar;
choro idvar / nolegend
 coutline=%darkgray;run;quit;;
```

Bar graph with labeled sub groups

Bar Graph Data

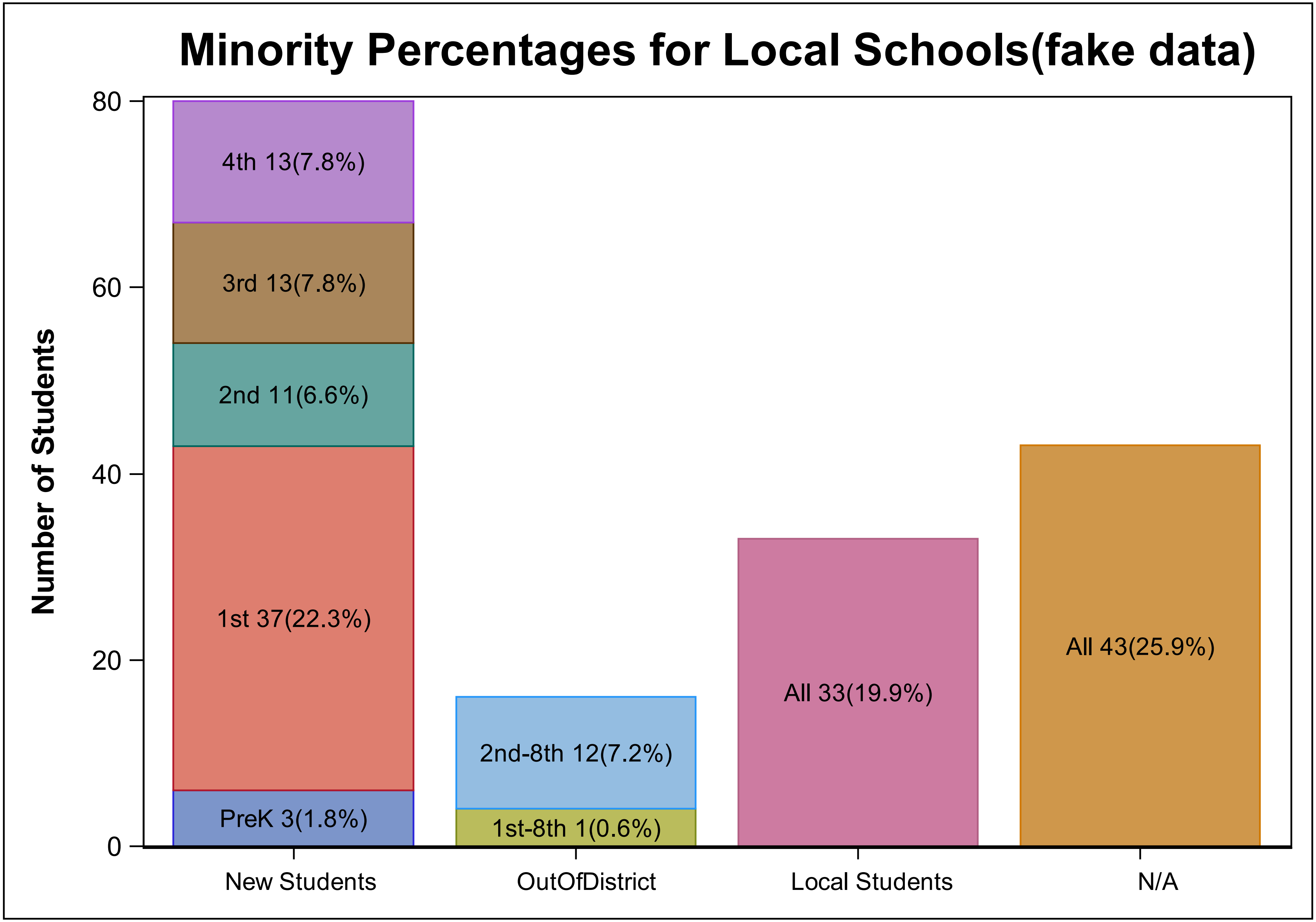
Substatus	Frequency	Statusdes	Des
BBB01	6.0005	New Students	PreK 3(1.8%)
BBB11	37.0010	New Students	1st 37(16.3%)
BBB21	11.0015	New Students	2nd 11(6.6%)
BBB31	13.0020	New Students	3rd 13(7.8%)
BBB41	13.0025	New Students	4th 13(7.8%)
EEE16_40	4.0035	OutOfDistrict	1st-8th 1(0.6%)
EEE1_15	12.0040	OutOfDistrict	2nd-8th 12(7.2%)
ALLCHA	33.0030	Local Students	All 33(19.9%)

Create bar graph data

```
proc sql;
%let _ins=Insert into bargrf(substatus,frequency,statusdes,des);
create table bargrf(substatus varchar(10),frequency float,
  statusdes varchar(18),des varchar(24));
&_ins Values("BBB01",6.0005,"  New Students","PreK 3(1.8%)");
&_ins Values("BBB11",37.001,"  New Students","1st 37(22.3%)");
&_ins Values("BBB21",11.0015,"  New Students","2nd 11(6.6%)");
&_ins Values("BBB31",13.002,"  New Students","3rd 13(7.8%)");
&_ins Values("BBB41",13.0025,"  New Students","4th 13(7.8%)");
&_ins Values("EEE16_40",4.0035,"   OutOfDistrict","1st-8th 1(0.6%)");
&_ins Values("EEE1_15",12.004,"   OutOfDistrict","2nd-8th 12(7.2%)");
&_ins Values("ALLCHA",33.003,"    Local Students","All 33(19.9%)");
&_ins Values("ALLNA",43.0045,"     N/A","All 43(25.9%)");
quit;
```

Bar chart with subsections labeled

```
data barfmt;
 retain fmtname "lbl2pnt" fuzz 1e-10;
 set bargrf;
 start=frequency;
 end=start;
 label=des;
 keep fmtname fuzz start end label;
;run;quit;
proc format cntlin=barfmt;
run;quit;
* output the graph;
proc sgplot data=bargrf noautolegend ;
title "Minority Percentages for Local Schools(fake data)";
vbar statusdes/group=substatus  response=frequency seglabel
     seglabelattrs=(family="Arial" size=12pt)  seglabelformat=lbl2pnt.;
yaxis labelattrs=(size=15pt) valueattrs=(size=13pt)
     label="Number of Students"  DISCRETEORDER=Data;;
xaxis labelattrs=(size=12pt) valueattrs=(size=12pt) display=(nolabel) ;
run;
```


Minority Percentages for Local Schools(fake data)
Number of Students
0
20
40
60
80
4th 13(7.8%)
3rd 13(7.8%)
2nd 11(6.6%)
1st 37(22.3%)
PreK 3(1.8%)
2nd-8th 12(7.2%)
1st-8th 1(0.6%)
All 33(19.9%)
All 43(25.9%)
New Students
OutOfDistrict
Local Students
N/A

Multidimensional preference analysis

Comments on Preference Analysis

First two principle components plotted.
Components are orthonomal.
One and two standard deviations from hiperspace mean.
First principle component accounts for more than 70%
Think of the major and minor axis of elipsoid

Template from proc prinqual with edits(part1) see SAS code

```
proc template;
define statgraph Stat.Prinqual.Graphics.MDPref;
notes "Multidimensional Preference Analysis Plot";
dynamic xVar yVar xVec yVec ylab xlab yshortlab xshortlab
xOri yOri stretch _byline_ _bytitle_ _byfootnote_;
dynamic xlab "Increasing Deductible and Premium" ;
begingraph;
entrytitle "Profitability of 14 Car Insurance Companies(fake data)";
layout overlayequated / equatetype=fit
  xaxisopts=(labelattrs=(size=15 weight=bold)
     label="Increasing (Deductible + Premium)" shortlabel=XSHORTLAB offsetmin=0.1 offsetmax=0.1 )
  yaxisopts=(labelattrs=(size=15 weight=bold) label="Increasing ( Deductible - Premium )"
     shortlabel=YSHORTLAB offsetmin=0.1 offsetmax=0.1);
  Layout Gridded / Border=false halign=right valign=bottom;Layout Gridded;
  Entry halign=left "High Average" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=left valign=top;Layout Gridded;
  Entry halign=left "Low Average" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=left valign=bottom;;Layout Gridded;
  Entry halign=left "Cheapest" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=right valign=center;;Layout Gridded;
  Entry halign=left "Expensive" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=left valign=center;;Layout Gridded;
  Entry halign=left "Very Cheap" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=center valign=top;;Layout Gridded;
  Entry halign=left "High Average" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=center valign=center;;Layout Gridded;
  Entry halign=left "Average Cost" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=center valign=bottom;;Layout Gridded;
  Entry halign=left "Low Average" / textattrs=(color=green weight=bold);endlayout;endlayout;
  Layout Gridded / Border=false halign=right valign=top;;Layout Gridded;
```

Template from proc prinqual with edits(part2)

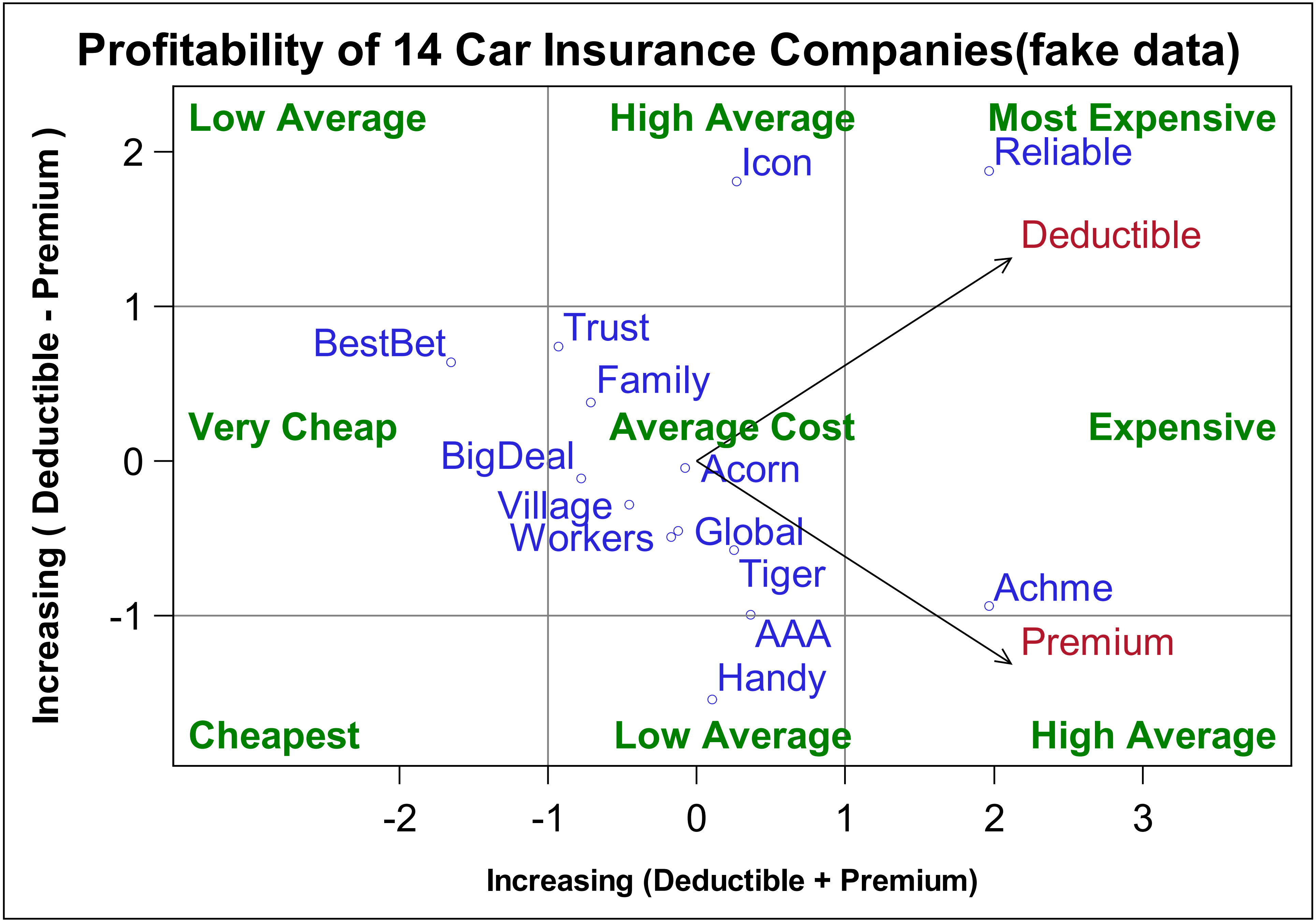
```
Entry halign=right "Most Expensive" / textattrs=(color=green weight=bold);endlayout;endlayout;
scatterplot y=YVAR x=XVAR /
   datalabel=IDLAB1 rolename=(_tip1=OBSNUMVAR _id2=IDLAB2 _id3=IDLAB3 _id4=IDLAB4
   _id5=IDLAB5 _id6=IDLAB6 _id7=IDLAB7 _id8=IDLAB8 _id9=
   IDLAB9 _id10=IDLAB10 _id11=IDLAB11 _id12=IDLAB12 _id13=IDLAB13 _id14=IDLAB14
   _id15=IDLAB15 _id16=IDLAB16 _id17=IDLAB17 _id18=IDLAB18 _id19=IDLAB19 _id20=
   IDLAB20) tip=(y x datalabel _tip1 _id2 _id3 _id4 _id5 _id6 _id7 _id8 _id9 _id10
   _id11 _id12 _id13 _id14 _id15 _id16 _id17 _id18 _id19 _id20) datalabelattrs=
   GRAPHVALUETEXT (color=GraphData1:ContrastColor) markerattrs=GRAPHDATA1;
referenceline x=1.0;referenceline x=-1.0;referenceline y=1.0;referenceline y=-1.0;
vectorplot y=YVEC x=XVEC xorigin=0 yorigin=0 / datalabel=LABEL2VAR shaftprotected=false
rolename=(_tip1=VNAME _tip2=VLABEL _tip3=YORI _tip4=XORI _tip5=LENGTH
   _tip6=LENGTH2) tip=(y x datalabel _tip1 _tip2 _tip3 _tip4 _tip5 _tip6)
    datalabelattrs=GRAPHVALUETEXT (color=GraphData2:ContrastColor) lineattrs=GRAPHDAT2 (
   pattern=solid) primary=true;
 if (0) entry "Vector Stretch = " STRETCH / autoalign=(topright topleft
 bottomright bottomleft right left top bottom);endif;endlayout;
 if (_BYTITLE_) entrytitle _BYLINE_ / textattrs=GRAPHVALUETEXT;
 else if (_BYFOOTNOTE_) entryfootnote halign=left _BYLINE_;
endif;endif;endgraph;end;
run;quit;
```

Data for multidimensional car insurance analysis

```
proc sql;
Create table pie_mdm (Deductible float, Premium float, lbl varchar(8));
Insert into pie_mdm(Deductible, Premium, lbl) Values(8010, 1011, "Achme");
Insert into pie_mdm(Deductible, Premium, lbl) Values(8009, 620, "Icon");
Insert into pie_mdm(Deductible, Premium, lbl) Values(3203, 736, "Global");
Insert into pie_mdm(Deductible, Premium, lbl) Values(901, 482, "BestBet");
Insert into pie_mdm(Deductible, Premium, lbl) Values(12704, 811, "Reliable");
Insert into pie_mdm(Deductible, Premium, lbl) Values(4001, 788, "Tiger");
Insert into pie_mdm(Deductible, Premium, lbl) Values(3604, 830, "AAA");
Insert into pie_mdm(Deductible, Premium, lbl) Values(4005, 712, "Acorn");
Insert into pie_mdm(Deductible, Premium, lbl) Values(2001, 636, "BigDeal");
Insert into pie_mdm(Deductible, Premium, lbl) Values(2003, 840, "Handy");
Insert into pie_mdm(Deductible, Premium, lbl) Values(3002, 558, "Trust");
Insert into pie_mdm(Deductible, Premium, lbl) Values(3001, 733, "Workers");
Insert into pie_mdm(Deductible, Premium, lbl) Values(3001, 609, "Family");
Insert into pie_mdm(Deductible, Premium, lbl) Values(2601, 686, "Village");
quit;run;
```

Analysis and graph of first two principle components

```
options orientation=landscape validvarname=v7;
ods listing close;
ods pdf close;
ods path work.templat(update) sasuser.templat(update)
  sashelp.tmplmst(read);
ods noptitle;
ods escapechar="^";
ods listing close;
ods graphics on / width=10in  height=7in ;
ods pdf file="c:/temp/bargrf.pdf" style=journal notoc;
ods exclude all;
ods select MDPrefPlot;
proc prinqual data=pie_mdm out=tut_grf_popminfin n=2 replace mdpref;
  id lbl ;
  transform monotone( Deductible Premium );
run;
ods select all;
ods graphics off;
ods pdf close;
ods listing;
```


Profitability of 14 Car Insurance Companies(fake data)
Low Average
High Average
Most Expensive
Very Cheap
Average Cost
Expensive
Cheapest
Low Average
High Average
Icon
Reliable
Deductible
Trust
BestBet
Family
BigDeal
Acorn
Village
Workers
Global
Tiger
Achme
AAA
Premium
Handy
2
1
0
-1
-2
-1
0
1
2
3
Increasing (Deductible - Premium)
Increasing (Deductible + Premium)

Chemistry of a stream

Data for river graph - see program for data or paste this

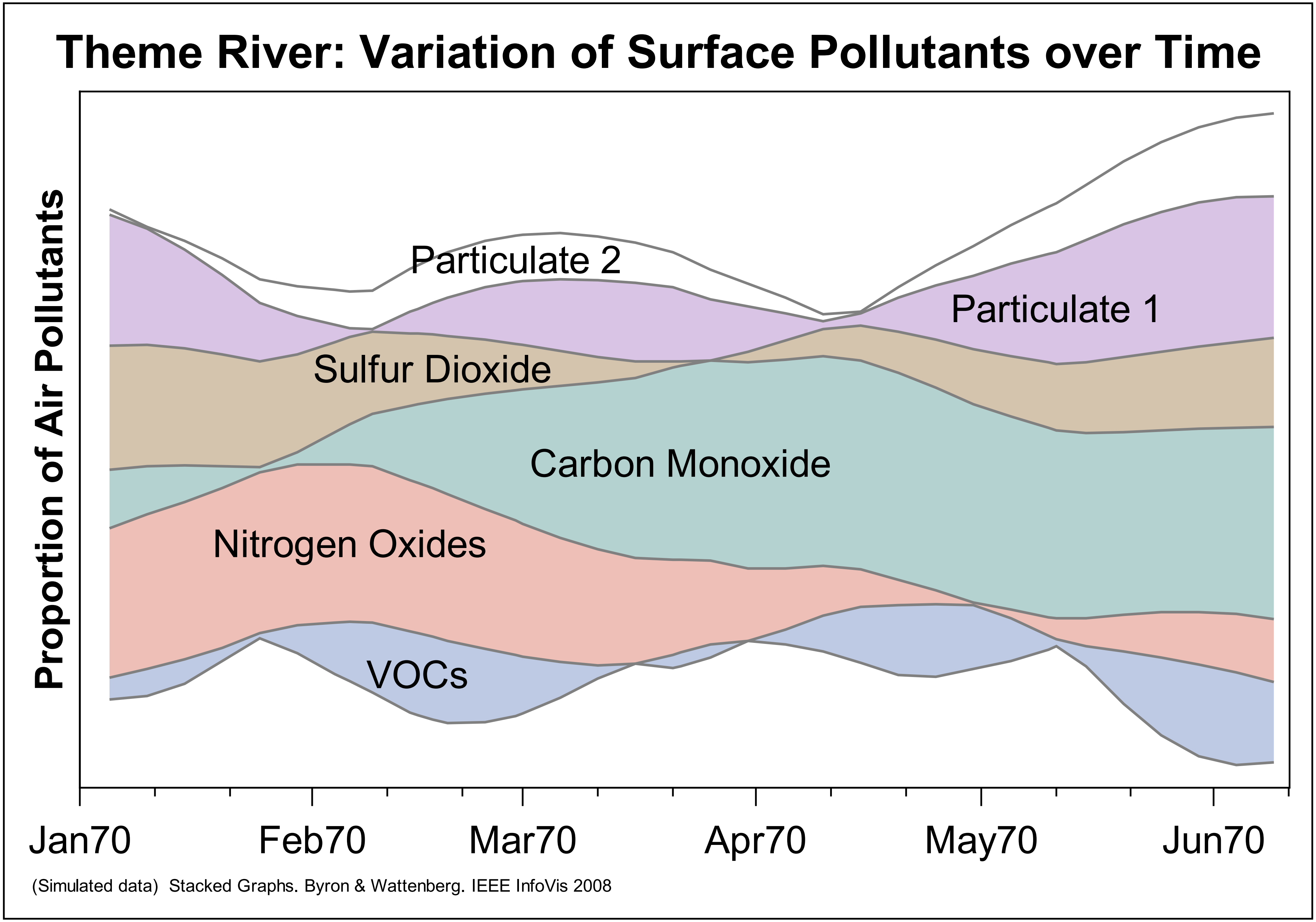
```
%let _ins=Insert into sines_river_mindevx(time,b1l,b1u,b2l,b2u,b3l,b3u,b4l,b4u,b5l,b5u,b6l,b6u,label,ly);proc sql;
Create table sines_river_mindevx(time float, b1l float, b1u float, b2l float, b2u float, b3l float, b3u float, b4l
float, b4u float, b5l float, b5u float, b6l float, b6u float, label varchar(24), ly float);
&_ins Values(3657,-5.849,-5.316,-5.316,-1.759,-1.759,-0.375,-0.375,2.587,2.587,5.705,5.705,5.844,"",.);
&_ins Values(3662,-5.757,-5.104,-5.104,-1.434,-1.434,-0.277,-0.277,2.609,2.609,5.372,5.372,5.413,"",.);
&_ins Values(3667,-5.462,-4.879,-4.879,-1.126,-1.126,-0.256,-0.256,2.527,2.527,4.879,4.879,5.098,"",.);
&_ins Values(3672,-4.921,-4.610,-4.610,-0.805,-0.805,-0.278,-0.278,2.378,2.378,4.274,4.274,4.665,"",.);
&_ins Values(3677,-4.389,-4.258,-4.258,-0.430,-0.430,-0.297,-0.297,2.208,2.208,3.621,3.621,4.172,"",.);
&_ins Values(3682,-4.743,-4.069,-4.069,-0.250,-0.250,0.052,0.052,2.387,2.387,3.302,3.302,4.000,"",.);
&_ins Values(3687,-5.237,-4.018,-4.018,-0.237,-0.237,0.533,0.533,2.681,2.681,3.099,3.099,3.926,"",.);
&_ins Values(3689,-5.412,-3.998,-3.998,-0.240,-0.240,0.724,0.724,2.793,2.793,3.017,3.017,3.890,"Nitrogen Oxides",-2.119);
&_ins Values(3692,-5.670,-4.004,-4.004,-0.291,-0.291,0.969,0.969,2.916,2.916,2.977,2.977,3.912,"",.);
&_ins Values(3697,-6.151,-4.222,-4.222,-0.605,-0.605,1.154,1.154,2.890,2.890,3.397,3.397,4.416,"",.);
&_ins Values(3698,-6.220,-4.265,-4.265,-0.671,-0.671,1.188,1.188,2.881,2.881,3.471,3.471,4.505,"VOCs",-5.242);
&_ins Values(3700,-6.328,-4.351,-4.351,-0.805,-0.805,1.252,1.252,2.857,2.857,3.610,3.610,4.668,"Sulfur Dioxide",2.055);
&_ins Values(3702,-6.396,-4.436,-4.436,-0.943,-0.943,1.312,1.312,2.829,2.829,3.735,3.735,4.813,"",.);
&_ins Values(3707,-6.392,-4.639,-4.639,-1.296,-1.296,1.441,1.441,2.732,2.732,3.979,3.979,5.089,"",.);
&_ins Values(3711,-6.229,-4.784,-4.784,-1.579,-1.579,1.525,1.525,2.634,2.634,4.105,4.105,5.219,"Particulate 2",4.662);
&_ins Values(3712,-6.170,-4.817,-4.817,-1.648,-1.648,1.544,1.544,2.607,2.607,4.127,4.127,5.239,"",.);
&_ins Values(3717,-5.792,-4.952,-4.952,-1.979,-1.979,1.631,1.631,2.466,2.466,4.184,4.184,5.270,"",.);
&_ins Values(3722,-5.345,-5.021,-5.021,-2.266,-2.266,1.717,1.717,2.324,2.324,4.162,4.162,5.193,"",.);
&_ins Values(3727,-4.993,-4.993,-4.993,-2.472,-2.472,1.831,1.831,2.213,2.213,4.090,4.090,5.038,"",.);
&_ins Values(3732,-5.089,-4.774,-4.774,-2.503,-2.503,2.062,2.062,2.225,2.225,3.985,3.985,4.821,"",.);
&_ins Values(3733,-5.056,-4.723,-4.723,-2.503,-2.503,2.106,2.106,2.227,2.227,3.930,3.930,4.741,"Carbon Monoxide",-0.198);
&_ins Values(3737,-4.834,-4.530,-4.530,-2.521,-2.521,2.244,2.244,2.244,2.244,3.694,3.694,4.395,"",.);
&_ins Values(3742,-4.447,-4.447,-4.447,-2.710,-2.710,2.195,2.195,2.449,2.449,3.526,3.526,4.069,"",.);
&_ins Values(3747,-4.539,-4.177,-4.177,-2.720,-2.720,2.265,2.265,2.717,2.717,3.369,3.369,3.733,"",.);
&_ins Values(3752,-4.701,-3.834,-3.834,-2.660,-2.660,2.351,2.351,2.991,2.991,3.178,3.178,3.346,"",.);
&_ins Values(3757,-4.974,-3.637,-3.637,-2.748,-2.748,2.242,2.242,3.060,3.060,3.363,3.363,3.403,"",.);
&_ins Values(3762,-5.250,-3.595,-3.595,-2.988,-2.988,1.940,1.940,2.927,2.927,3.730,3.730,3.987,"",.);
&_ins Values(3767,-5.305,-3.573,-3.573,-3.244,-3.244,1.593,1.593,2.739,2.739,4.034,4.034,4.513,"",.);
&_ins Values(3772,-5.103,-3.583,-3.583,-3.523,-3.523,1.205,1.205,2.500,2.500,4.266,4.266,4.967,"",.);
&_ins Values(3777,-4.935,-3.905,-3.905,-3.705,-3.705,0.908,0.908,2.341,2.341,4.541,4.541,5.460,"",.);
&_ins Values(3782,-4.646,-4.319,-4.319,-3.874,-3.874,0.631,0.631,2.193,2.193,4.776,4.776,5.903,"",.);
&_ins Values(3783,-4.572,-4.401,-4.401,-3.909,-3.909,0.576,0.576,2.162,2.162,4.815,4.815,5.983,"Particulate 1",3.488);
&_ins Values(3787,-5.049,-4.573,-4.573,-3.897,-3.897,0.517,0.517,2.197,2.197,5.102,5.102,6.425,"",.);
&_ins Values(3792,-5.952,-4.704,-4.704,-3.817,-3.817,0.536,0.536,2.324,2.324,5.481,5.481,6.983,"",.);
&_ins Values(3802,-7.196,-5.002,-5.002,-3.755,-3.755,0.603,0.603,2.577,2.577,6.005,6.005,7.796,"",.);
&_ins Values(3807,-7.406,-5.198,-5.198,-3.807,-3.807,0.633,0.633,2.684,2.684,6.128,6.128,8.024,"",.);
&_ins Values(3812,-7.334,-5.430,-5.430,-3.920,-3.920,0.661,0.661,2.777,2.777,6.162,6.162,8.132,"",.);
quit;
```

Graphics template for river plot

```
proc template;
  define statgraph river;
    dynamic dynTime "time"
      dynLL1 "first lower limit" dynLU1 "first upper limit"
      dynLL2 dynLU2 dynLL3 dynLU3 dynLL4 dynLU4 dynLL5 dynLU5 dynLL6 dynLU6
      dynTitle dynFootNote;
    begingraph / designwidth=7in designheight=4.5in;
      entrytitle dynTitle;
      layout overlay / cycleattrs=true
          xaxisopts=(offsetmin=0 offsetmax=0 label="Date" display=(line ticks tickvalues)
                timeopts=(minorticks=true interval=month tickvalueformat=monyy.))
            yaxisopts=(display=(line label) label="Proportion Stream Surface Pollutants");
      %let dispFillAttrs = datatransparency=0.5;
        bandplot x=dyntime limitlower=dynLL1 limitupper=dynLU1 / name="f1" datatransparency=0.5 ;
        bandplot x=dyntime limitlower=dynLL2 limitupper=dynLU2 / name="f2" datatransparency=0.5 ;
        bandplot x=dyntime limitlower=dynLL3 limitupper=dynLU3 / name="f3" datatransparency=0.5 ;
        bandplot x=dyntime limitlower=dynLL4 limitupper=dynLU4 / name="f4" datatransparency=0.5 ;
        bandplot x=dyntime limitlower=dynLL5 limitupper=dynLU5 / name="f5" datatransparency=0.5 ;
      %let seriesVizAttrs = lineattrs=(pattern=solid color=grey thickness=2px);
        seriesplot x=dyntime y=dynLL1 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLL2 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLL3 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLL4 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLL5 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLL6 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        seriesplot x=dyntime y=dynLU6 / lineattrs=(pattern=solid color=grey thickness=2px) ;
        scatterplot x=dyntime y=ly / markercharacter=label markerattrs=(color=black);
      endlayout;
      entryfootnote halign=left dynFootNote;
    endgraph;
end;run;
```

River surface chemistry time series

```
options orientation=landscape validvarname=v7;
ods listing close;
ods pdf close;
ods path work.templat(update) sasuser.templat(update)
   sashelp.tmplmst(read);
ods noptitle;
ods escapechar="^";
ods listing close;
ods graphics on / width=10in  height=7in ;
ods pdf file="c:/temp/bargrf.pdf" style=journal notoc;
ods exclude all;
ods select MDPrefPlot;
proc sgrender template=river data=pie_sim ;
 dynamic dynTime="time"
 dynLL1="b1L" dynLU1="b1U" dynLL2="b2L" dynLU2="b2U" dynLL3="b3L" dynLU3="b3U"
 dynLL4="b4L" dynLU4="b4U" dynLL5="b5L" dynLU5="b5U" dynLL6="b6L" dynLU6="b6U"
 dynTitle="Theme River: Variation of Pollutants over Time"
 dynFootNote="Stacked Graphs. Byron & Wattenberg. IEEE InfoVis 2008";
run;
ods select all;
ods graphics off;
ods pdf close;
ods listing;
```


Theme River: Variation of Surface Pollutants over Time
Proportion of Air Pollutants
Particulate 2
Particulate 1
Sulfur Dioxide
Carbon Monoxide
Nitrogen Oxides
VOCs
Jan70
Feb70
Mar70
Apr70
May70
Jun70
(Simulated data) Stacked Graphs. Byron & Wattenberg. IEEE InfoVis 2008

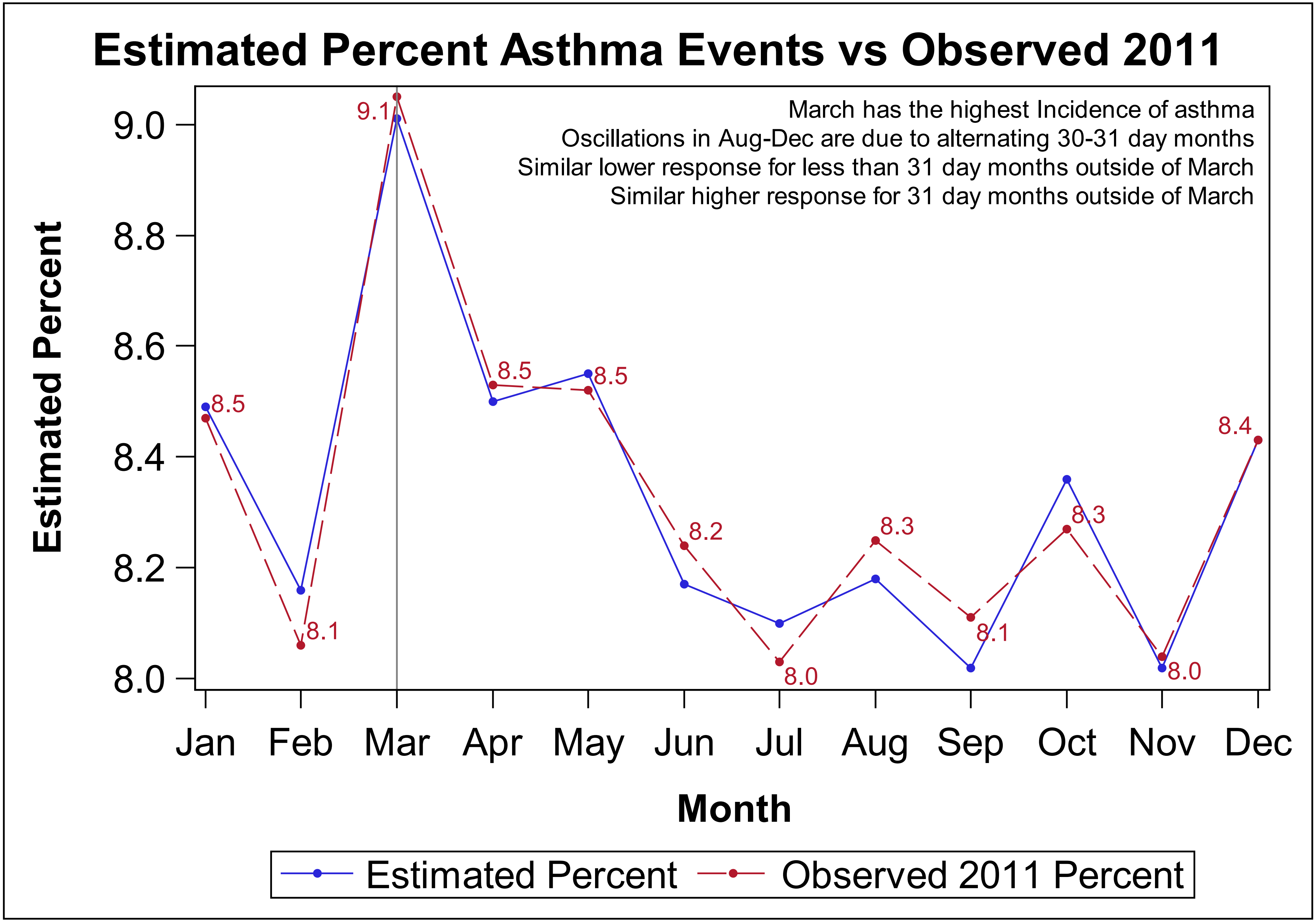
Time series model of asthma

Asthma time series data

```
%let _ins=Insert into tym_series_addmod
   (mon,_2005,_2006,_2007,_2008,_2009,_2010,_2011,_2012,_2013,_2014,mean,i);
proc sql;
Create table tym_series_addmod
 (mon float,_2005 float,_2006 float,_2007 float,_2008 float,_2009 float,
_2010 float,_2011 float,_2012 float,_2013 float,_2014 float,mean float,i float);
&_ins Values(1,8.51,8.67,8.78,8.17,8.40,8.15,8.47,8.41,8.85,8.46,8.49,13);
&_ins Values(2,8.71,8.29,8.18,8.50,7.97,7.84,8.06,8.22,8.02,7.81,8.16,13);
&_ins Values(3,9.58,9.50,9.21,8.89,8.81,8.93,9.05,8.99,8.71,8.46,9.01,13);
&_ins Values(4,8.78,8.36,8.48,8.68,8.55,8.51,8.53,8.33,8.44,8.40,8.50,13);
&_ins Values(5,8.47,8.53,8.74,8.65,8.45,8.36,8.52,8.53,8.64,8.59,8.55,13);
&_ins Values(6,8.11,8.18,8.28,8.13,8.24,8.14,8.24,8.12,8.06,8.20,8.17,13);
&_ins Values(7,7.78,7.78,8.03,8.19,8.33,8.24,8.03,8.03,8.25,8.33,8.10,13);
&_ins Values(8,7.90,8.11,8.42,8.03,8.01,8.11,8.25,8.35,8.40,8.27,8.18,13);
&_ins Values(9,7.89,7.95,7.97,7.97,8.16,8.11,8.11,7.88,7.99,8.15,8.02,13);
&_ins Values(10,8.03,8.24,8.15,8.48,8.57,8.42,8.27,8.46,8.39,8.62,8.36,13);
&_ins Values(11,7.89,8.03,7.90,7.89,8.08,8.12,8.04,8.17,8.06,7.97,8.02,13);
&_ins Values(12,8.34,8.37,7.86,8.40,8.45,9.07,8.43,8.50,8.20,8.73,8.43,13);
;quit;
```

Proc timeseries output model - average of years

```
Proc format;
 value mon2nam
 1="Jan" 2="Feb" 3="Mar" 4="Apr" 5="May" 6="Jun"
 7="Jul" 8="Aug" 9="Sep" 10="Oct" 11="Nov" 12="Dec";run;
proc sgplot data=tym_series_addmod  ;
  title "Estimated Percent Incidence of Asthma vs Observed 2011 Incidence";
  label mon="Month";label _2011="Observed 2011 Percent";
  label mean="Estimated Percent";
  format mon mon2nam. _2011 mean 5.1 ;
  series x=mon y=mean / markers markerattrs=(symbol=circlefilled) ;
  series x=mon y=_2011 / markers markerattrs=(symbol=circlefilled)
   datalabel datalabelattrs=(size=12);
  xaxis values=(1 to 12 by 1);
  inset (
   " "     ="March has the highest Incidence of asthma"
   "  "    ="Oscillations in Aug-Dec are due to alternating 30-31 day months"
   "   "   ="Similar lower response for less than 31 day months outside of March"
   "    "  ="Similar higher response for 31 day months outside of March"
 ) / position=topright  textattrs=( Size=15pt);
  refline 3 / axis=x;
run;quit;
```



Estimated Percent Asthma Events vs Observed 2011
March has the highest Incidence of asthma
Oscillations in Aug-Dec are due to alternating 30-31 day months
Similar lower response for less than 31 day months outside of March
Similar higher response for 31 day months outside of March
Estimated Percent
9.0
8.8
8.6
8.4
8.2
8.0
9.1
8.5
8.5
8.5
8.1
8.2
8.0
8.3
8.1
8.3
8.0
8.4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Estimated Percent
Observed 2011 Percent

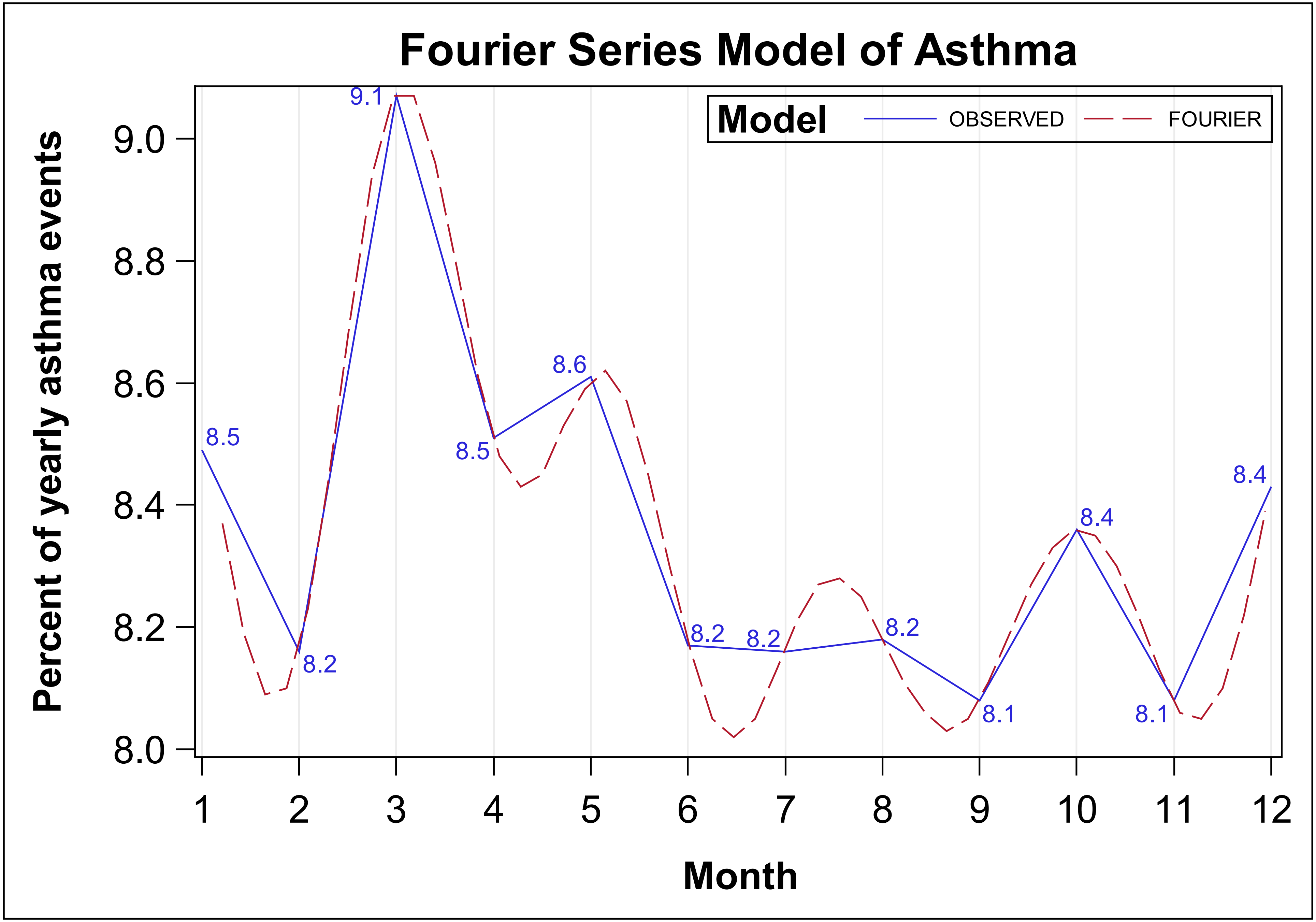
Fourier time series model of asthma

Data for Fourier model to comare with timseries model

```
%let _ins=Insert into tym_series_twoser001(radian,mon,model,percent,pctlbl);
proc sql;Create table tym_series_twoser001(radian float,mon float,
model varchar(8),percent float,pctlbl float);
&_ins Values(1.00,1.00,"OBSERVED",8.49,8.49); &_ins Values(1.21,1.21,"FOURIER",8.37,.);
&_ins Values(1.43,1.43,"FOURIER",8.19,.);&_ins Values(1.65,1.65,"FOURIER",8.09,.);
&_ins Values(1.87,1.87,"FOURIER",8.10,.);&_ins Values(2.00,2.00,"OBSERVED",8.16,8.16);
&_ins Values(2.09,2.09,"FOURIER",8.23,.);&_ins Values(2.31,2.31,"FOURIER",8.45,.);
&_ins Values(2.53,2.53,"FOURIER",8.71,.);&_ins Values(2.75,2.75,"FOURIER",8.94,.);
&_ins Values(2.97,2.97,"FOURIER",9.07,.);&_ins Values(3.00,3.00,"OBSERVED",9.07,9.07);
&_ins Values(3.18,3.18,"FOURIER",9.07,.);&_ins Values(3.40,3.40,"FOURIER",8.96,.);
&_ins Values(3.62,3.62,"FOURIER",8.79,.);&_ins Values(3.84,3.84,"FOURIER",8.61,.);
&_ins Values(4.00,4.00,"OBSERVED",8.51,8.51);&_ins Values(4.06,4.06,"FOURIER",8.48,.);
&_ins Values(4.28,4.28,"FOURIER",8.43,.);&_ins Values(4.50,4.50,"FOURIER",8.45,.);
&_ins Values(4.72,4.72,"FOURIER",8.53,.);&_ins Values(4.94,4.94,"FOURIER",8.59,.);
&_ins Values(5.00.00,"OBSERVED",8.61,8.61);&_ins Values(5.15.15,"FOURIER",8.62,.);
&_ins Values(5.37.37,"FOURIER",8.57,.);&_ins Values(5.59.59,"FOURIER",8.45,.);
&_ins Values(5.81.81,"FOURIER",8.30,.);&_ins Values(6.00,6.00,"OBSERVED",8.17,8.17);
&_ins Values(6.03,6.03,"FOURIER",8.16,.);&_ins Values(6.25,6.25,"FOURIER",8.05,.);
&_ins Values(6.47,6.47,"FOURIER",8.02,.);&_ins Values(6.69,6.69,"FOURIER",8.05,.);
&_ins Values(6.91,6.91,"FOURIER",8.13,.);&_ins Values(7.00,7.00,"OBSERVED",8.16,8.16);
&_ins Values(7.12,7.12,"FOURIER",8.21,.);&_ins Values(7.34,7.34,"FOURIER",8.27,.);
&_ins Values(7.56,7.56,"FOURIER",8.28,.);&_ins Values(7.78,7.78,"FOURIER",8.25,.);
&_ins Values(8.00,8.00,"FOURIER",8.18,.);&_ins Values(8.00,8.00,"OBSERVED",8.18,8.18);
&_ins Values(8.22,8.22,"FOURIER",8.11,.);&_ins Values(8.44,8.44,"FOURIER",8.06,.);
&_ins Values(8.66,8.66,"FOURIER",8.03,.);&_ins Values(8.88,8.88,"FOURIER",8.05,.);
&_ins Values(9.00,9.00,"OBSERVED",8.08,8.08);&_ins Values(9.09,9.09,"FOURIER",8.11,.);
&_ins Values(9.31,9.31,"FOURIER",8.19,.);&_ins Values(9.53,9.53,"FOURIER",8.27,.);
&_ins Values(9.75,9.75,"FOURIER",8.33,.);&_ins Values(9.97,9.97,"FOURIER",8.36,.);
&_ins Values(10.00,10.00,"OBSERVED",8.36,8.36);&_ins Values(10.19,10.19,"FOURIER",8.35,.);
&_ins Values(10.41,10.41,"FOURIER",8.30,.);&_ins Values(10.63,10.63,"FOURIER",8.22,.);
&_ins Values(10.85,10.85,"FOURIER",8.13,.);&_ins Values(11.00,11.00,"OBSERVED",8.08,8.08);
&_ins Values(11.06,11.06,"FOURIER",8.06,.);&_ins Values(11.28,11.28,"FOURIER",8.05,.);
&_ins Values(11.50,11.50,"FOURIER",8.10,.);&_ins Values(11.72,11.72,"FOURIER",8.22,.);
&_ins Values(11.94,11.94,"FOURIER",8.39,.);&_ins Values(12.00,12.00,"OBSERVED",8.43,8.43);
;quit;
```

Proc timeseries output model - average of years

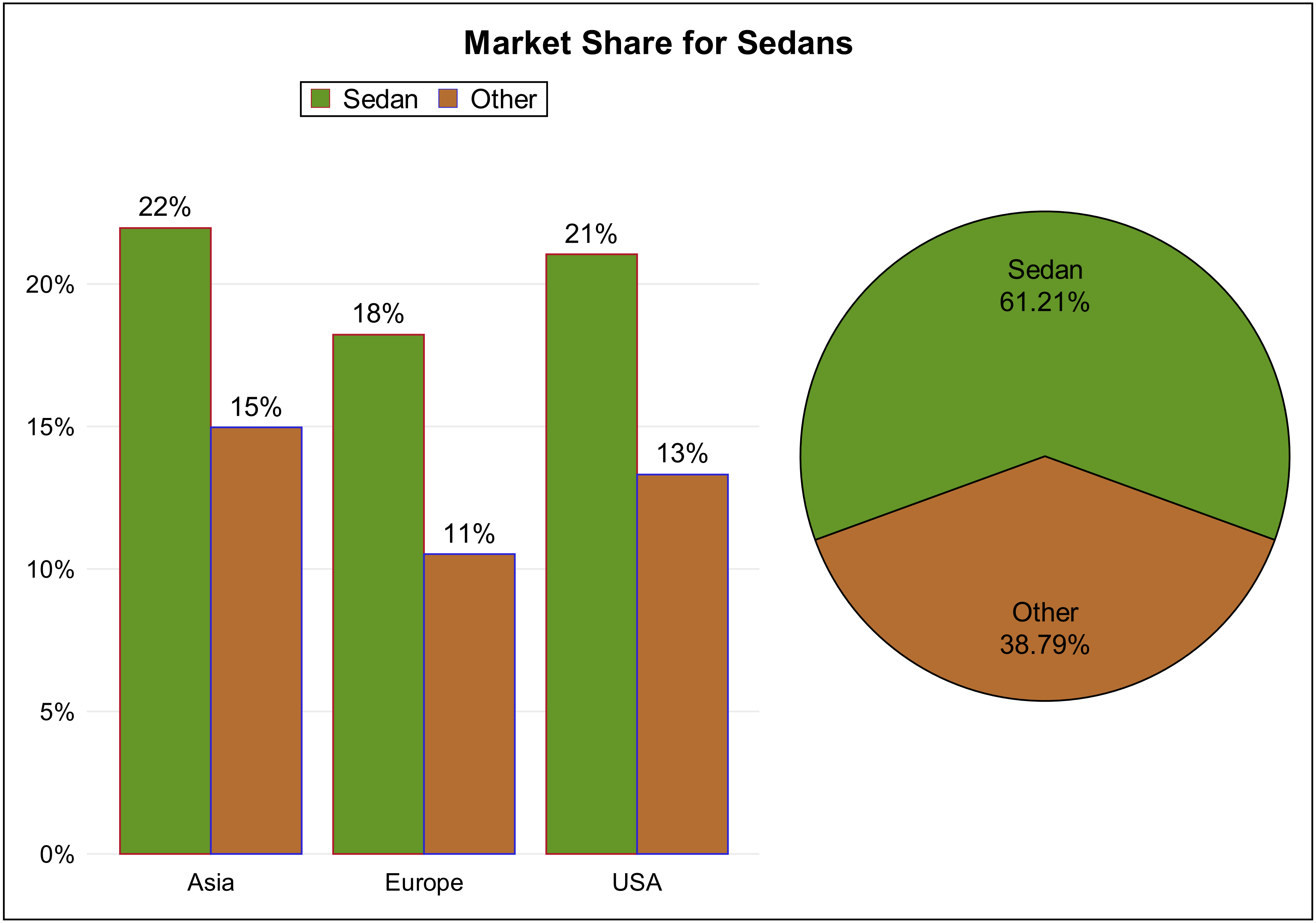
```
proc sgplot data=tym_series_twoser001;
title1 "Fourier Series Model of Asthma";
format percent pctlbl 5.1;
  label radian="Month";
  label percent="Percent of yearly asthma events";
  label model="Model";
  series x=radian y=percent / group=Model
  datalabel=pctlbl datalabelattrs=(size=12)
grouplc=model name="Models";
xaxis values=(1 to 12 by 1) grid;
keylegend / location = inside
position=TopRight   valueattrs=(size=10);
run;quit;
```



Fourier Series Model of Asthma
Model
OBSERVED
FOURIER
Percent of yearly asthma events
9.0
8.8
8.6
8.4
8.2
8.0
Month
1
2
3
4
5
6
7
8
9
10
11
12
8.5
8.2
9.1
8.5
8.6
8.2
8.2
8.2
8.1
8.4
8.1
8.4

SAS Template Pie Chart and Barchart together -see SLY220

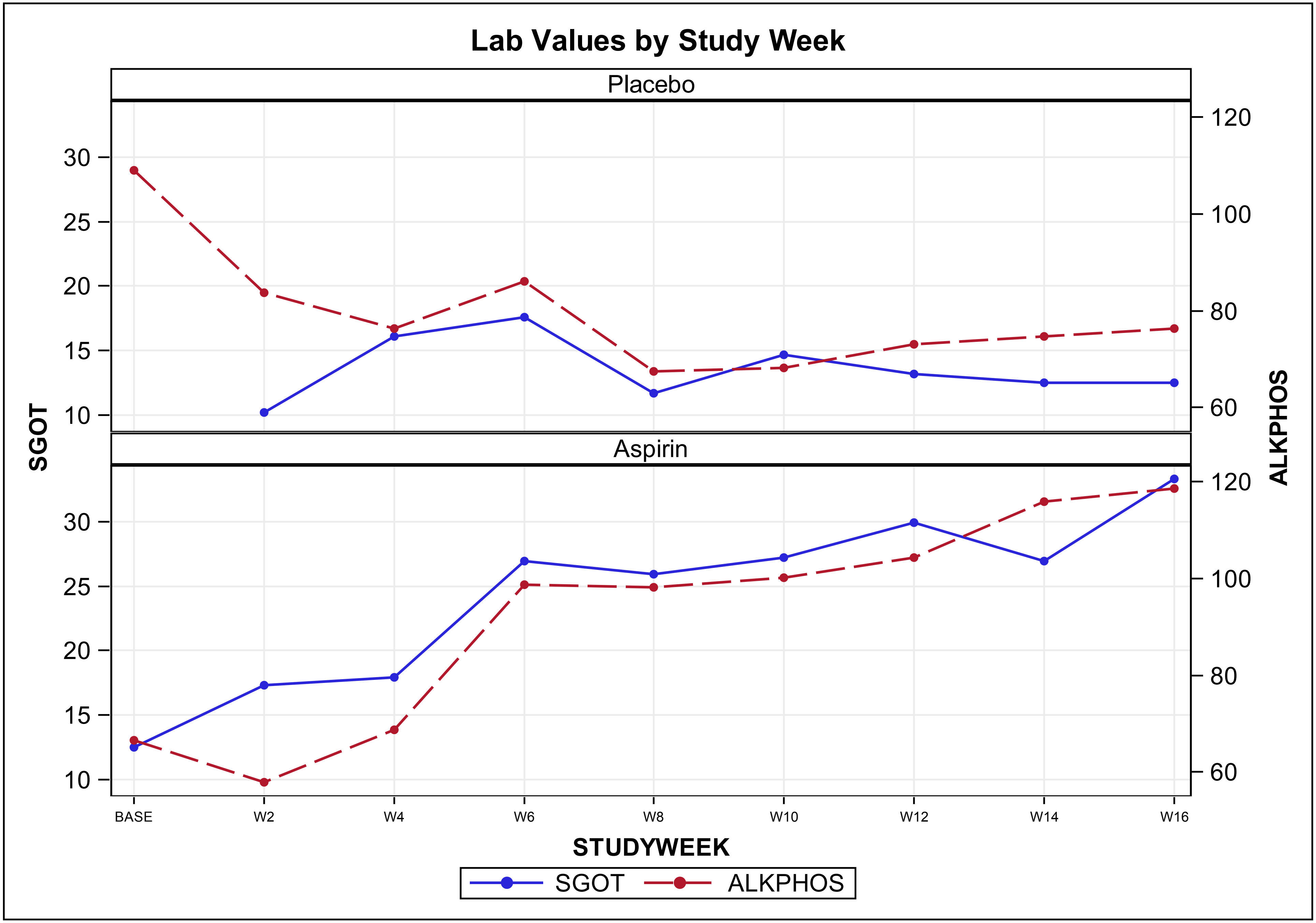
```
data Sedans;
set sashelp.cars(keep=origin type mpg_city mpg_highway horsepower);
if type ne "Sedan" then type="Other";run;
proc template;
define statgraph BarPie;
dynamic _tsize _lsize;
begingraph;
entrytitle "Market Share for Sedans" / textattrs=(size=_tsize);
discreteattrmap name="origin" / ignorecase=true;
value "Sedan" / fillattrs=(color=CX649628);
value "Other" / fillattrs=(color=CXB46E32);
enddiscreteattrmap;
discreteattrvar attrvar=type var=type attrmap="origin";
layout lattice / columns=2 columnweights=(0.6 0.4) columngutter=20;
layout overlay / xaxisopts=(display=(tickvalues)) walldisplay=none
yaxisopts=(display=(tickvalues) linearopts=(tickvalueformat=percent.)
griddisplay=on offsetmax=0.2);
barchart category=origin / name="a" barlabel=true stat=proportion
group=type groupdisplay=cluster barlabelformat=percent6.1 baselineattrs=
(thickness=0) barlabelattrs=(size=_lsize) grouporder=descending ;
discretelegend "a" / location=inside halign=center valign=top
autoitemsize=true valueattrs=(size=_lsize);endlayout;
layout region / pad=(bottom=30);
piechart category=type / centerfirstslice=true start=270
stat=pct datalabelattrs=(size=_lsize);;endlayout;endlayout;endgraph;end;
run;
proc sgrender data=Sedans template=BarPie;
dynamic _tsize=16 _lsize=13;
run;quit;
```



Market Share for Sedans
Sedan
Other
22%
15%
18%
11%
21%
13%
20%
15%
10%
5%
0%
Asia
Europe
USA
Sedan
61.21%
Other
38.79%

Response by Week for SQOG and Alkaline Phosphate SLY230.sas

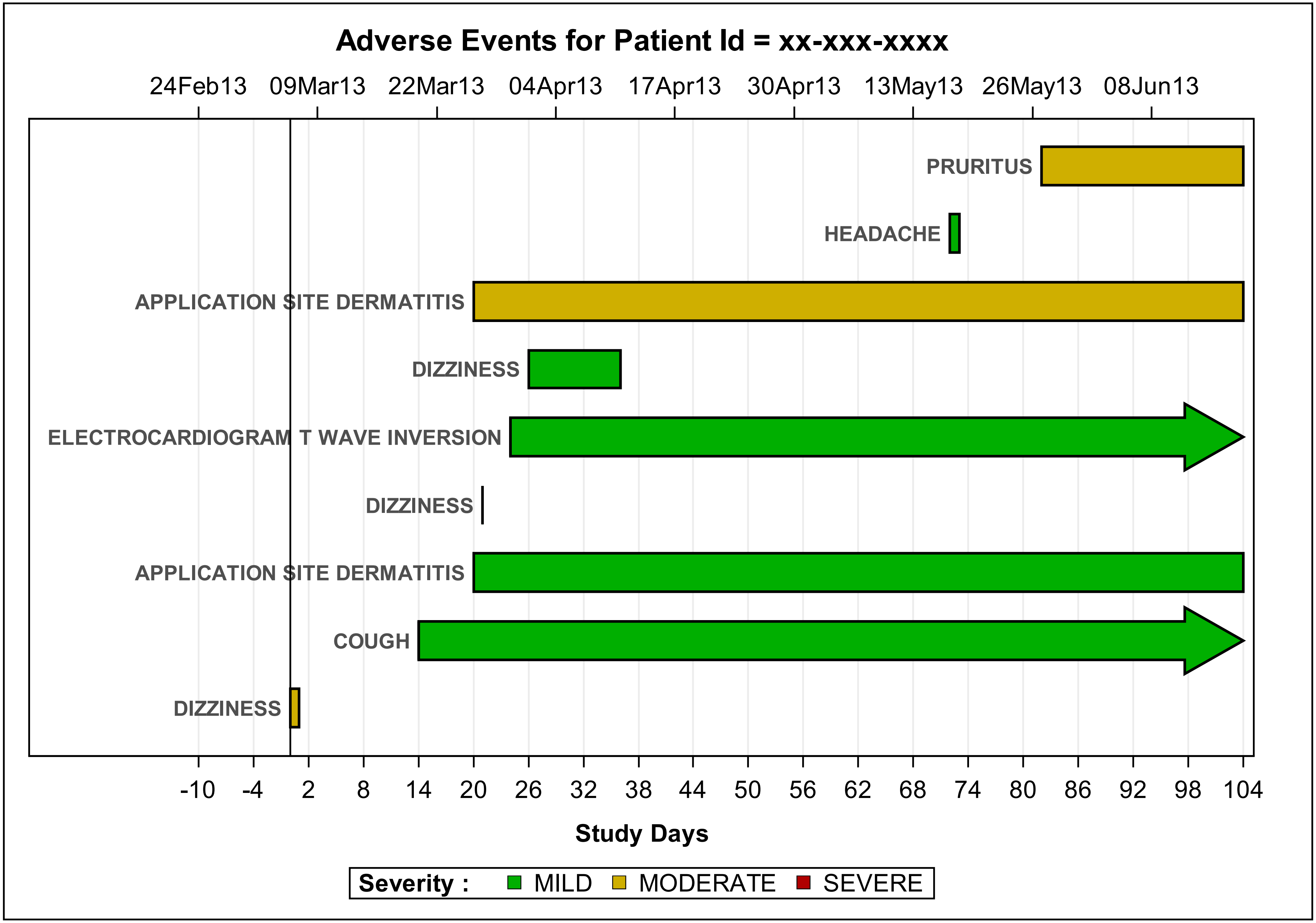
```
data labs(rename=( aph=ALKPHOS visit=StudyWeek));
length treatment $8;input visit $ treatment $ sgot aph @@;
if treatment="P" then treatment="Placebo";else treatment="Aspirin";
datalines;
BASE P .  108.9 W2 P 10.2 83.7 W4 P 16.1 76.4
W6 P 17.6 86.1 W8 P 11.7 67.4 W10 P 14.7 68.2
W12 P 13.2 73.1 W14 P 12.5 74.7 W16 P 12.5 76.4
BASE A 12.5 66.6 W2 A 17.3 57.9 W4 A 17.9 68.8
W6 A 26.9 98.7 W8 A 25.9 98.2 W10 A 27.2 100.1
W12 A 29.9 104.2 W14 A 26.9 115.9 W16 A 33.3 118.6
;run;
proc template;
define statgraph panel;
begingraph;
entrytitle "Lab Values by Study Week";
layout gridded / rowgutter=5;
layout datapanel classvars=(treatment) / rowaxisopts=(griddisplay=on)
columnaxisopts=(tickvalueattrs=(size=7) griddisplay=on)
columns=1 headerLabelDisplay=Value cellheightmin=50;
layout prototype /  cycleattrs=true;
SeriesPlot X=studyweek Y=sgot / primary=true display=(markers)
markerattrs=(size=9px symbol=circlefilled)
lineattrs=(thickness=2px) NAME="s1";
SeriesPlot X=studyweek Y=ALKPHOS / yaxis=y2 display=(markers)
markerattrs=(size=9px symbol=circlefilled)
lineattrs=(thickness=2px) NAME="s2";endlayout;endlayout;
DiscreteLegend "s1" "s2" /;
endlayout;endgraph;end;run;
proc sgrender data=labs template="panel";run;
run;quit;
```



Lab Values by Study Week
Placebo
Aspirin
SGOT
ALKPHOS
30
25
20
15
10
120
100
80
60
BASE
W2
W4
W6
W8
W10
W12
W14
W16
STUDYWEEK
SGOT
ALKPHOS

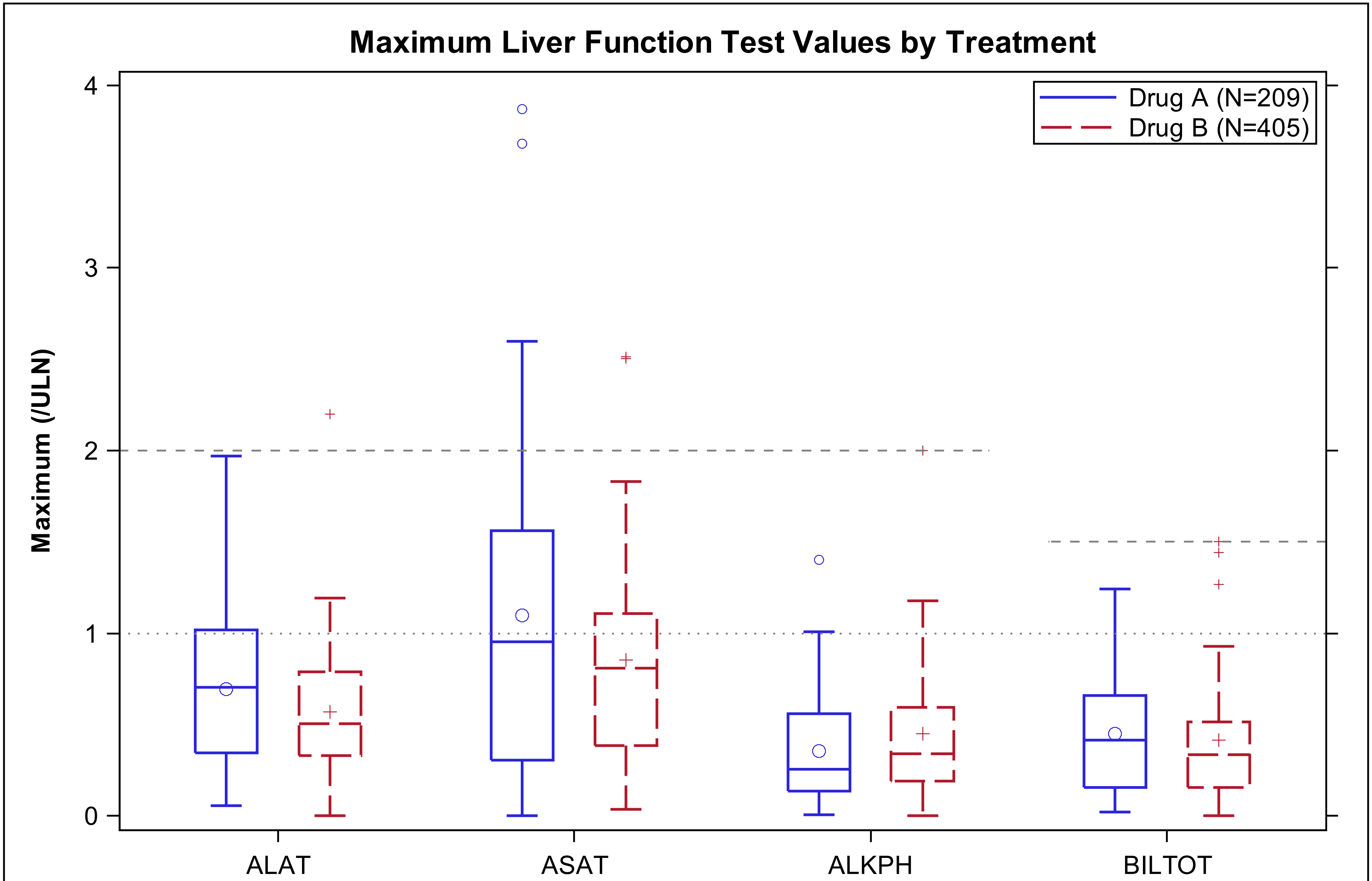
Adverse action patient profile see attached SLY240.sas for datand code

```
title "Adverse Events for Patient Id = xx-xxx-xxxx";
proc sgplot data=ae2  nocycleattrs dattrmap=attrmap;
highlow y=aeseq low=stday high=enday / group=aesev lowlabel=aedecod type=bar
barwidth=1 lineattrs=(color=black) lowcap=lcap highcap=hcap
attrid=Severity labelattrs=(size=10 weight=bold color=cx4f4f4f)
lineattrs=(thickness=2) name="sev";
scatter x=aestdate y=aeseq /  markerattrs=(size=0) x2axis;
refline 0 / axis=x lineattrs=(thickness=1 color=black);
yaxis display=(nolabel noticks novalues) type=discrete;
xaxis grid label="Study Days" values=(-10 to 104 by 2);
x2axis notimesplit display=(nolabel) values=(19413 to 19527);
keylegend "sev"/ title="Severity :";
run;quit;
```


Adverse Events for Patient Id = xx-xxx-xxxx
24Feb13
09Mar13
22Mar13
04Apr13
17Apr13
30Apr13
13May13
26May13
08Jun13
PRURITUS
HEADACHE
APPLICATION SITE DERMATITIS
DIZZINESS
ELECTROCARDIOGRAM T WAVE INVERSION
DIZZINESS
APPLICATION SITE DERMATITIS
COUGH
DIZZINESS
-10
-4
2
8
14
20
26
32
38
44
50
56
62
68
74
80
86
92
98
104
Study Days
Severity :
MILD
MODERATE
SEVERE

Maximum Liver Function Test Values by Treatment SLY250.sas

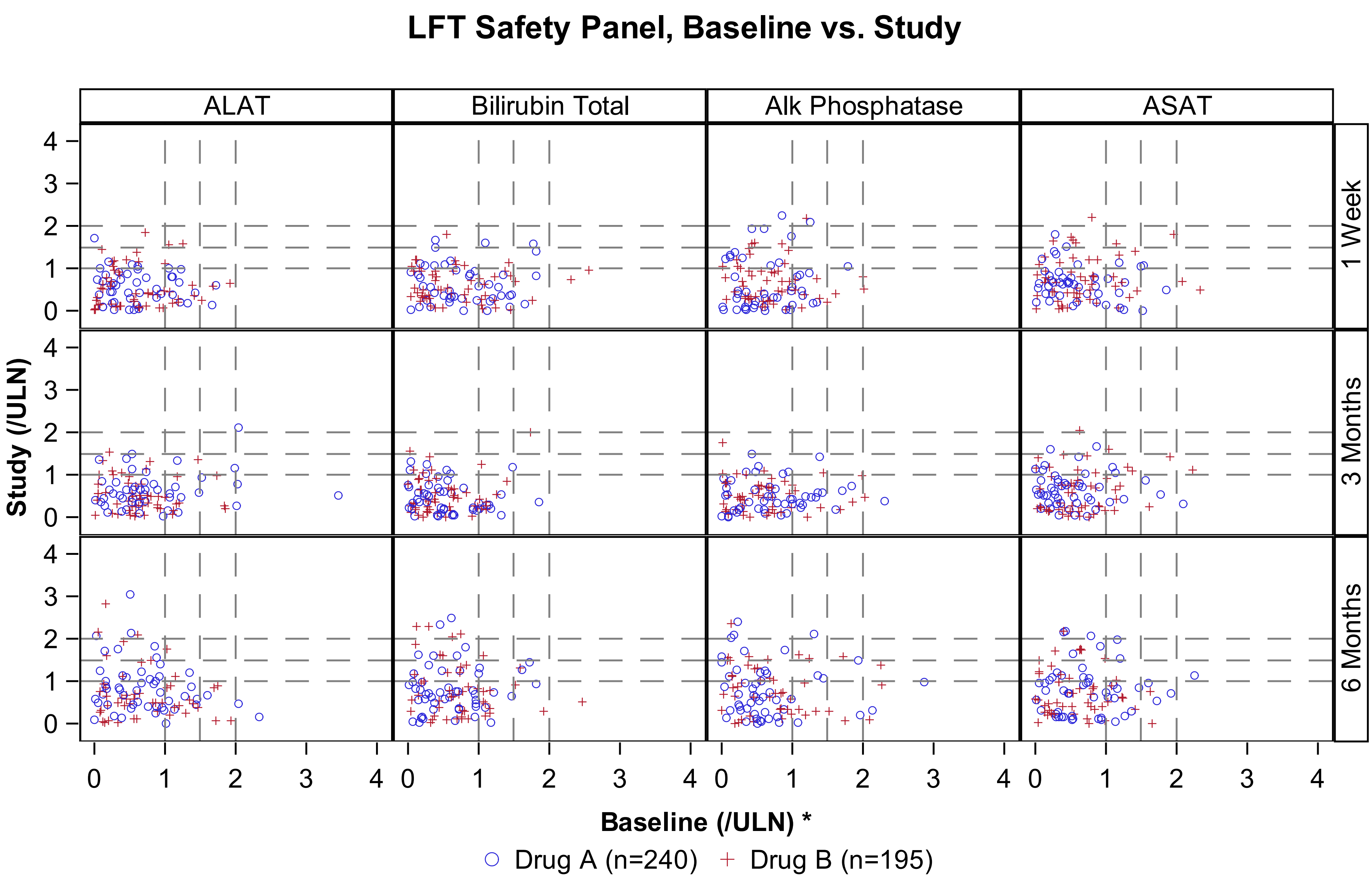
```
proc template;
define statgraph LFT_MaxByTrt;
dynamic _footnote _thick;
begingraph;
entrytitle "Maximum Liver Function Test Values by Treatment";
layout overlay / yaxisopts=(linearopts=(viewmin=0 viewmax=4)
label="Maximum (/ULN)")
y2axisopts=(linearopts=(viewmin=0 viewmax=4) display=(ticks))
xaxisopts=(display=(line ticks tickvalues));
boxplot x=Test y=value / display=(mean median outliers caps) group=drug
groupdisplay=cluster name="a" outlineattrs=(thickness=_thick)
medianattrs=(thickness=_thick)  whiskerattrs=(thickness=_thick);
referenceline y=1 / lineattrs=(pattern=dot);
dropline x="BILTOT" y=1.5 / dropto=Y yaxis=y2
discreteoffset=-.4 lineattrs=(pattern=shortdash);
dropline x="ALKPH" y=2.0 / dropto=Y yaxis=y
discreteoffset=.4 lineattrs=(pattern=shortdash);
discretelegend "a" "b" / location=inside valign=top halign=right across=1;
endlayout;
if (exists(_footnote) eq 1)
entryfootnote halign=left
"For ALAT, ASAT and ALKPH, the Clinical Concern Level is 2 ULN;";
entryfootnote halign=left
"For BILTOT, the CCL is 1.5 ULN: where ULN is Upper Level  Normal Range";
endif;endgraph;end;run;
proc sgrender data=LFT_Group template=LFT_MaxByTrt;
dynamic _footnote="y" _thick=2;run;
```



For ALAT, ASAT and ALKPH, the Clinical Concern Level is 2 ULN;
For BILTOT, the CCL is 1.5 ULN: where ULN is Upper Level Normal Range

Safety Panel, Baseline vs. Study code SLY260

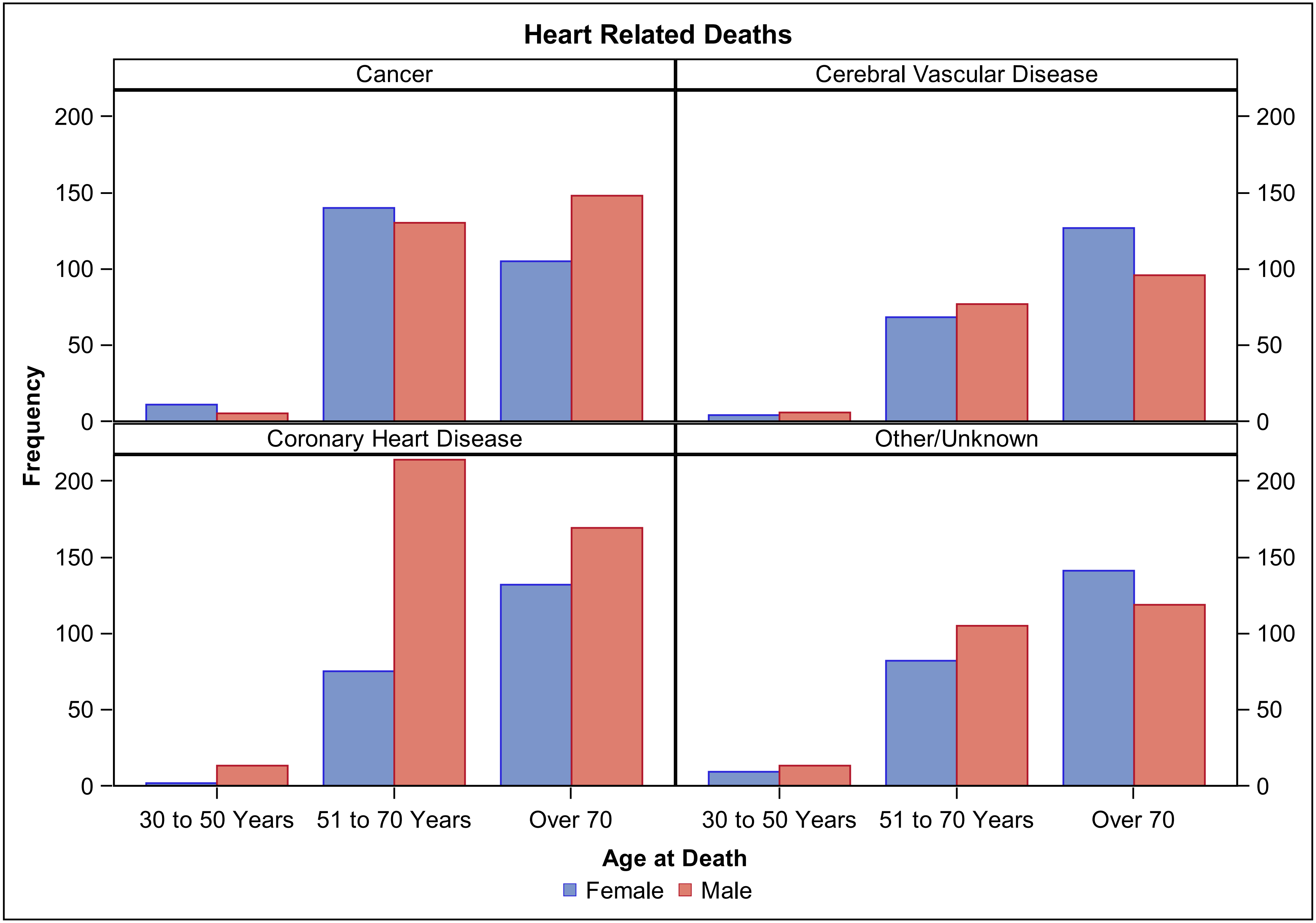
```
proc template;
define style listingSmallFont;
parent = styles.listing;
style GraphFonts from GraphFonts
"Fonts used in graph styles" /
"GraphUnicodeFont" = ("",9pt)
"GraphValueFont" = (", ",8pt)
"GraphLabelFont" = (", ",9pt)
"GraphFootnoteFont" = (", ",8pt)
"GraphTitleFont" = (", ",11pt,bold);
end;run;
title "LFT Safety Panel, Baseline vs. Study";
title2 " ";
footnote1 " ";
footnote2 j=l italic height=8pt
"* For ALAT, ASAT and Alkaline Phosphatase,"
" the Clinical Concern Level is 2 ULN;";
footnote3 j=l italic height=8pt
" For Bilirubin Total, the CCL is 1.5 ULN: "
"where ULN is the Upper Level of Normal";
proc sgpanel data=labs;
panelby labtest visitnum / layout=lattice onepanel novarname;
scatter x=pre y=result / group=drug markerattrs=(size=9);
refline 1 1.5 2 / axis=Y lineattrs=(pattern=dash);
refline 1 1.5 2 / axis=X lineattrs=(pattern=dash);

rowaxis integer min=0 max=4 label="Study (/ULN)";
colaxis integer min=0 max=4 label="Baseline (/ULN) *";
keylegend / title=" " noborder;run;
```



* For ALAT, ASAT and Alkaline Phosphatase, the Clinical Concern Level is 2 ULN;
For Bilirubin Total, the CCL is 1.5 ULN: where ULN is the Upper Level of Normal

Heart Related Deaths code SLY270.sas

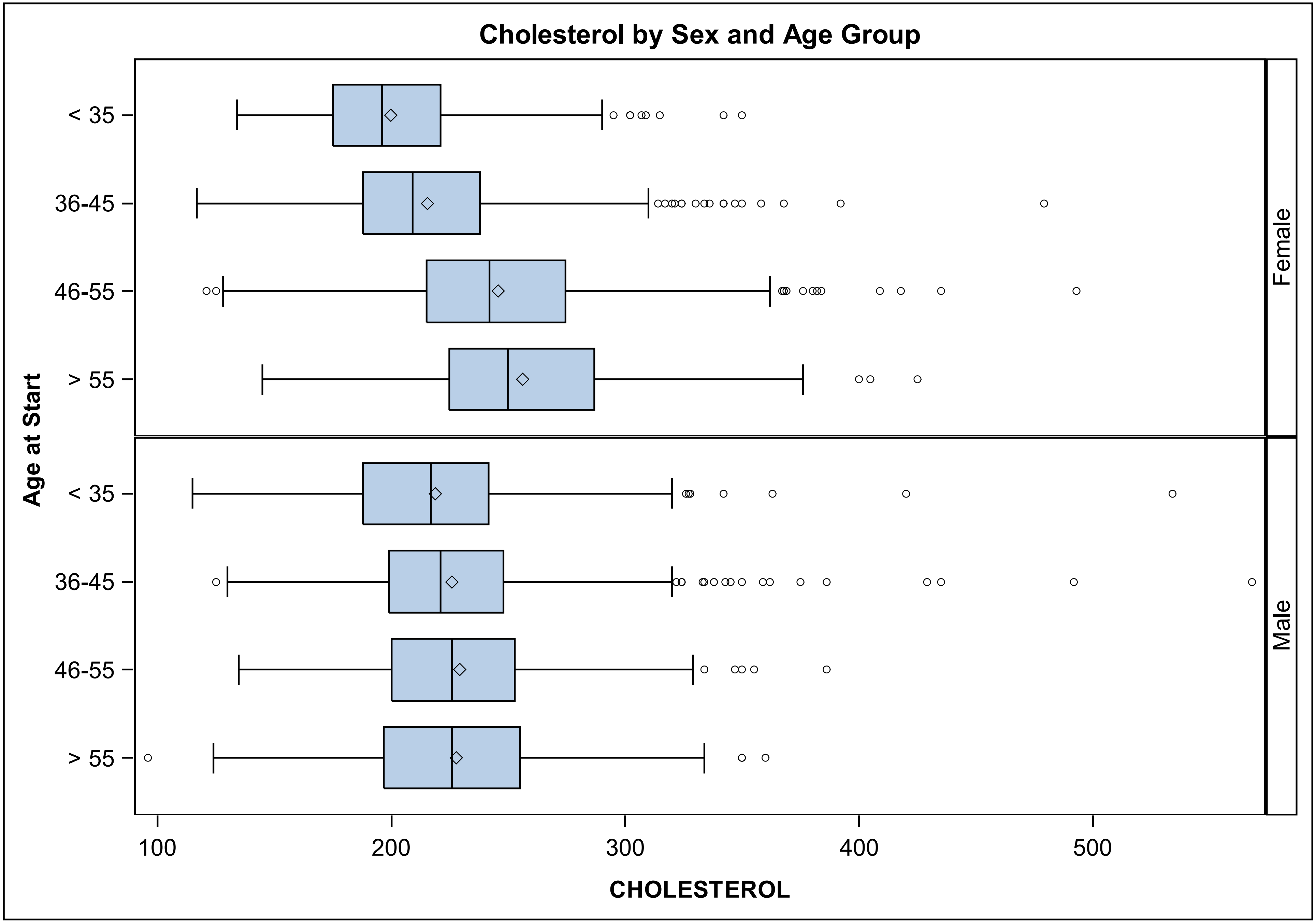
```
proc format;
value agefmt
low-29 = "Under 30"
30-50  = "30 to 50 Years"
51-70  = "51 to 70 Years"
71-high = "Over 70";run;
proc template;
define style barcolors ;
parent=styles.htmlblue;
style GraphData1 from GraphData1 /
color=cxffbbcc contrastcolor=black;
style GraphData2 from GraphData2 /
color=lightblue contrastcolor=black;
style GraphFonts from GraphFonts /
"GraphValueFont" = (,10pt)
"GraphLabelFont" = (,12pt);
end;run;
data heart;
set sashelp.heart;
if deathcause in ("Other" "Unknown") then
deathcause="Other/Unknown";run;
title "Heart Related Deaths";
proc sgpanel data=heart;
format ageatdeath agefmt.;
panelby deathcause / novarname sparse;

vbar ageatdeath / group=sex groupdisplay=cluster
clusterwidth=0.8; rowaxis refticks=(values);
keylegend / title="" noborder;run;
```



Heart Related Deaths
Cancer
Cerebral Vascular Disease
Coronary Heart Disease
Other/Unknown
Frequency
0
50
100
150
200
30 to 50 Years
51 to 70 Years
Over 70
Age at Death
Female
Male

Cholesterol by Sex and Age Group code SLY280.sas

```
proc format;
value age
28-34 = "< 35"
35-44 = "36-45"
45-54 = "46-55"
55-65 = "> 55";
run;
proc template;
define style myBlock;
parent=styles.BlockPrint;
style colors from colors
"Colors for doc" /
"docbg" = cxaaaf9f;
end;
run;
ods listing close;
title "Cholesterol by Sex and Age Group";
proc sgpanel data=sashelp.heart;
format ageatstart age.;
panelby sex / columns=1 layout=rowlattice novarname;
hbox cholesterol / category=ageatstart boxwidth=0.7;
run;
```


Cholesterol by Sex and Age Group
Age at Start
< 35
36-45
46-55
> 55
Female
Male
100
200
300
400
500
CHOLESTEROL

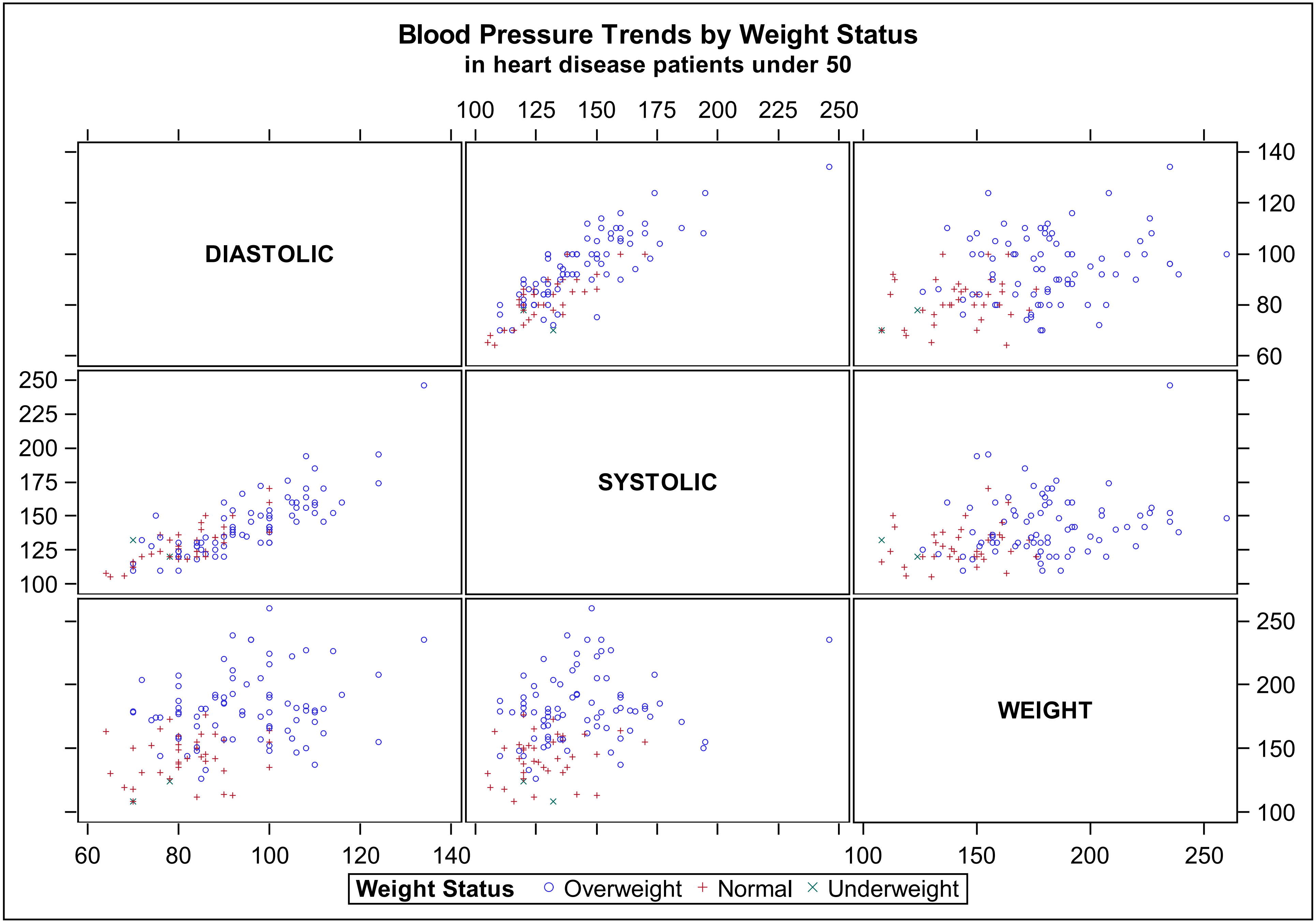
SERIESPLOT Statement with different Y2AXIS sly290.sas

```
proc template;
define statgraph plot;
begingraph;
entrytitle "SERIESPLOT Statement with Y2AXIS" ;
layout datapanel classvars=(sex) / columns=2 rows=1
headerlabelattrs=(color=red weight=bold)
headeropaque=false; layout prototype;
seriesplot x=age y=height / group=dose display=all name="height"
lineattrs=(color=cx5DAF5D)
markerattrs=(symbol=squarefilled color=cx5DAF5D);
seriesplot x=age y=weight / group=dose
yaxis=y2 display=all name="weight"
lineattrs=(color=cx4B50AA pattern=2)
markerattrs=(symbol=circlefilled color=cx4B50AA);
endlayout;
sidebar / align=bottom;
discretelegend "height" "weight" / ;
endsidebar;endlayout;endgraph;end;
define style noheaderborder;
parent = styles.default;
class graphborderlines / contrastcolor=white;
class graphbackground / color=white ;
end;run;
proc sort data=sashelp.class out=class;
by age;run;
proc sgrender data=class template=plot;run;
```


SERIESPLOT Statement with Y2AXIS
SEX = F
SEX = M
HEIGHT
WEIGHT
70
65
60
55
50
140
120
100
80
60
11
12
13
14
15
16
AGE
HEIGHT
WEIGHT

Blood Pressure Trends by Weight Status sly300.sas

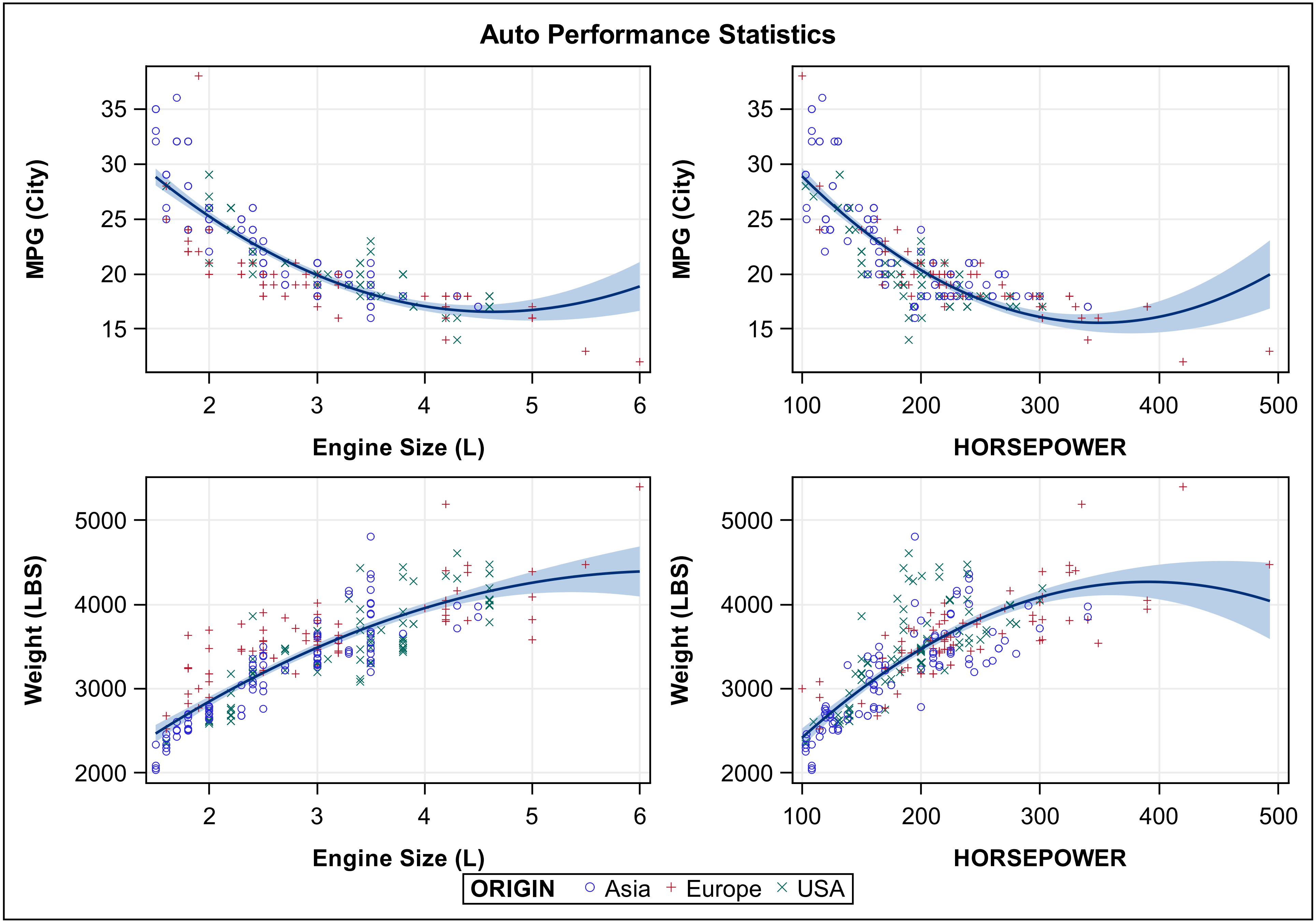
```
title1 "Blood Pressure Trends by Weight Status";
title2 "in heart disease patients under 50";
proc sgscatter data=sashelp.heart;
where AgeCHDdiag lt 50 and AgeCHDdiag gt 0;
matrix diastolic systolic weight /
group=weight_status;
run;
```



Blood Pressure Trends by Weight Status
in heart disease patients under 50
DIASTOLIC
SYSTOLIC
WEIGHT
100 125 150 175 200 225 250
140 120 100 80 60
250 225 200 175 150 125 100
250 200 150 100
60 80 100 120 140
100 150 200 250
Weight Status ○ Overweight + Normal × Underweight

Auto Performance Statistics sly310.sas

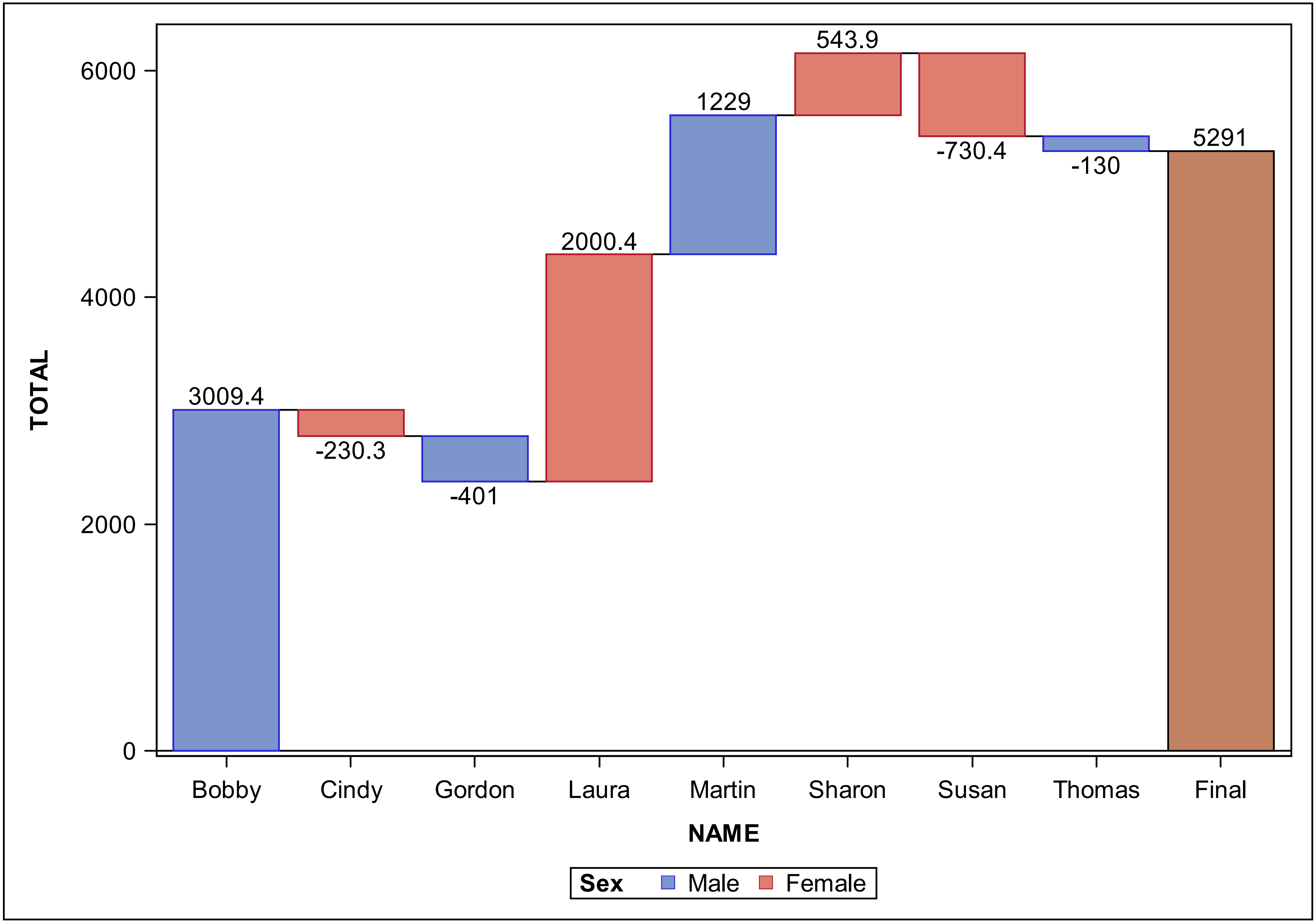
```
title "Auto Performance Statistics";
proc sgscatter data=sashelp.cars;
where type="Sedan";
plot (mpg_city weight) * (enginesize horsepower) /
group=origin reg=(nogroup clm degree=2) grid ;run;
```



Auto Performance Statistics
MPG (City)
Engine Size (L)
HORSEPOWER
Weight (LBS)
ORIGIN
Asia
Europe
USA

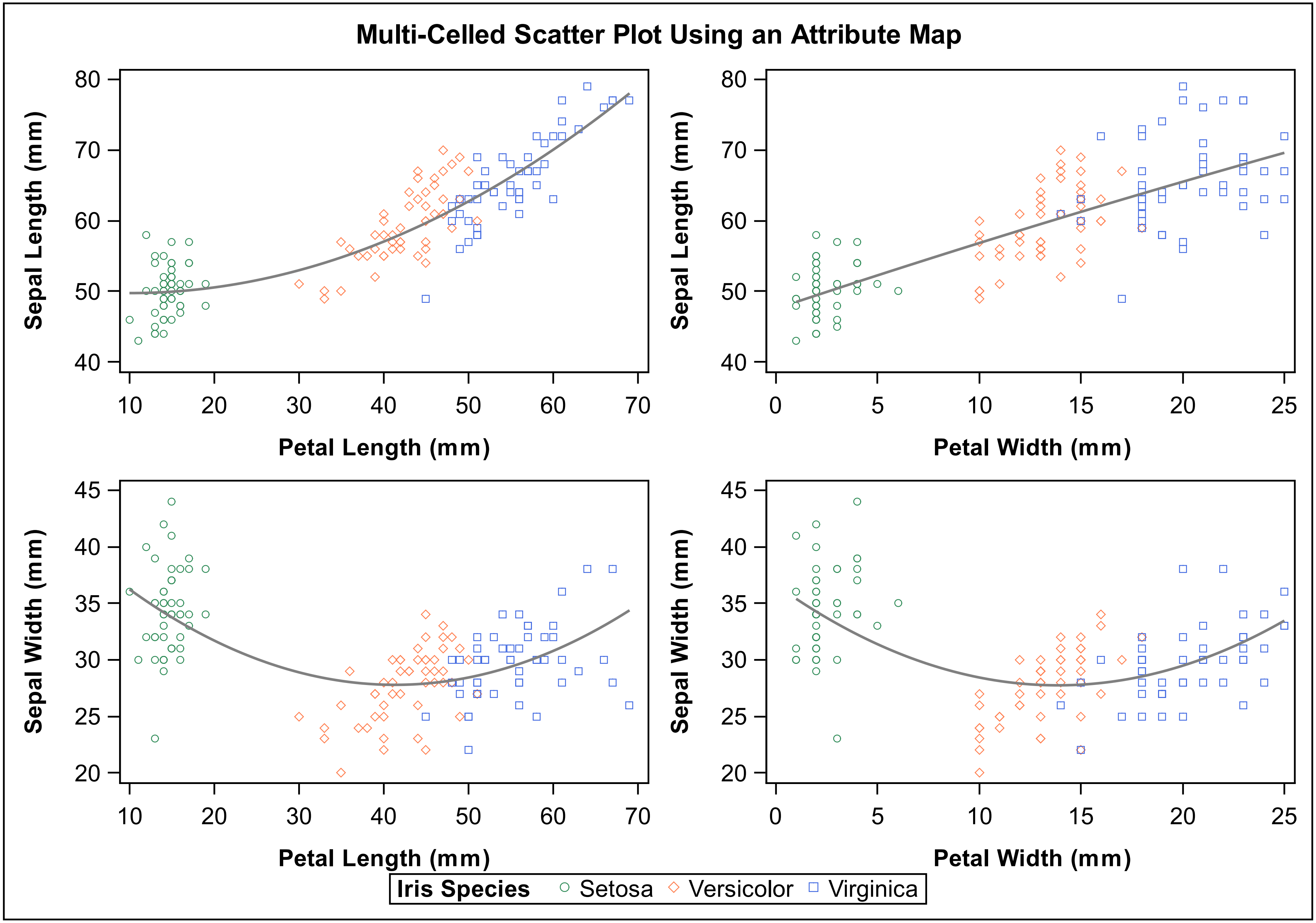
Waterfallchart SLY320.sas

```
data totals;
input sex $ : Name $ Total dollar8.2;
datalines;
Male Martin 1229.00
Male Thomas -130.00
Male Bobby 3009.40
Male Gordon -400.95
Female Susan -730.43
Female Cindy -230.34
Female Sharon 543.90
Female Laura 2000.40
;
run;
proc sort data=totals;by name;run;
proc template;
define statgraph waterfall;
begingraph;
layout overlay;
waterfallchart category=name response=total /
colorgroup=sex barlabel=true
name="waterfall" dataskin=gloss filltype=gradient;
discretelegend "waterfall" / title="Sex";
endlayout;endgraph;end;
proc sgrender template=waterfall data=totals;run;
```


TOTAL
6000
4000
2000
0
3009.4
-230.3
-401
2000.4
1229
543.9
-730.4
-130
5291
Bobby
Cindy
Gordon
Laura
Martin
Sharon
Susan
Thomas
Final
NAME
Sex
Male
Female

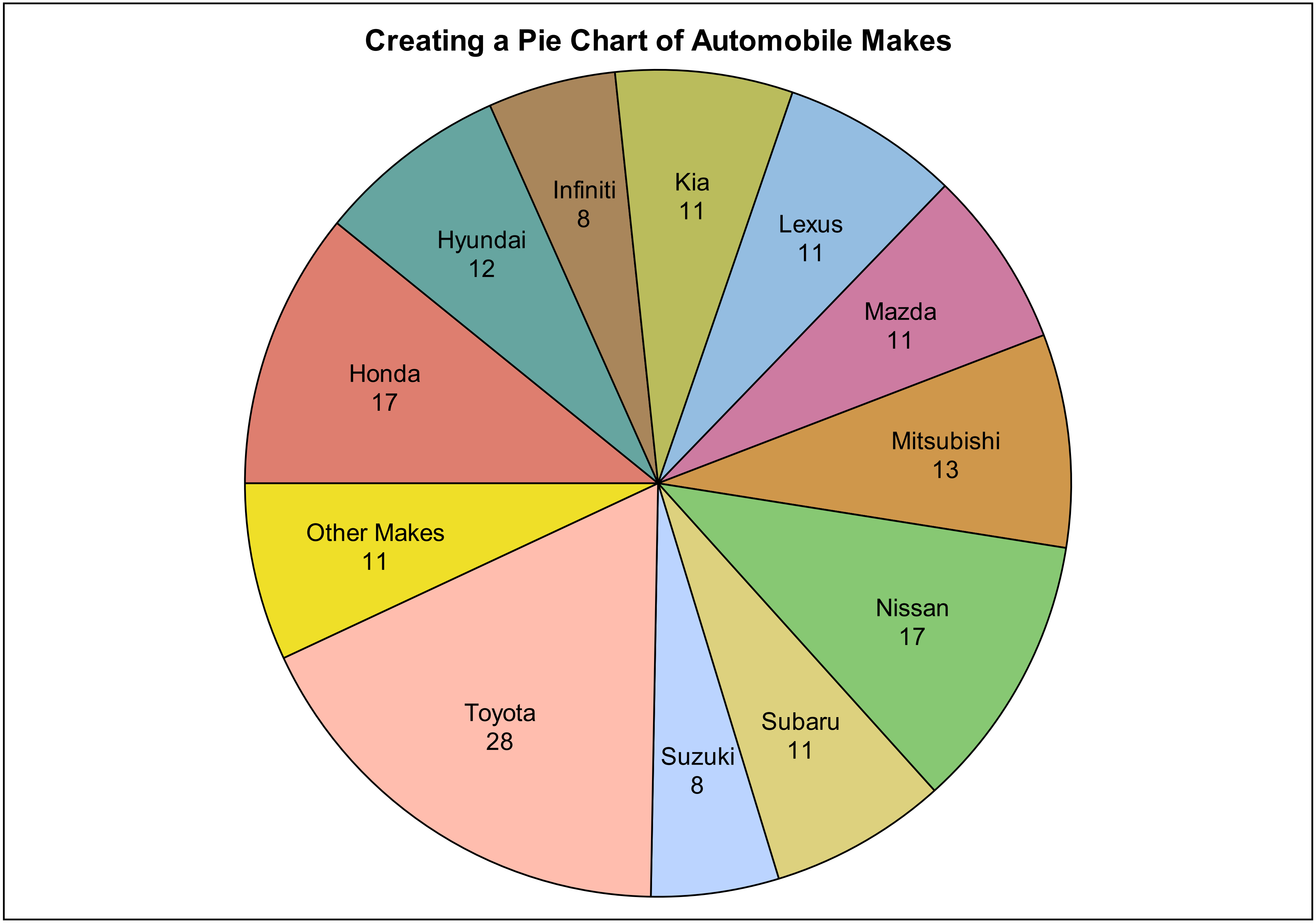
Multi-Celled Scatter Plot Using an Attribute Map SLY330.sas

```
data myattrmap;
length value markercolor $10;
retain id "myid";
input value $ markersymbol $ markercolor $;
datalines;
Setosa     circle   SeaGreen
Versicolor  diamond   Coral
Virginica   square    RoyalBlue
;
run;
proc sgscatter data=sashelp.iris dattrmap=myattrmap;
title "Multi-Celled Scatter Plot Using an Attribute Map";
plot (sepallength sepalwidth)*(petallength petalwidth)
/ attrid=myid group=species
reg=(nogroup degree=2 lineattrs=(color=gray));
run;
```


Multi-Celled Scatter Plot Using an Attribute Map
Sepal Length (mm)
Petal Length (mm)
Petal Width (mm)
Sepal Width (mm)
Iris Species
Setosa
Versicolor
Virginica

Creating a Pie Chart of Automobile Makes   SLY340.sas

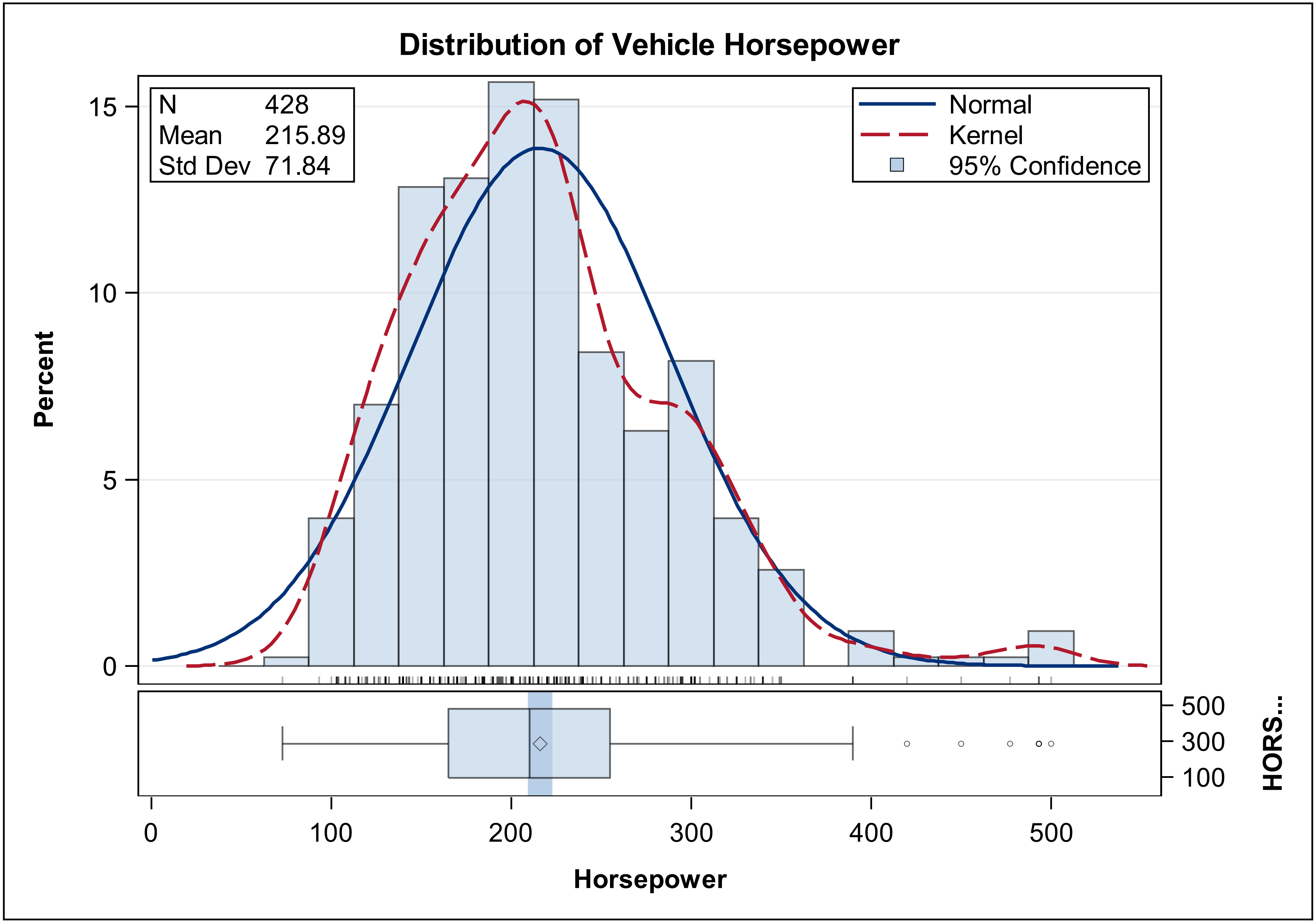
```
proc template;
define statgraph piechart;
begingraph;
entrytitle "Creating a Pie Chart of Automobile Makes";
layout region;
piechart category=make / datalabellocation=inside
categorydirection=clockwise start=180
othersliceopts=(type=percent percent=5 label="Other Makes");
endlayout;endgraph;end;
define style mystyle;
parent=styles.watercolor;
style graphoutlines from graphoutlines / contrastcolor=gray55;end;run;
proc sgrender data=sashelp.cars template=piechart;
where origin="Asia";run;
```



Creating a Pie Chart of Automobile Makes
Infiniti 8
Kia 11
Lexus 11
Hyundai 12
Mazda 11
Honda 17
Mitsubishi 13
Other Makes 11
Nissan 17
Toyota 28
Subaru 11
Suzuki 8

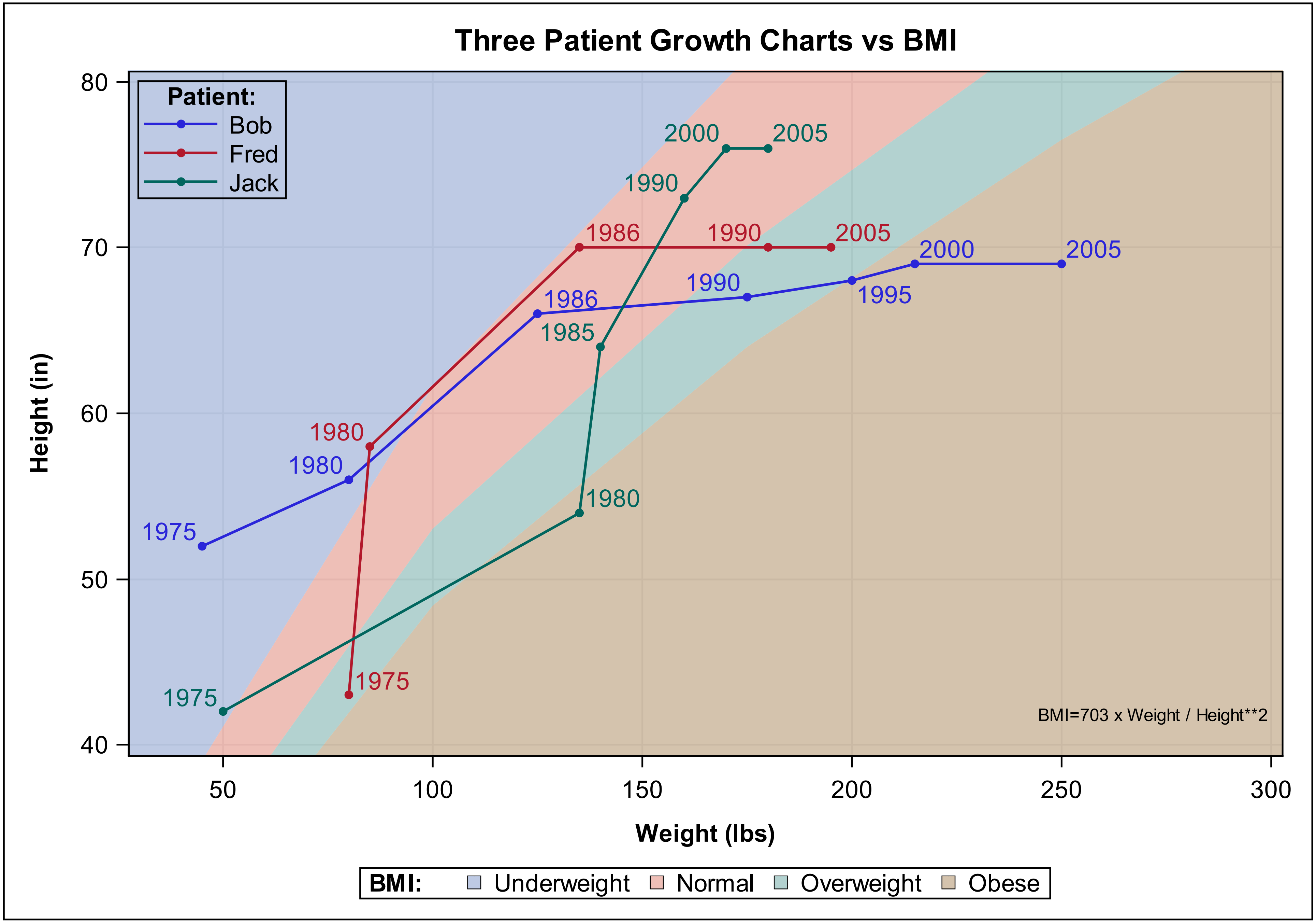
Heart Related Deaths code SLY350.sas

```
proc template;
define statgraph SGF2009.Histogram;
begingraph / designwidth=600px designheight=400px;
entrytitle "Distribution of Vehicle Horsepower";
layout lattice / rowweights=(.85 .15) columndatarange=union rowgutter=2px;columnaxes;
columnaxis / display=(ticks tickvalues label) label="Horsepower";endcolumnaxes;
layout overlay / yaxisopts=(offsetmin=.03 griddisplay=auto_on);
layout gridded / columns=2 autoalign=(topleft) border=true
opaque=true backgroundcolor=GraphWalls:color;
entry halign=left "N";       entry halign=left eval(strip(put(n(horsepower),12.0)));
entry halign=left "Mean";    entry halign=left eval(strip(put(mean(horsepower),12.2)));
entry halign=left "Std Dev"; entry halign=left eval(strip(put(stddev(horsepower),12.2)));
endlayout;
histogram horsepower / scale=percent primary=true binaxis=false nbins=20 datatransparency=0.4;
densityplot horsepower / normal( ) name="norm" legendlabel="Normal";
densityplot horsepower / kernel( ) name="kern" legendlabel="Kernel" lineattrs=graphdata2(thickness=2px);
fringeplot horsepower / datatransparency=.7 fringeheight=5px;
discretelegend "norm" "kern" "band" / location=inside across=1 autoalign=(topright) opaque=true;
endlayout;
layout overlay;
bandplot y=horsepower limitlower=eval(lclm(horsepower)) limitupper=eval(uclm(horsepower)) /
yaxis=y2 extend=true display=(fill) fillattrs=GraphConfidence2
name="band" legendlabel="95% Confidence";
boxplot y=horsepower / orient=horizontal primary=true boxwidth=.9 datatransparency=0.4;
endlayout;endlayout;endgraph;end;run;
proc sgrender data=sashelp.cars template=SGF2009.Histogram ;run;
```


Distribution of Vehicle Horsepower
N 428
Mean 215.89
Std Dev 71.84
Normal
Kernel
95% Confidence
Percent
0
5
10
15
500
300
100
HORS...
0
100
200
300
400
500
Horsepower

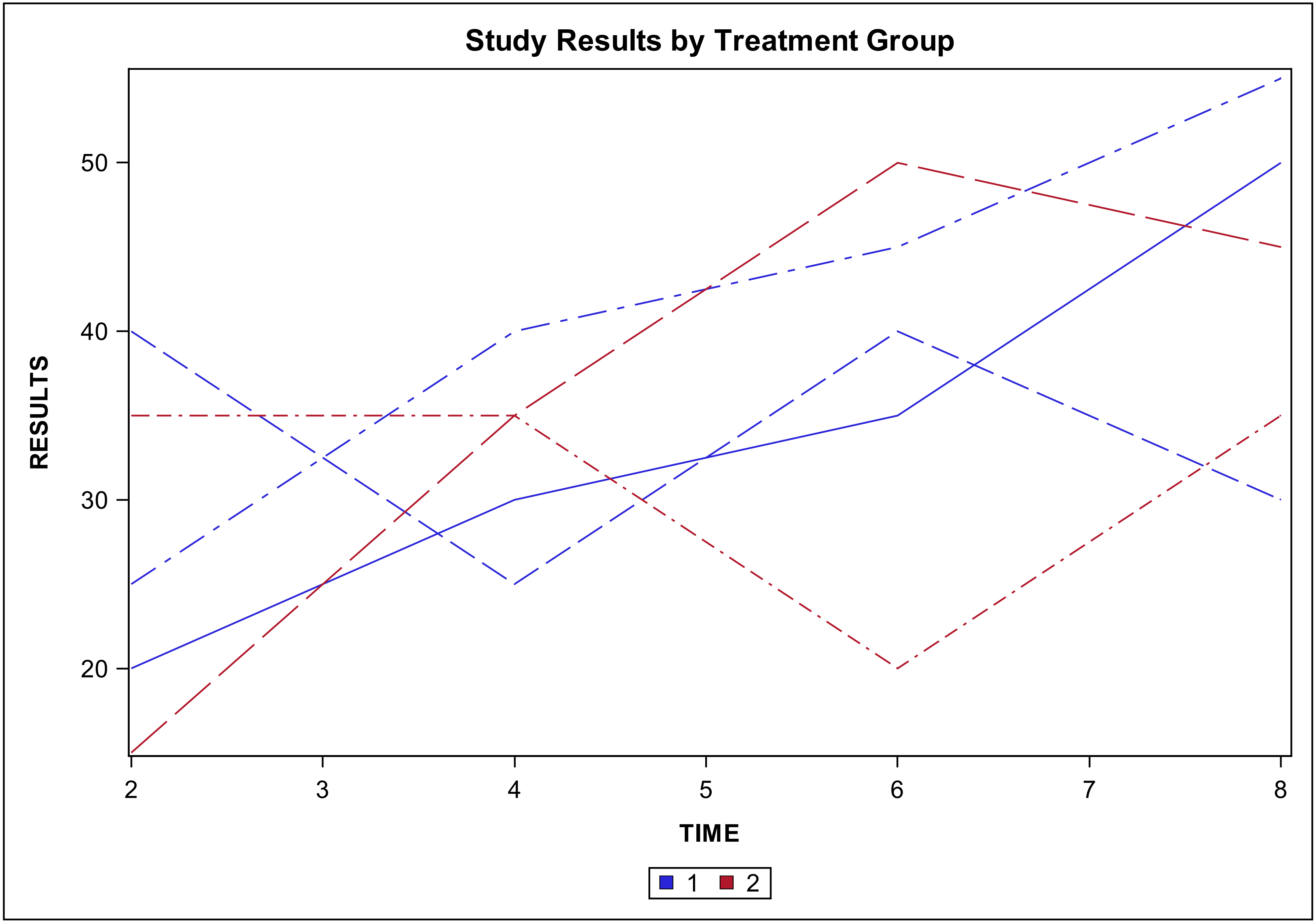
Three Patient Growth Charts vs BMI SLY360.sas (data is there)

```
proc template;
define style styles.bmi;
parent=styles.analysis;
style graphcolors from graphcolors /
"gcdata1"=CX31035E
"gcdata2"=CXB2182B
"gcdata3"=CX01665E
"gdata1"=CXFFFFFF
"gdata3"=CXFDC861
"gdata4"=CXDC531F
"gdata2"=CX679920;
end;run;
title "Three Patient Growth Charts vs BMI";
proc sgplot data=merged;
band x=weight_bmi upper=upper_hgt lower=lower_hgt /
transparency=.5 group=category name="bmi";
xaxis min=30 max=300 label="Weight (lbs)" grid;
yaxis min=40 max=80  label="Height (in)"  grid;
keylegend "bmi" / position=bottom location=outside across=4 title="BMI: ";
series x=wgt y=hgt / datalabel=year lineattrs=(pattern=solid thickness=2px)
markerattrs=(symbol=circlefilled ) markers group=name name="pts";
keylegend "pts" / position=topleft location=inside across=1 title="Patient:";
inset "BMI=703 x Weight / Height**2"  " " /
position=bottomright textattrs=graphfootnotetext;
run;
```

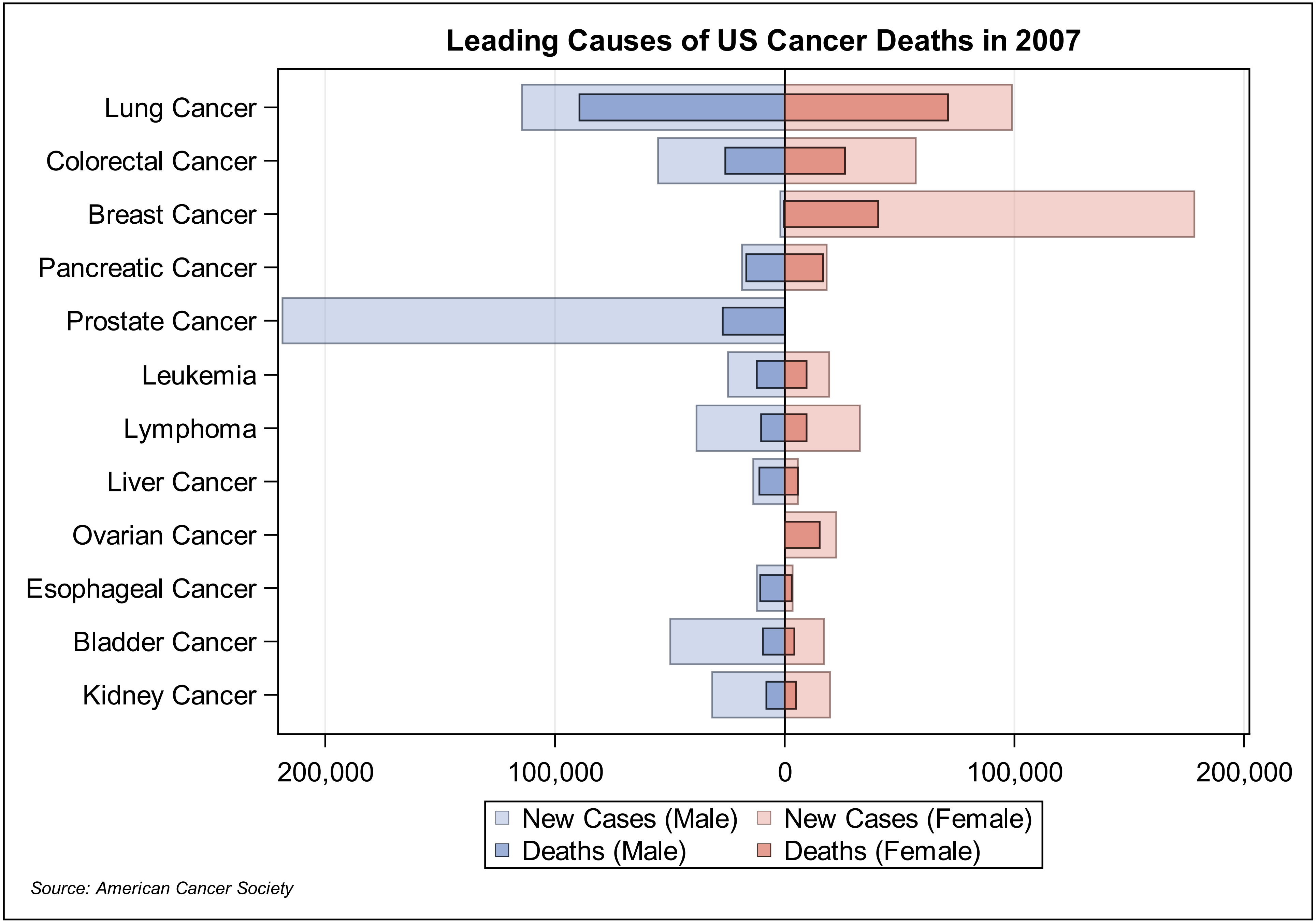

Three Patient Growth Charts vs BMI
Patient:
Bob
Fred
Jack
2000
2005
1990
1986
1990
2005
2000
2005
1990
1986
1995
1985
1980
1980
1980
1975
1975
1975
BMI=703 x Weight / Height**2
Height (in)
80
70
60
50
40
50
100
150
200
250
300
Weight (lbs)
BMI:
Underweight
Normal
Overweight
Obese

Spaghetti Plots   SYL210.sas

```
data one;
input trt_group time subject results @@;
datalines;
1 2 100 20 1 4 100 30 1 6 100 35 1 8 100 50
1 2 200 40 1 4 200 25 1 6 200 40 1 8 200 30
1 2 300 25 1 4 300 40 1 6 300 45 1 8 300 55
2 2 400 15 2 4 400 35 2 6 400 50 2 8 400 45
2 2 500 35 2 4 500 35 2 6 500 20 2 8 500 35

run;
title "Spaghetti Plots";
proc sgplot data=one;
title "Study Results by Treatment Group
series x=time y=results/ group=subject
grouplc=trt_group name="grouping";
keylegend "grouping" / type=linecolor;
run;
```

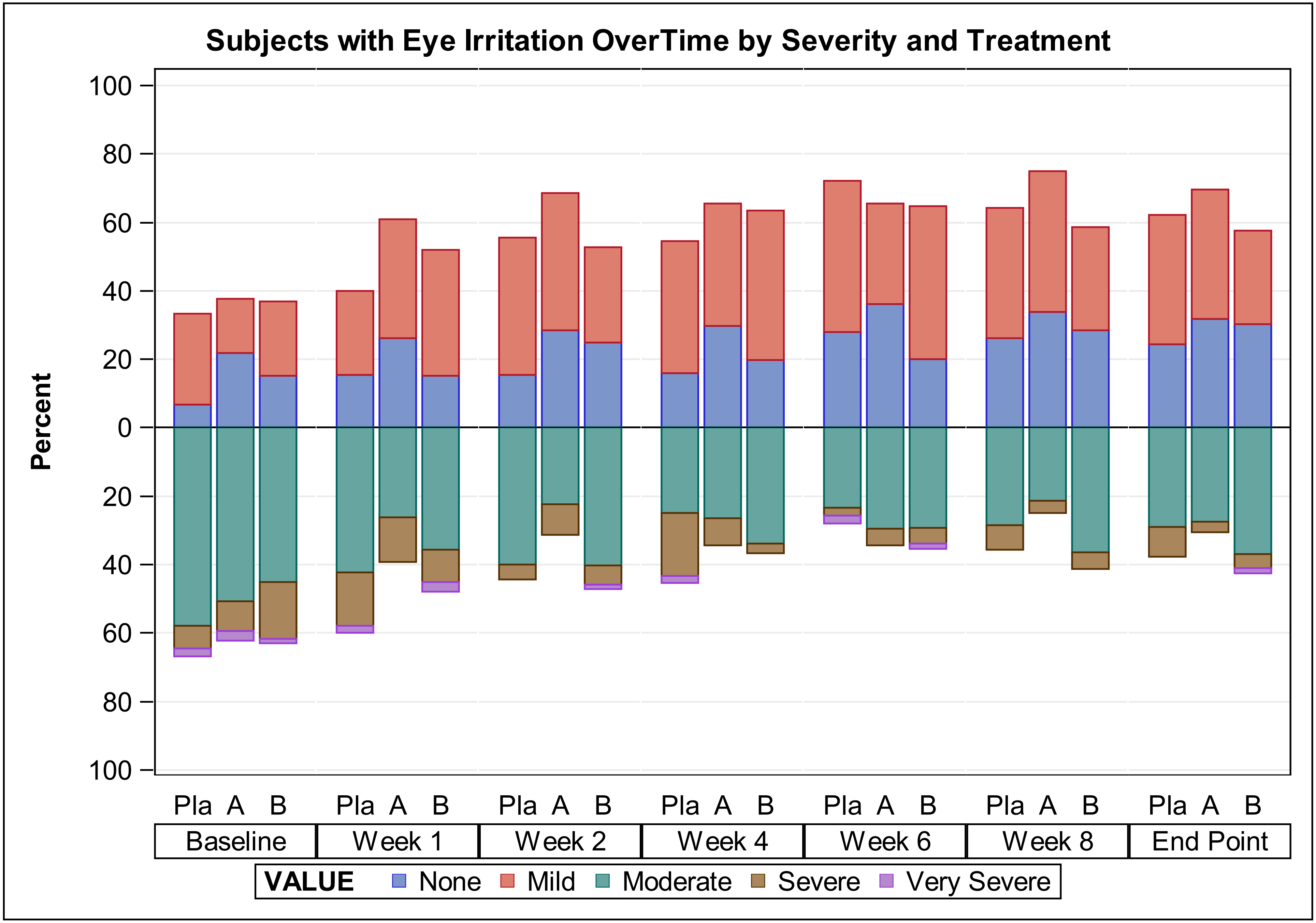

Study Results by Treatment Group
RESULTS
50
40
30
20
2
3
4
5
6
7
8
TIME
1
2

```
title "Leading Causes of US Cancer Deaths in 2007";
footnote justify=left italic "Source: American Cancer Society";
proc sgplot data=cancer;
format mcases mdeaths fcases fdeaths positive.;
hbar cause / response=mcases
fillattrs=graphdata1 transparency=.65
legendlabel="New Cases (Male)" name="mcases" ;
hbar cause / response=mdeaths barwidth=.5
fillattrs=graphdata1 transparency=.25
legendlabel="Deaths (Male)" name="mdeaths" ;
hbar cause / response=fcases
fillattrs=graphdata2 transparency=.65
legendlabel="New Cases (Female)" name="fcases";
hbar cause / response=fdeaths barwidth=.5
fillattrs=graphdata2 transparency=.25
legendlabel="Deaths (Female)" name="fdeaths";
keylegend "mcases" "fcases" "mdeaths" "fdeaths" / across=2;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) discreteorder=data;
run;
```


Leading Causes of US Cancer Deaths in 2007
Lung Cancer
Colorectal Cancer
Breast Cancer
Pancreatic Cancer
Prostate Cancer
Leukemia
Lymphoma
Liver Cancer
Ovarian Cancer
Esophageal Cancer
Bladder Cancer
Kidney Cancer
200,000
100,000
0
100,000
200,000
New Cases (Male)
New Cases (Female)
Deaths (Male)
Deaths (Female)
Source: American Cancer Society

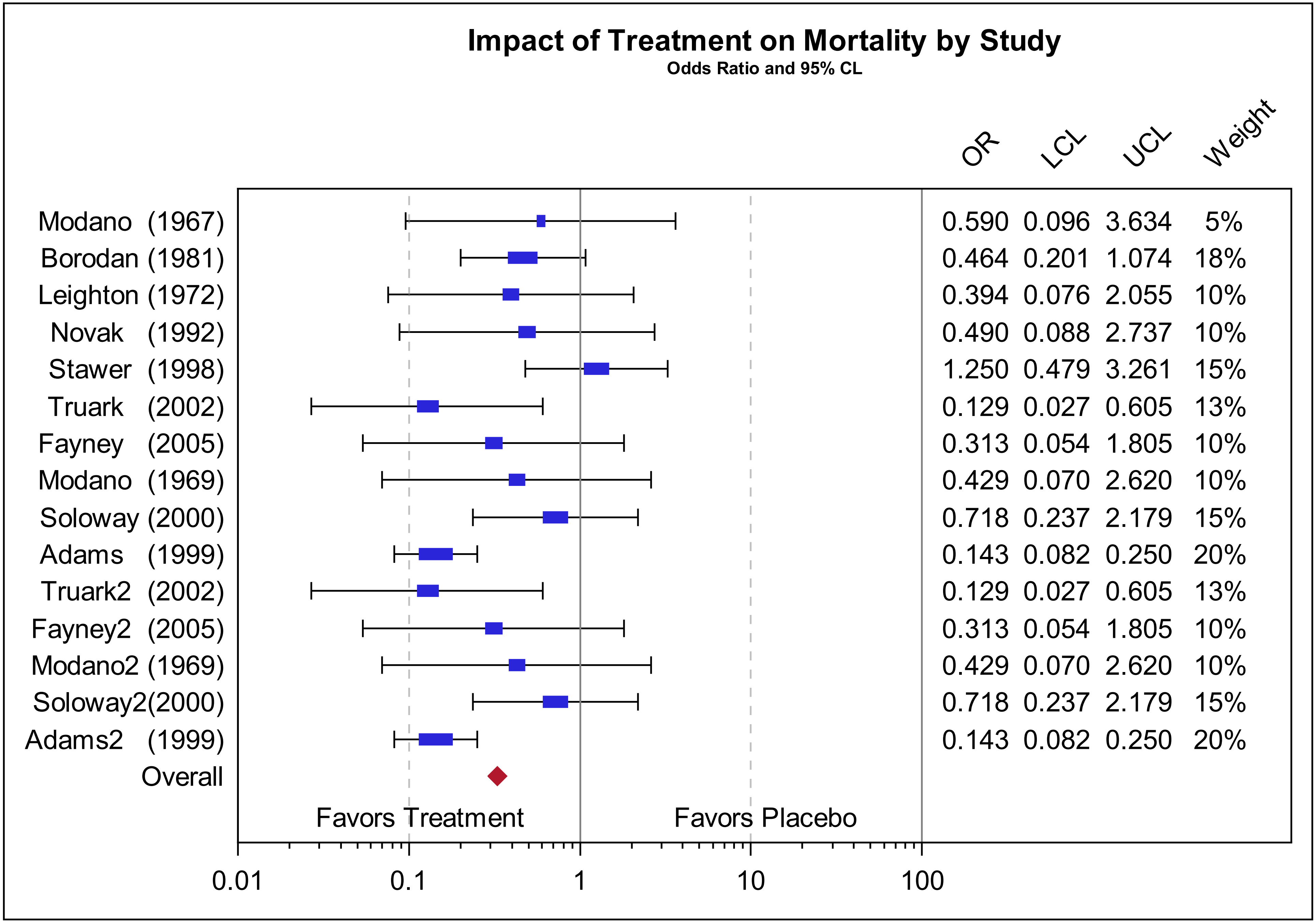
```
example-> 200
```

```
title "Subjects with Eye Irritation Over
Time by Severity and Treatment";
proc sgpanel data=eye2;
format percent abs.;
panelby time / layout=columnlattice onepanel
noborder colheaderpos=bottom novarname;
vbar trtgrp / response=percent group=value;
colaxis display=(nolabel noticks);
rowaxis label="Percent" values=(-100 to 100 by 20)
grid offsetmax=0.025;
run;
```


Subjects with Eye Irritation OverTime by Severity and Treatment
Percent
100
80
60
40
20
0
20
40
60
80
100
Pla A B
Baseline
Week 1
Week 2
Week 4
Week 6
Week 8
End Point
VALUE
None
Mild
Moderate
Severe
Very Severe

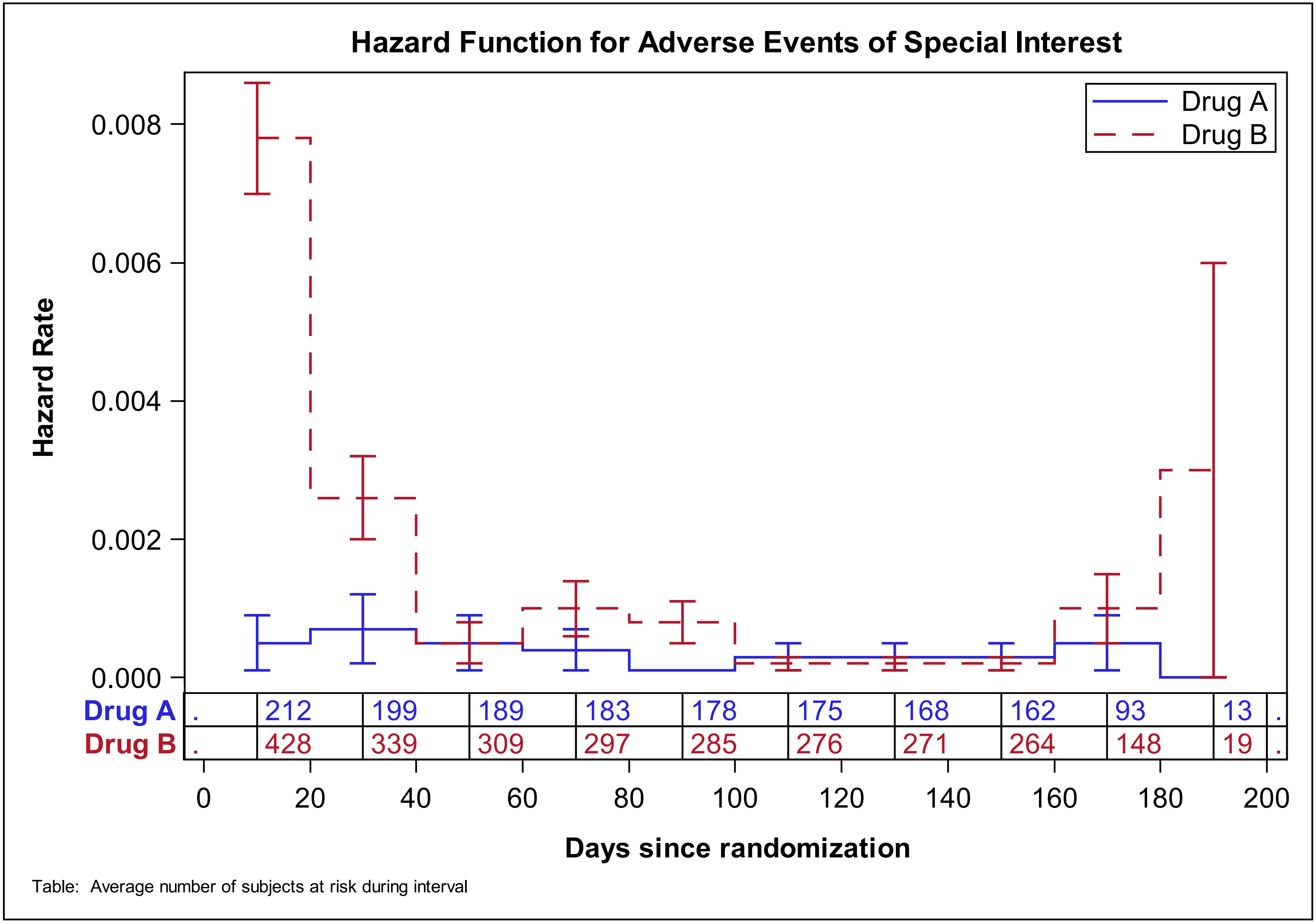
```
example-> 160
```

```
title "Impact of Treatment on Mortality by Study";
title2 h=8pt "Odds Ratio and 95% CL";
proc sgplot data=forest4 noautolegend;
scatter y=study2value x=oddsratio /
markerattrs=graphdata2(symbol=diamondfilled size=10);
scatter y=studyvalue x=oddsratio / xerrorupper=ucl2
xerrorlower=lcl2 markerattrs=graphdata1(symbol=squarefilled size=0);
vector x=x2 y=studyvalue / xorigin=x1 yorigin=studyvalue
lineattrs=graphdata1(thickness=8) noarrowheads;
scatter y=studyvalue x=or / markerchar=oddsratio x2axis;
scatter y=studyvalue x=lcl / markerchar=lowercl x2axis;
scatter y=studyvalue x=ucl / markerchar=uppercl x2axis;
scatter y=studyvalue x=wt / markerchar=weight x2axis;
refline 1 100  / axis=x;
refline 0.1 10 / axis=x lineattrs=(pattern=shortdash)
transparency=0.5;
inset "        Favors Treatment"  / position=bottomleft;
inset "Favors Placebo"  / position=bottom;
xaxis type=log offsetmin=0 offsetmax=0.35 min=0.01
max=100 minor display=(nolabel) ;
x2axis offsetmin=0.7 display=(noticks nolabel);
yaxis display=(noticks nolabel) offsetmin=0.1
offsetmax=0.05 values=(1 to &count by 1);
run;
```


Impact of Treatment on Mortality by Study
Odds Ratio and 95% CL
OR
LCL
UCL
Weight
Modano (1967) 0.590 0.096 3.634 5%
Borodan (1981) 0.464 0.201 1.074 18%
Leighton (1972) 0.394 0.076 2.055 10%
Novak (1992) 0.490 0.088 2.737 10%
Stawer (1998) 1.250 0.479 3.261 15%
Truark (2002) 0.129 0.027 0.605 13%
Fayney (2005) 0.313 0.054 1.805 10%
Modano (1969) 0.429 0.070 2.620 10%
Soloway (2000) 0.718 0.237 2.179 15%
Adams (1999) 0.143 0.082 0.250 20%
Truark2 (2002) 0.129 0.027 0.605 13%
Fayney2 (2005) 0.313 0.054 1.805 10%
Modano2 (1969) 0.429 0.070 2.620 10%
Soloway2(2000) 0.718 0.237 2.179 15%
Adams2 (1999) 0.143 0.082 0.250 20%
Overall
Favors Treatment
Favors Placebo
0.01
0.1
1
10
100

```
example-> 210
```

```
proc template;
define statgraph hazard_function;
begingraph / designwidth=7in designheight=4.5in;
entrytitle "Hazard Function for Adverse Events of Special Interest";
layout overlay / yaxisopts=(label="Hazard Rate")
xaxisopts=(linearopts=(viewmin=0
tickvaluelist=(0 20 40 60 80 100 120 140 160 180 200)));
stepplot x=day y=A / errorupper=AHigh errorlower=ALow justify=center
lineattrs=graphdata1(pattern=solid thickness=2)
errorbarattrs=graphdata1(pattern=solid thickness=2) name="a";
stepplot x=day y=B / errorupper=BHigh errorlower=BLow justify=center
lineattrs=graphdata2(pattern=dash thickness=2)
errorbarattrs=graphdata2(pattern=solid thickness=2) name="b";
discretelegend "a" "b" / location=inside halign=right
valign=top across=1 border=true;
innermargin;
blockplot x=day block=BRisk / display=(values label outline)
labelattrs=GraphData2 valueattrs=GraphData2;
blockplot x=day block=ARisk / display=(values label outline)
labelattrs=GraphData1 valueattrs=GraphData1;
endinnermargin;endlayout;
entryfootnote halign=left
"Table:  Average number of subjects at risk during interval";
endgraph;end;run;
proc sgrender data=hazardx template=hazard_function;run;
```


Hazard Function for Adverse Events of Special Interest
Drug A
Drug B
Hazard Rate
0.008
0.006
0.004
0.002
0.000
Drug A . 212 199 189 183 178 175 168 162 93 13 .
Drug B . 428 339 309 297 285 276 271 264 148 19 .
0 20 40 60 80 100 120 140 160 180 200
Days since randomization
Table: Average number of subjects at risk during interval

```
example-> 230
```

SAS Proc template to create Marginal Histograms - part 1 (007)

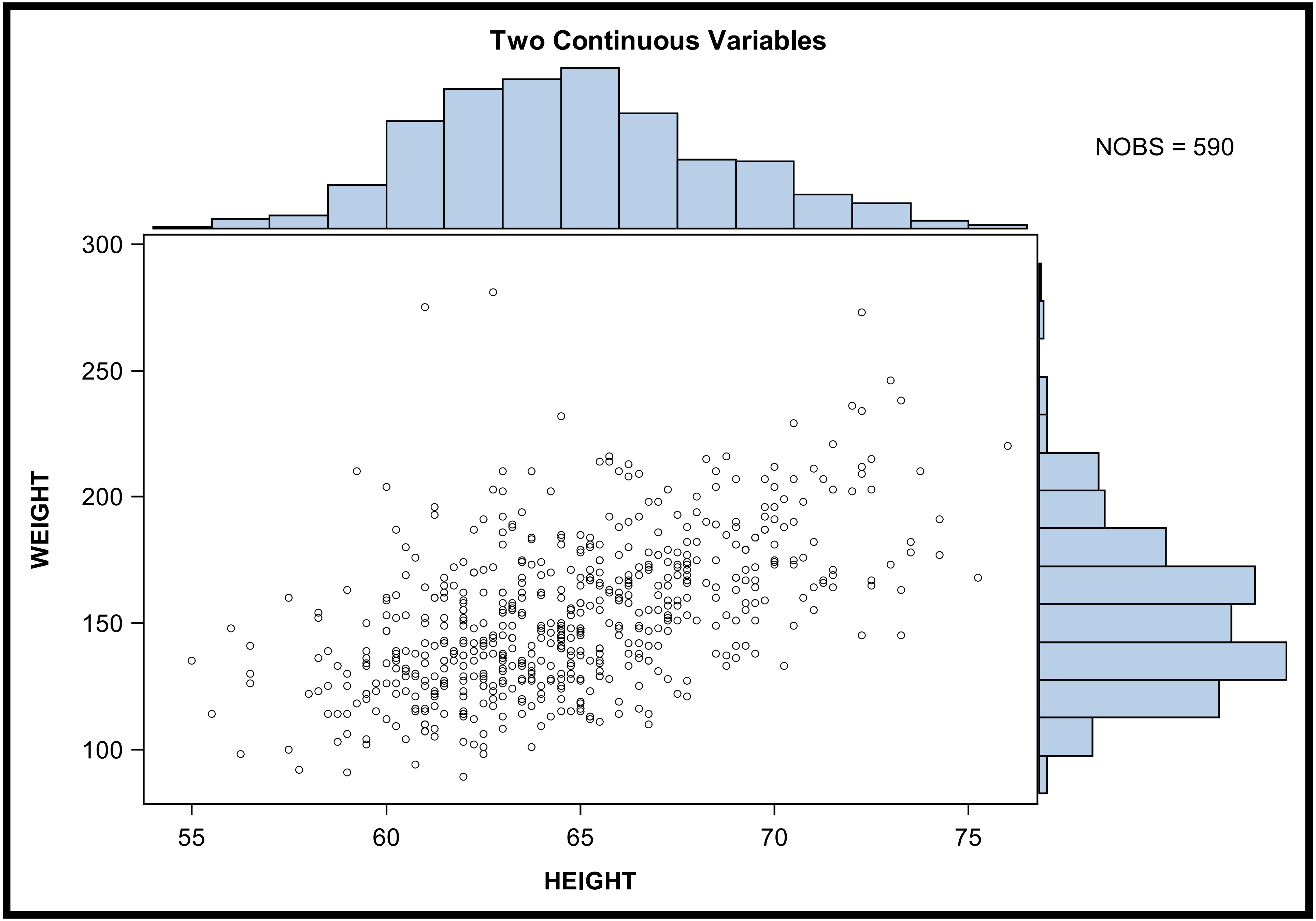
```
proc template;
define statgraph scatterhist;
dynamic XVAR YVAR XTYPE YTYPE TITLE;
begingraph / designwidth=10in designheight=7in borderattrs=(thickness=3pt);
entrytitle TITLE;
layout lattice / rows=2 columns=2 rowweights=(.2 .8) columnweights=(.8 .2)
rowdatarange=union columndatarange=union rowgutter=0 columngutter=0;
layout overlay / walldisplay=(fill) wallcolor=GraphBackground:color
xaxisopts=(display=none)
yaxisopts=(display=none offsetmin=0);
if (upcase(XTYPE) = "DISCRETE") barchart x=XVAR / barwidth=1 stat=pct;
else histogram XVAR / binaxis=false;
endif;
endlayout;
layout overlay;
entry "NOBS = " eval(n(XVAR));
endlayout;
layout overlay / xaxisopts=(type=XTYPE) yaxisopts=(type=YTYPE);
scatterplot y=YVAR x=XVAR ;
endlayout;
layout overlay / walldisplay=(fill) wallcolor=GraphBackground:color
xaxisopts=(display=none offsetmin=0) yaxisopts=(display=none);
if (upcase(YTYPE) = "DISCRETE") barchart x=YVAR / barwidth=1 orient=horizontal stat=pct;
else histogram YVAR / orient=horizontal binaxis=false;
endif;
endlayout;
endlayout;
endgraph;
end;
run;
```

SAS Proc template to create Marginal Histograms - part 1 (007)

```
proc template;
define Style ScatterHistStyle;
parent = styles.journal;
style GraphFonts from GraphFonts
"Fonts used in graph styles" /
"GraphTitleFont" = (", ",10pt,bold)
"GraphFootnoteFont" = (", ",8pt)
"GraphLabelFont" = (", ",8pt)
"GraphValueFont" = (", ",7pt)
"GraphDataFont" = (", ",7pt);
end;
run;
```

R code to create Marginal Histograms - part 1 (007)

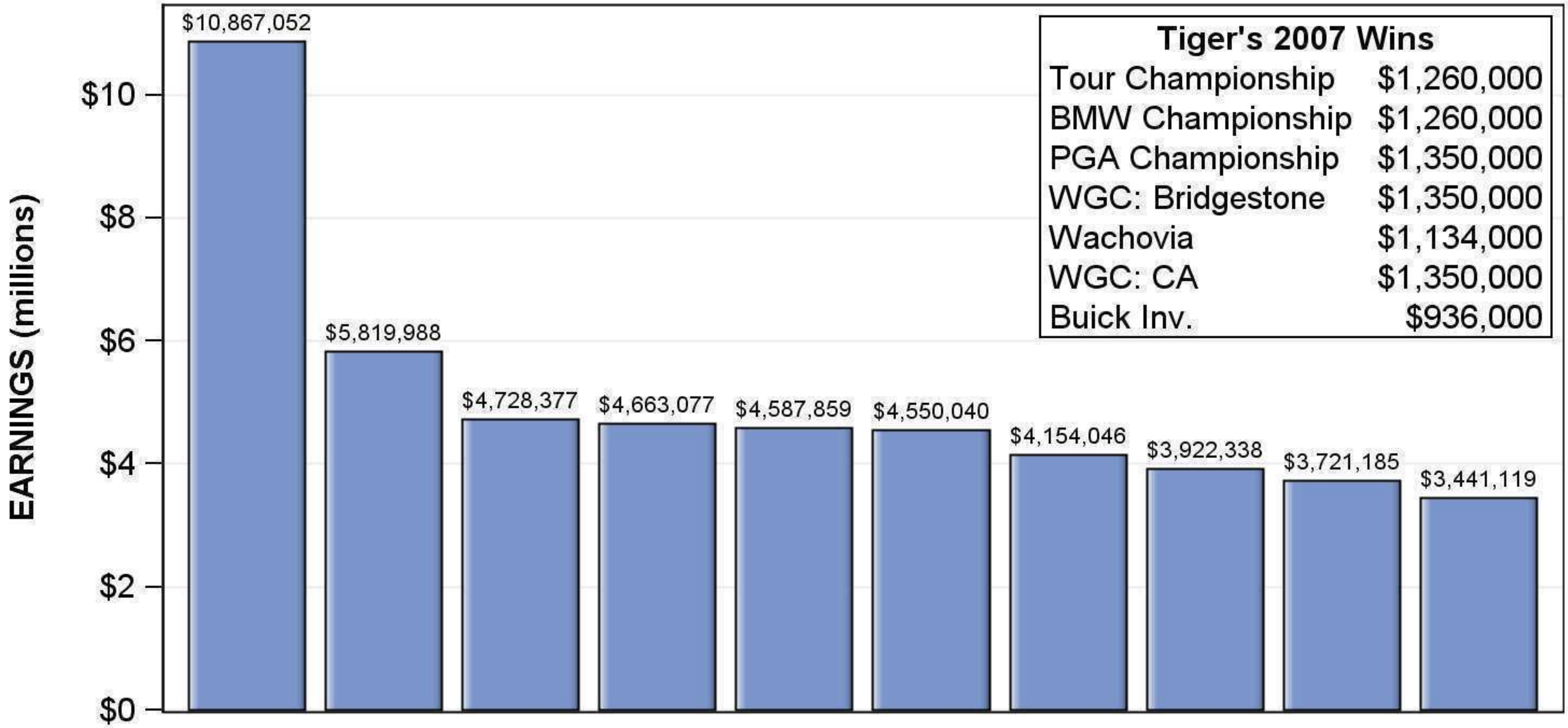
```
library(sas7bdat);
library(ggplot2);
scatterhist = function(x, y, xlab="", ylab=""){
zones=matrix(c(2,0,1,3), ncol=2, byrow=TRUE);
layout(zones, widths=c(4/5,1/5), heights=c(1/5,4/5));
xhist = hist(x, plot=FALSE);
yhist = hist(y, plot=FALSE);
top = max(c(xhist$counts, yhist$counts));
par(mar=c(5,5,0,1));
plot(x,y, xlab=', ylab=');
par(mar=c(1,5,1,1));
barplot(xhist$counts, axes=FALSE, ylim=c(0, top), space=0);
par(mar=c(5,0,0,1));
barplot(yhist$counts, axes=FALSE, xlim=c(0, top), space=0, horiz=TRUE);
par(oma=c(5,5,0,1));
mtext(xlab, side=1, line=2, outer=TRUE, adj=0,
at=.8 * (mean(x) - min(x))/(max(x)-min(x)));
mtext(ylab, side=2, line=2, outer=TRUE, adj=0,
at=(.65 * (mean(y) - min(y))/(max(y) - min(y))));
};
ds<-read.sas7bdat("&pth/ds.sas7bdat");
head(ds);
pdf(file = "&pdf007_r", width = 10, height = 7);
with(ds, scatterhist(MCS, PCS, xlab="MCS",ylab="PCS"));
dev.off();
```


Two Continuous Variables
NOBS = 590
300
250
200
150
100
WEIGHT
55
60
65
70
75
HEIGHT

```
example-> 220
```

```
proc template;
define statgraph bartable ;
mvar T1 T2 T3 T4 T5 T6 T7 T8 T9 P1 P2 P3 P4 P5 P6 P7 P8 P9;
begingraph / designwidth=600px designheight=400px;
entrytitle "Professional Golf Statistics for 2007";
layout lattice / rows=2 rowgutter=0 rowweights=(.75 .25);
layout overlay / xaxisopts=(display=(tickvalues))
yaxisopts=(griddisplay=on
linearopts=(tickvalueformat=(extractscale=true)) );
layout gridded / valign=top halign=right border=true
opaque=true backgroundcolor=GraphWalls:color;
entry "Tigers 2007 Wins" / textattrs=(weight=bold);
layout gridded /columns=2 opaque=true backgroundcolor=GraphWalls:color;
entry halign=left T1; entry halign=right P1;
entry halign=left T2; entry halign=right P2;
entry halign=left T3; entry halign=right P3;
entry halign=left T4; entry halign=right P4;
entry halign=left T5; entry halign=right P5;
entry halign=left T6;      entry halign=right P6;
entry halign=left T7; entry halign=right P7;endlayout;endlayout;
barchart x=LastName y=Earnings /
barlabel=true barlabelformat=dollar12. fillattrs=graphdata1
skin=satin outlineattrs=(color=black);endlayout;
layout overlay / xaxisopts=(type=discrete display=none) walldisplay=(fill);
blockplot x=LastName block=stat / class=statName display=(outline values label)
valuehalign=right repeatedvalues=true
labelattrs=(size=7pt);endlayout;endlayout;endgraph;end;run;
proc sgrender data=PGA2007 template=bartable;run;quit;
```

Professional Golf Statistics for 2007



	Woods	Mickelson	Singh	Stricker	Choi	Sabbatini	Furyk	Johnson	Garcia	Baddeley
AGE	33	38	45	41	38	32	38	32	29	27
EVENTS	16	22	27	23	25	23	24	23	19	23
Cuts Made	16	16	25	19	20	18	20	18	16	19
WINS	7	3	2	1	2	1	1	2	0	1
Top 10s	12	7	7	9	7	10	8	5	7	7

```
example-> 010
```

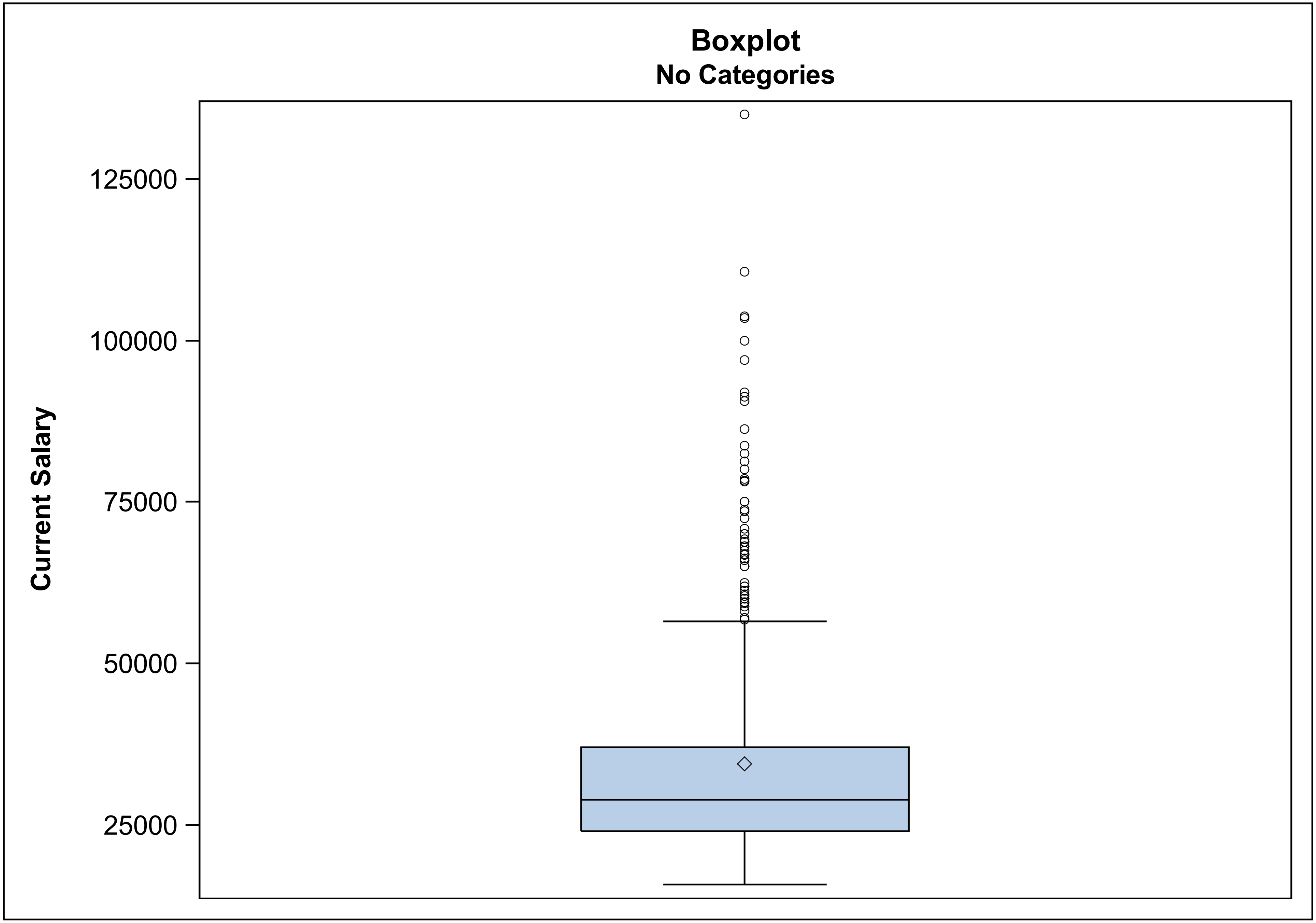
Proc Report

Dataset used to give examples of sg procedures Proc Report				
m-Male f=Female	Birth Date	Educ Years	Salary	Minority
m	03FEB1952	15	$57,000	0
m	23MAY1958	16	$40,200	0
f	26JUL1929	12	$21,450	0
f	15APR1947	8	$21,900	0
m	09FEB1955	15	$45,000	0
m	22AUG1958	15	$32,100	0
m	26APR1956	15	$36,000	0
f	06MAY1966	12	$21,900	0
f	23JAN1946	15	$27,900	0
f	13FEB1946	12	$24,000	0
f	07FEB1950	16	$30,300	0
m	11JAN1966	8	$28,350	1
m	17JUL1960	15	$27,750	1
f	26FEB1949	15	$35,100	1
m	29AUG1962	12	$27,300	0
m	17NOV1964	12	$40,800	0
m	18JUL1962	15	$46,000	0
m	20MAR1956	16	$103,750	0
m	19AUG1962	12	$42,300	0
f	23JAN1940	12	$26,250	0

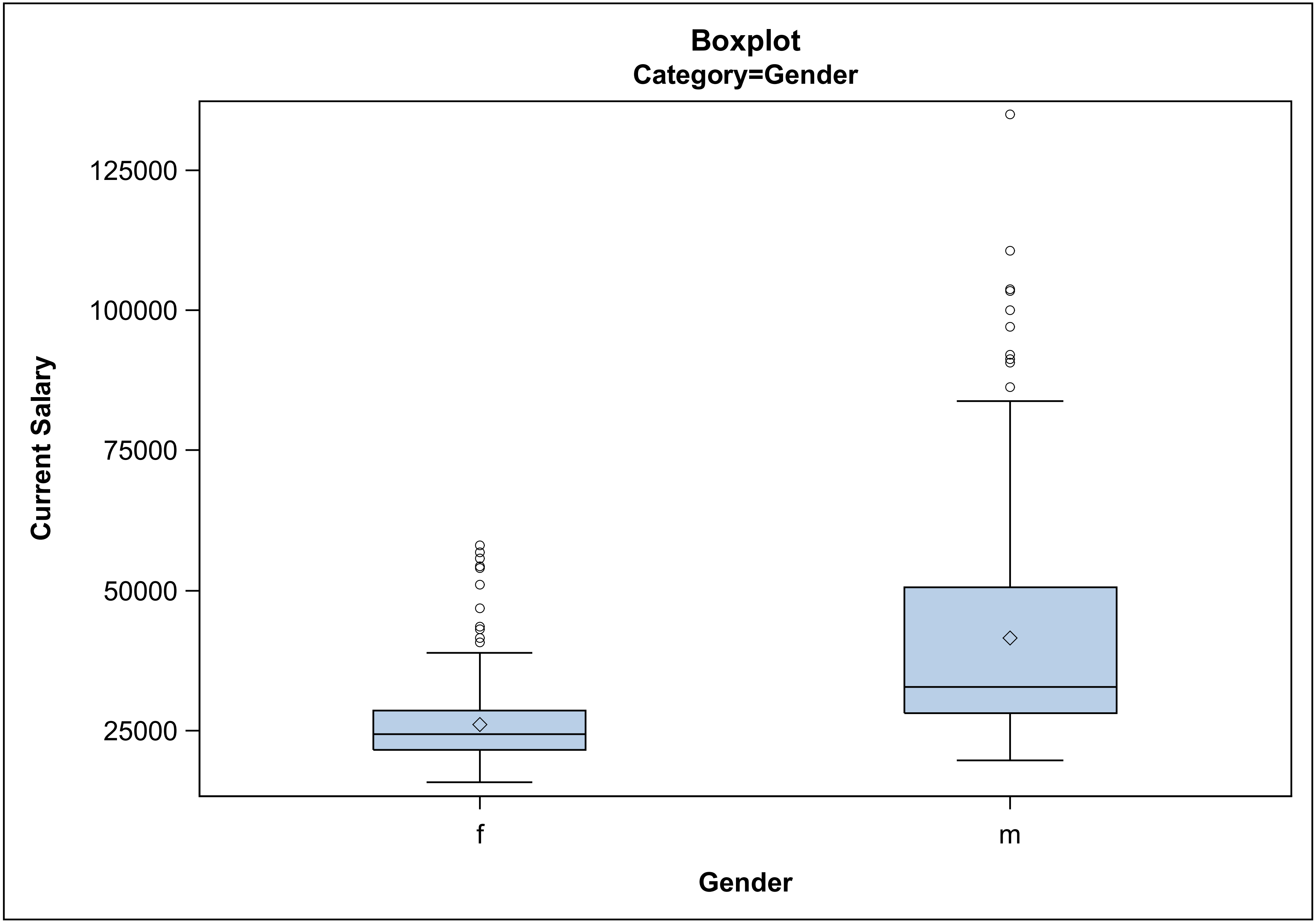
example-> 020

Box Plots

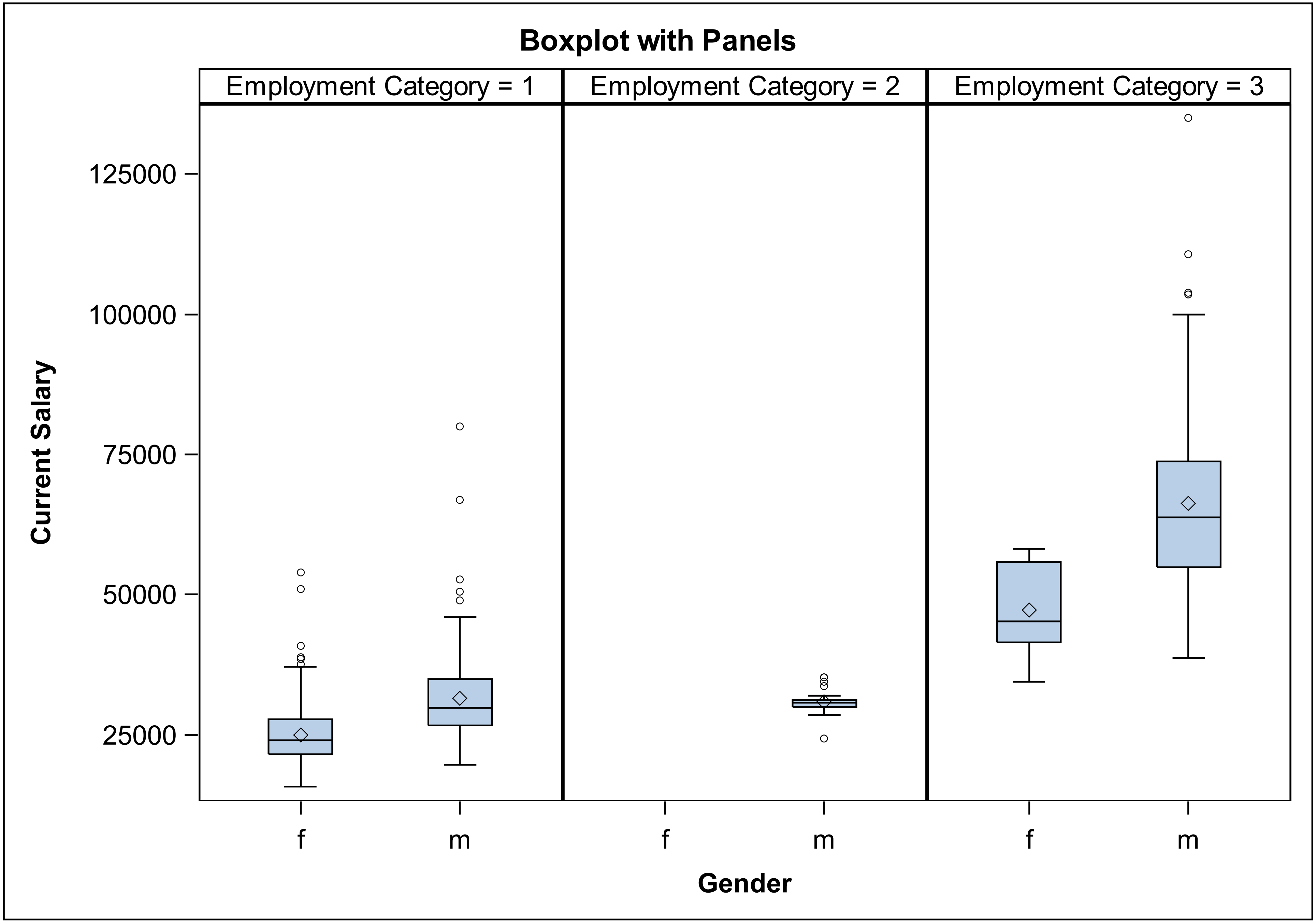
```
title "Boxplot";
title2 "No Categories";
proc sgplot data=employee;
vbox salary;
run;quit;
```


Boxplot
No Categories
Current Salary
125000
100000
75000
50000
25000

```
title "Boxplot";
title2 "Category=Gender";
proc sgplot data=employee;
vbox salary/ category=gender;
run;quit;
```


Boxplot
Category=Gender
Current Salary
125000
100000
75000
50000
25000
f
m
Gender

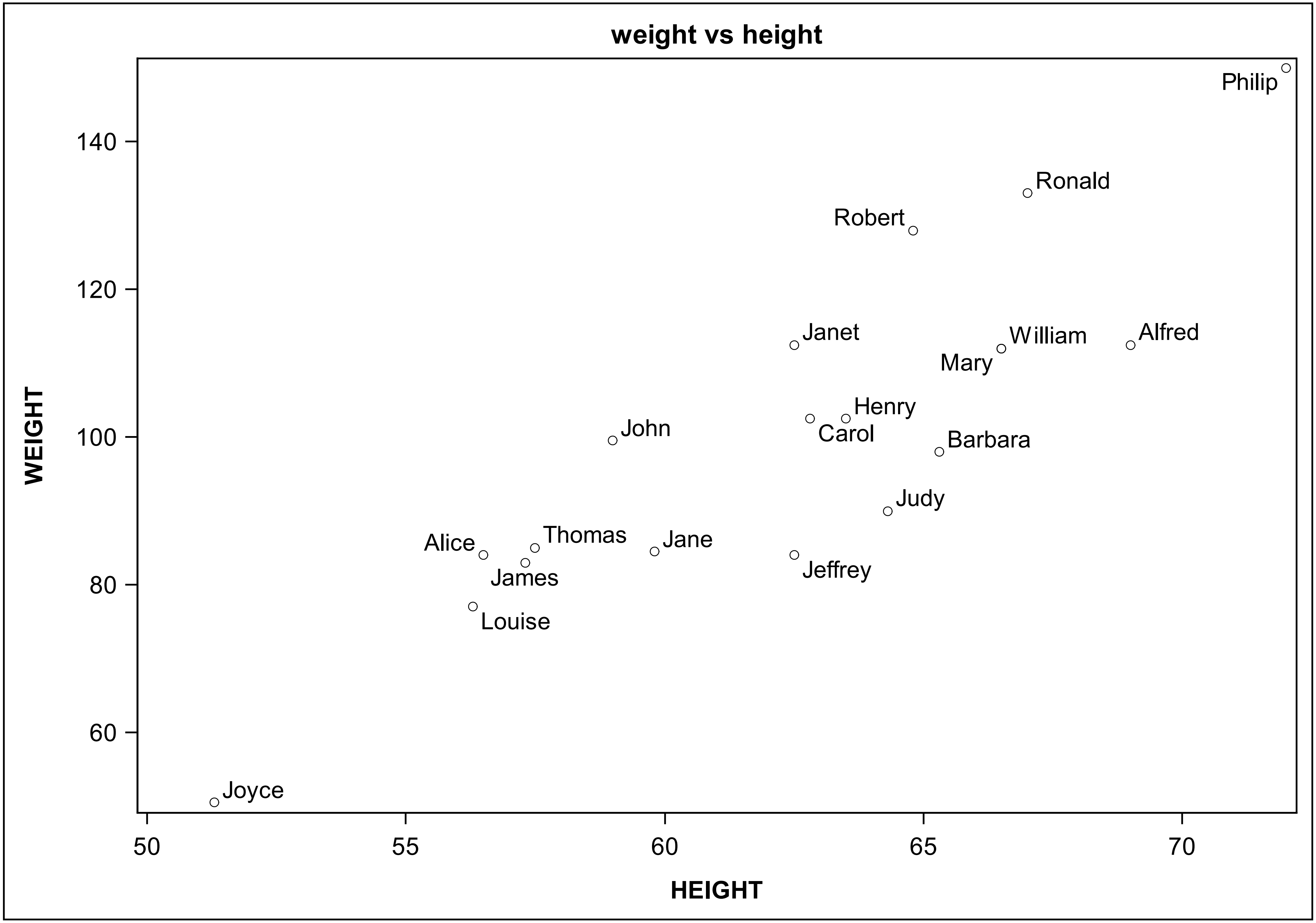
```
title "Boxplot with Panels";
proc sgpanel data=employee;
panelby jobcat / rows=1 columns=3 ;
vbox salary / category= gender;
run;quit;
```



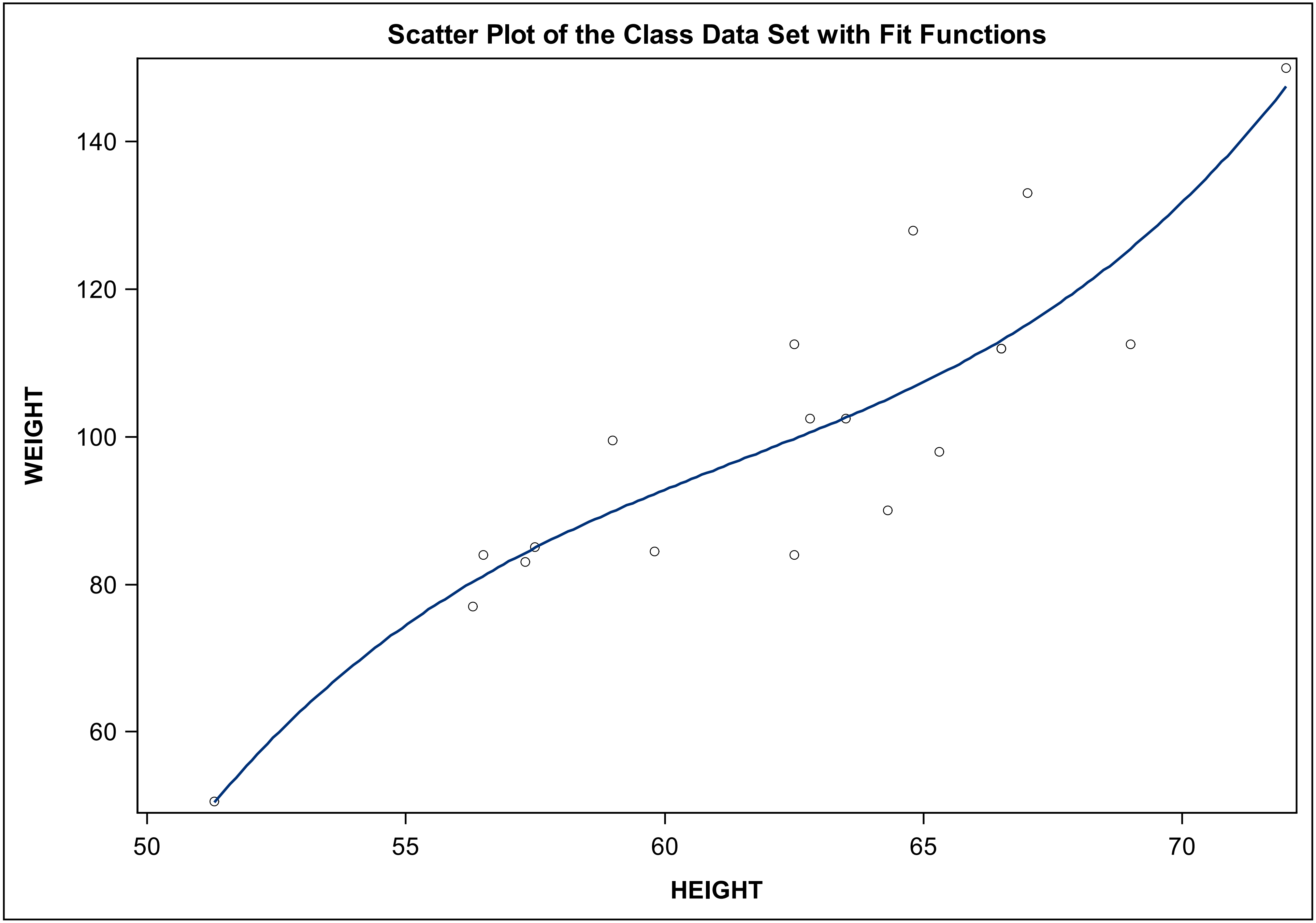
Boxplot with Panels
Employment Category = 1
Employment Category = 2
Employment Category = 3
Current Salary
125000
100000
75000
50000
25000
f
m
f
m
f
m
Gender

example-> 030

```
proc template;
define statgraph scatter; begingraph;
entrytitle "weight vs height";
layout overlay;
scatterplot y = weight x = height / datalabel = name
datalabelattrs=(size=12); endlayout; endgraph;
end;
run;
proc sgrender data = sashelp.class template = scatter;
run;quit;
```

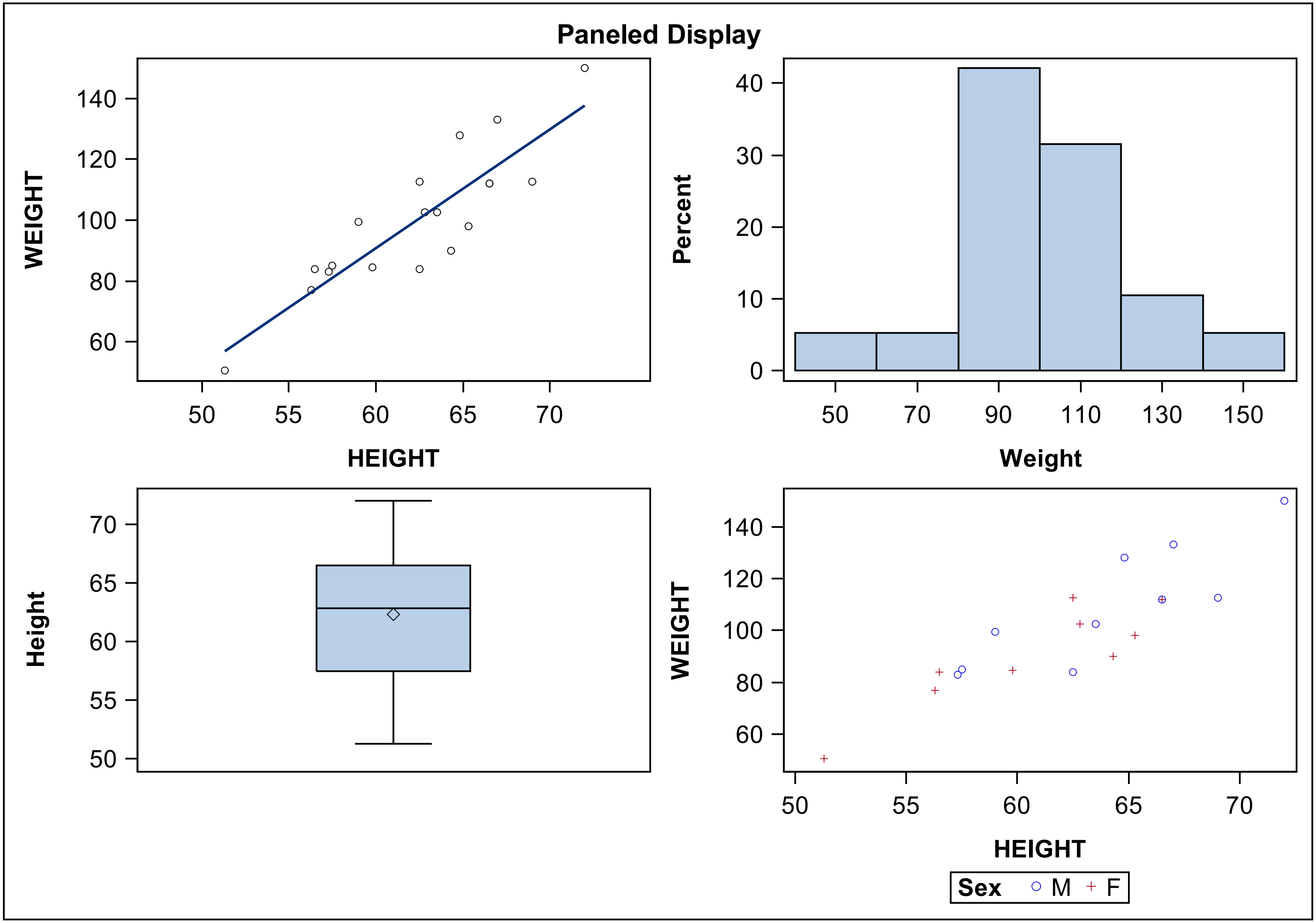

weight vs height
WEIGHT
HEIGHT
140
120
100
80
60
50
55
60
65
70
Philip
Ronald
Robert
Janet
William
Alfred
Mary
Henry
John
Carol
Barbara
Judy
Thomas
Alice
Jane
James
Jeffrey
Louise
Joyce

```
PROC TEMPLATE;
DEFINE STATGRAPH Scatter; BEGINGRAPH;
ENTRYTITLE "Scatter Plot with Fit Functions";
LAYOUT OVERLAY; SCATTERPLOT Y = Weight X = Height;
REGRESSIONPLOT Y = Weight X = Height / DEGREE = 3;
ENDLAYOUT; ENDGRAPH; END; RUN;
PROC SGRENDER DATA = Sashelp.Class TEMPLATE = Scatter; RUN;quit;
```



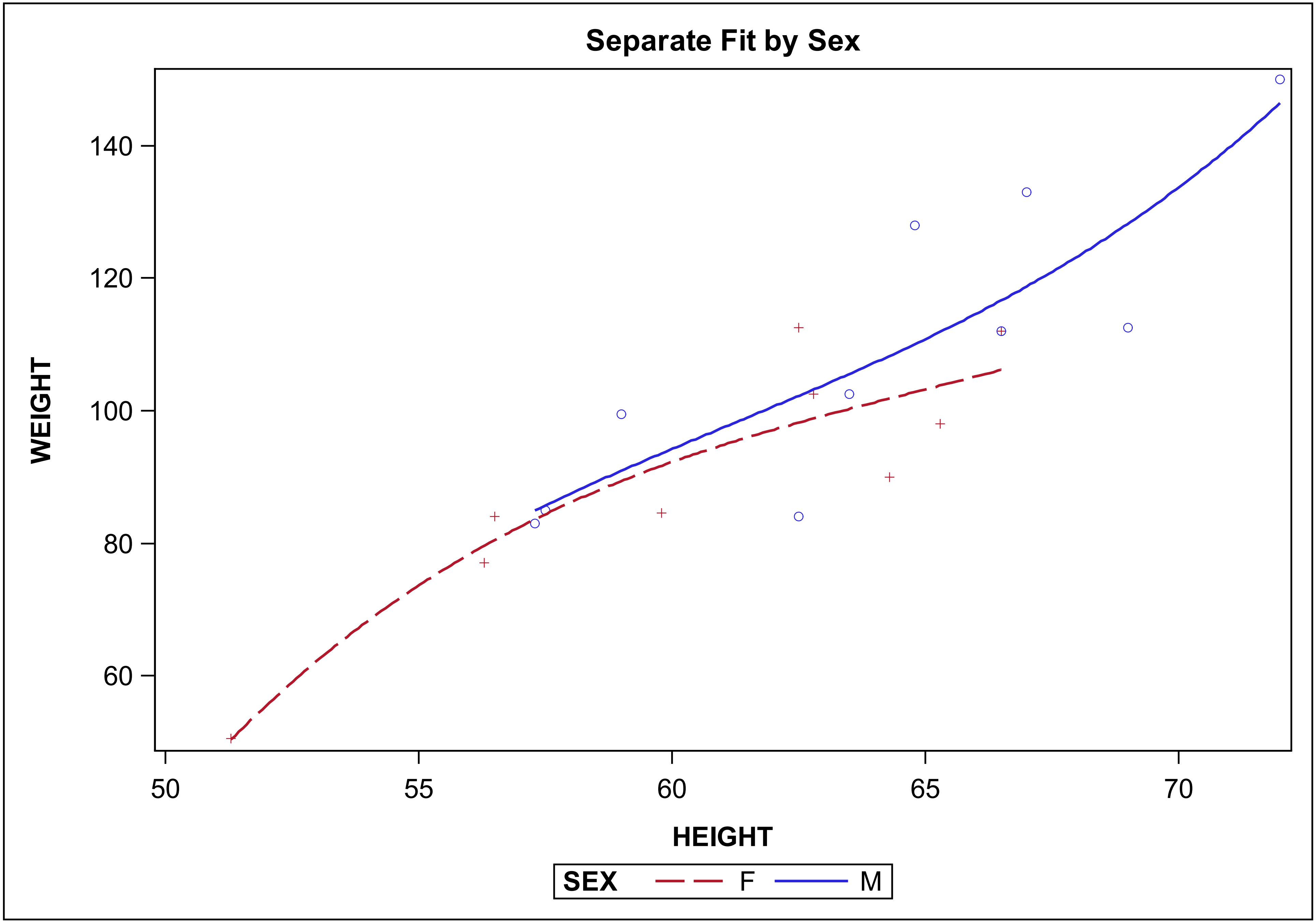
Scatter Plot of the Class Data Set with Fit Functions
140
120
100
80
60
WEIGHT
50
55
60
65
70
HEIGHT

```
PROC TEMPLATE; DEFINE STATGRAPH Panel; BEGINGRAPH;
ENTRYTITLE "Paneled Display ";
LAYOUT LATTICE / ROWS = 2 COLUMNS = 2 ROWGUTTER = 10
COLUMNGUTTER = 10;
LAYOUT OVERLAY; SCATTERPLOT Y = Weight X = Height;
REGRESSIONPLOT Y = Weight X = Height; ENDLAYOUT;
LAYOUT OVERLAY / XAXISOPTS = (LABEL = "Weight");
HISTOGRAM Weight; ENDLAYOUT;
LAYOUT OVERLAY / YAXISOPTS = (LABEL = "Height");
BOXPLOT Y = Height; ENDLAYOUT;
LAYOUT OVERLAY; SCATTERPLOT Y = weight X = height /
GROUP = sex NAME = "Scat"; DISCRETELEGEND "Scat"
/ TITLE = "Sex"; ENDLAYOUT;
ENDLAYOUT; ENDGRAPH; END; RUN;
PROC SGRENDER DATA = Sashelp.Class TEMPLATE = Panel; RUN;
```

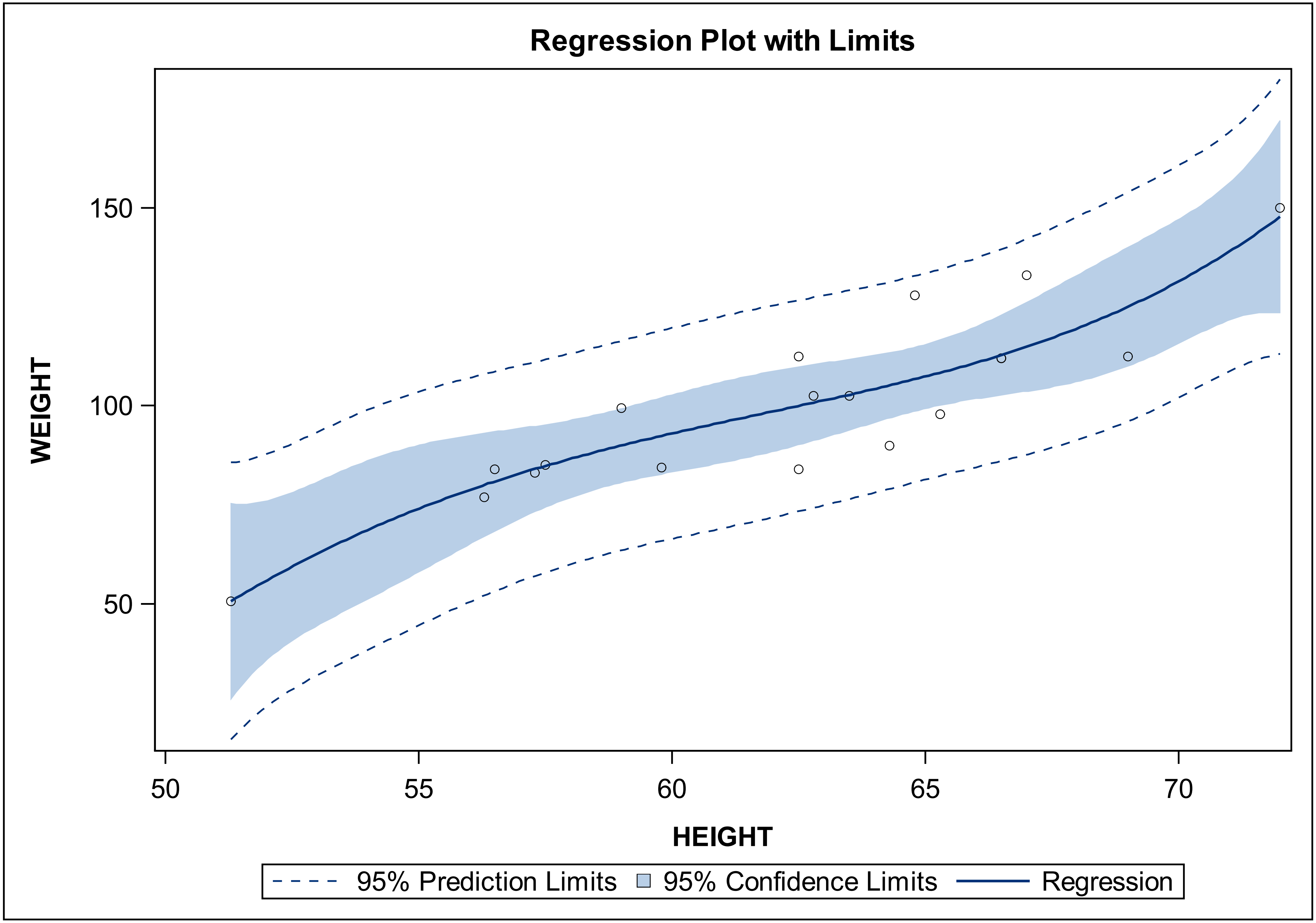


Paneled Display
WEIGHT
140
120
100
80
60
50
55
60
65
70
HEIGHT
Percent
40
30
20
10
0
50
70
90
110
130
150
Weight
Height
70
65
60
55
50
WEIGHT
140
120
100
80
60
50
55
60
65
70
HEIGHT
Sex
M
F

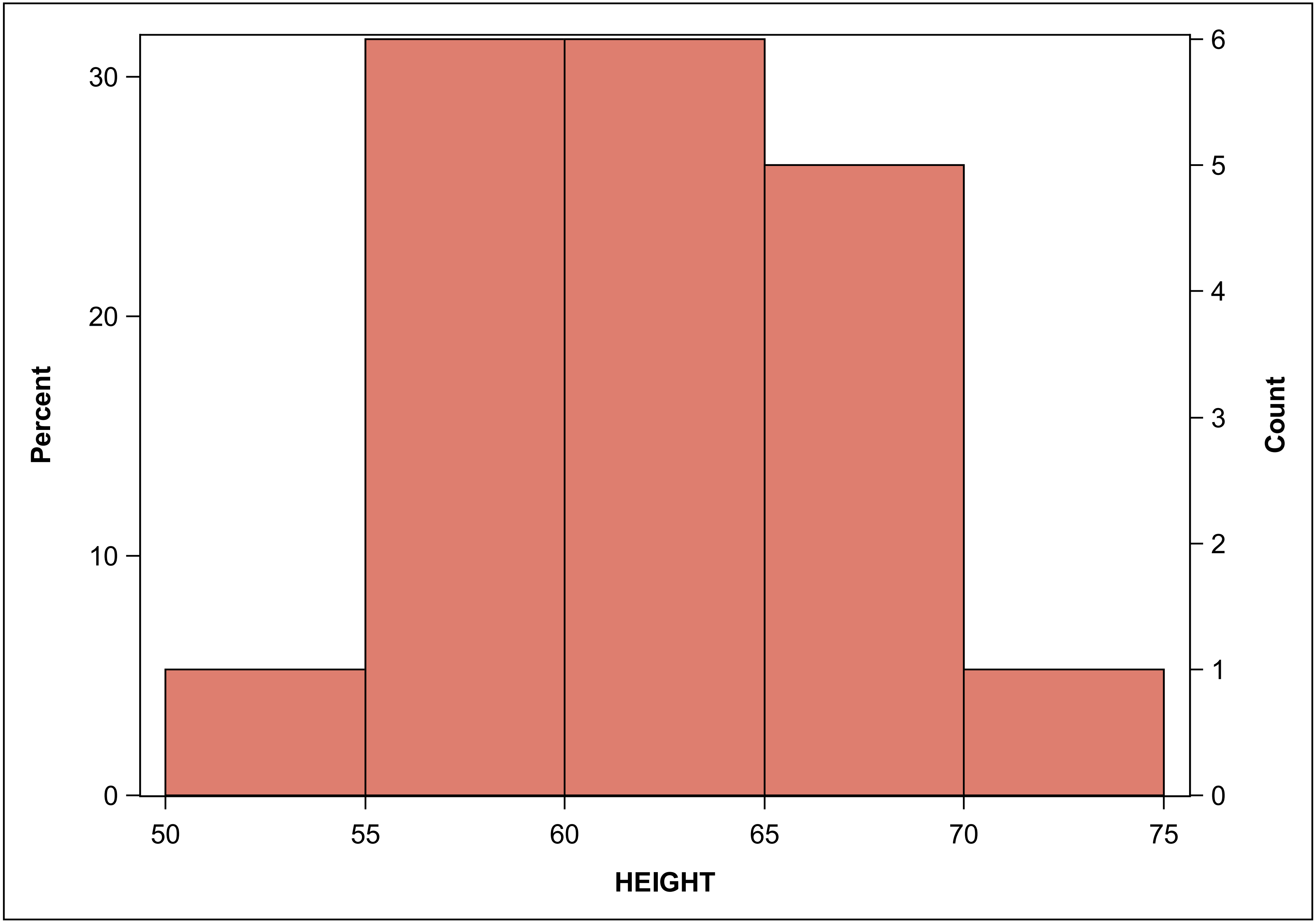
```
PROC SGPLOT DATA = Sashelp.Class ;
TITLE "Separate Fit by Sex" ;
REG Y = Weight X = Height / GROUP= Sex DEGREE= 3;
RUN;
```


Separate Fit by Sex
WEIGHT
140
120
100
80
60
50
55
60
65
70
HEIGHT
SEX
F
M

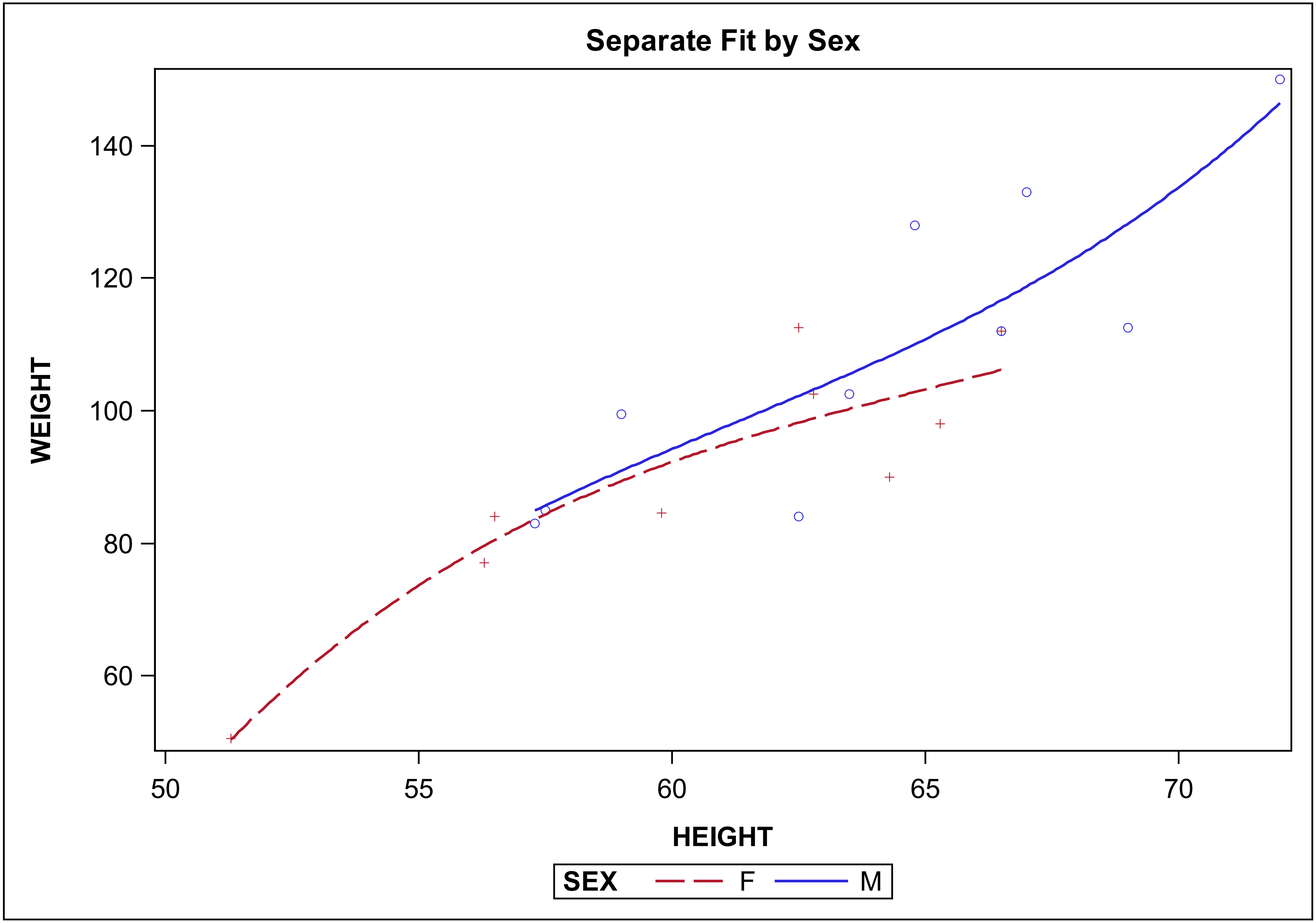
```
PROC SGPLOT DATA = Sashelp.Class ;
TITLE "Regression Plot with Limits" ;
REG Y = Weight X = Height / DEGREE= 4 CLI CLM ;
RUN;
```


Regression Plot with Limits
150
100
50
WEIGHT
50
55
60
65
70
HEIGHT
95% Prediction Limits
95% Confidence Limits
Regression

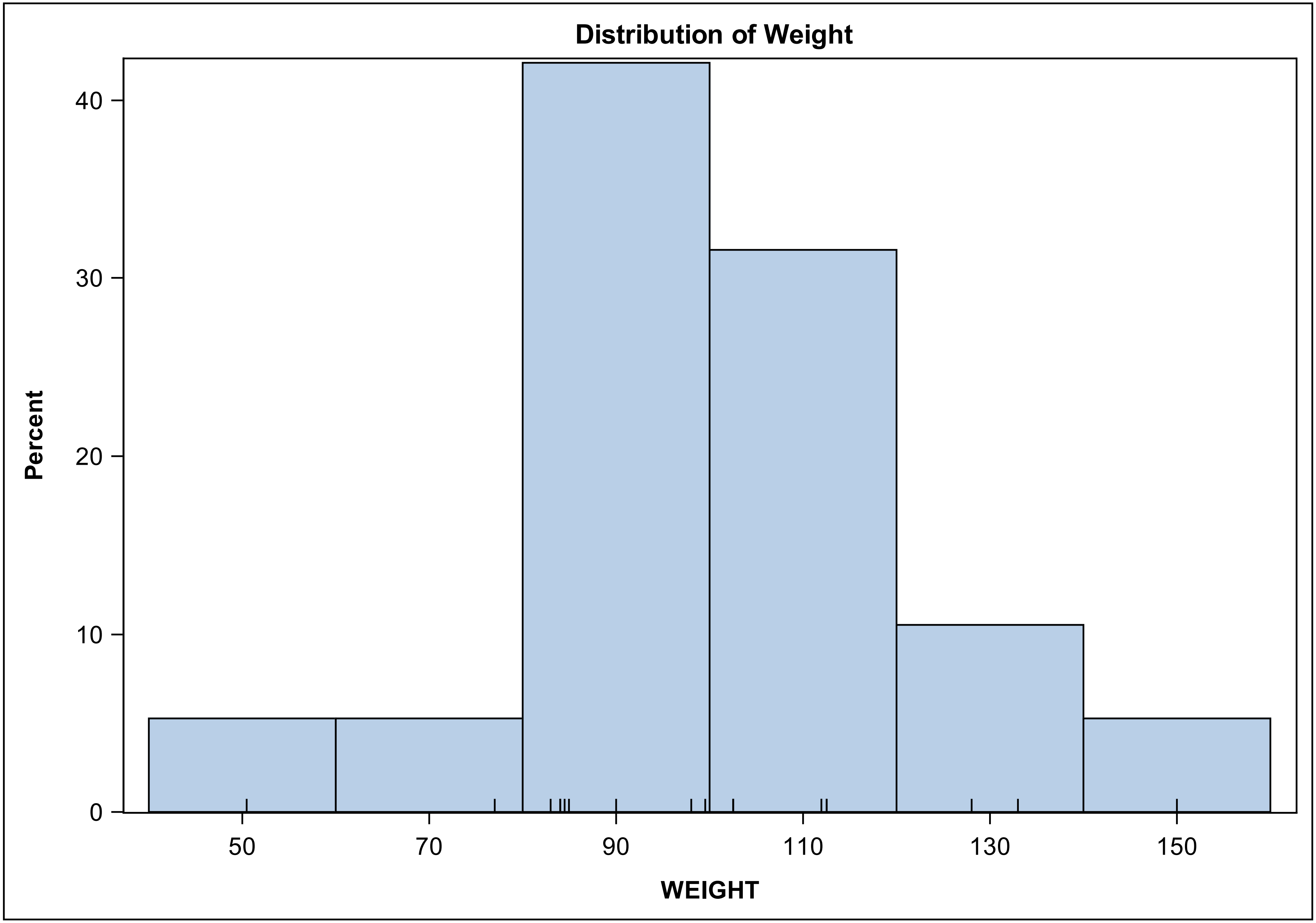
```
PROC SGPLOT DATA = Sashelp.Class NOAUTOLEGEND;
HISTOGRAM Height;
HISTOGRAM Height / SCALE= COUNT Y2AXIS;
RUN;
```


Percent
30
20
10
0
Count
6
5
4
3
2
1
0
50
55
60
65
70
75
HEIGHT

```
PROC SGPLOT DATA = Sashelp.Class ;
TITLE "Separate Fit by Sex"  ;
REG Y = Weight X = Height / GROUP= Sex DEGREE= 3;
RUN;
```

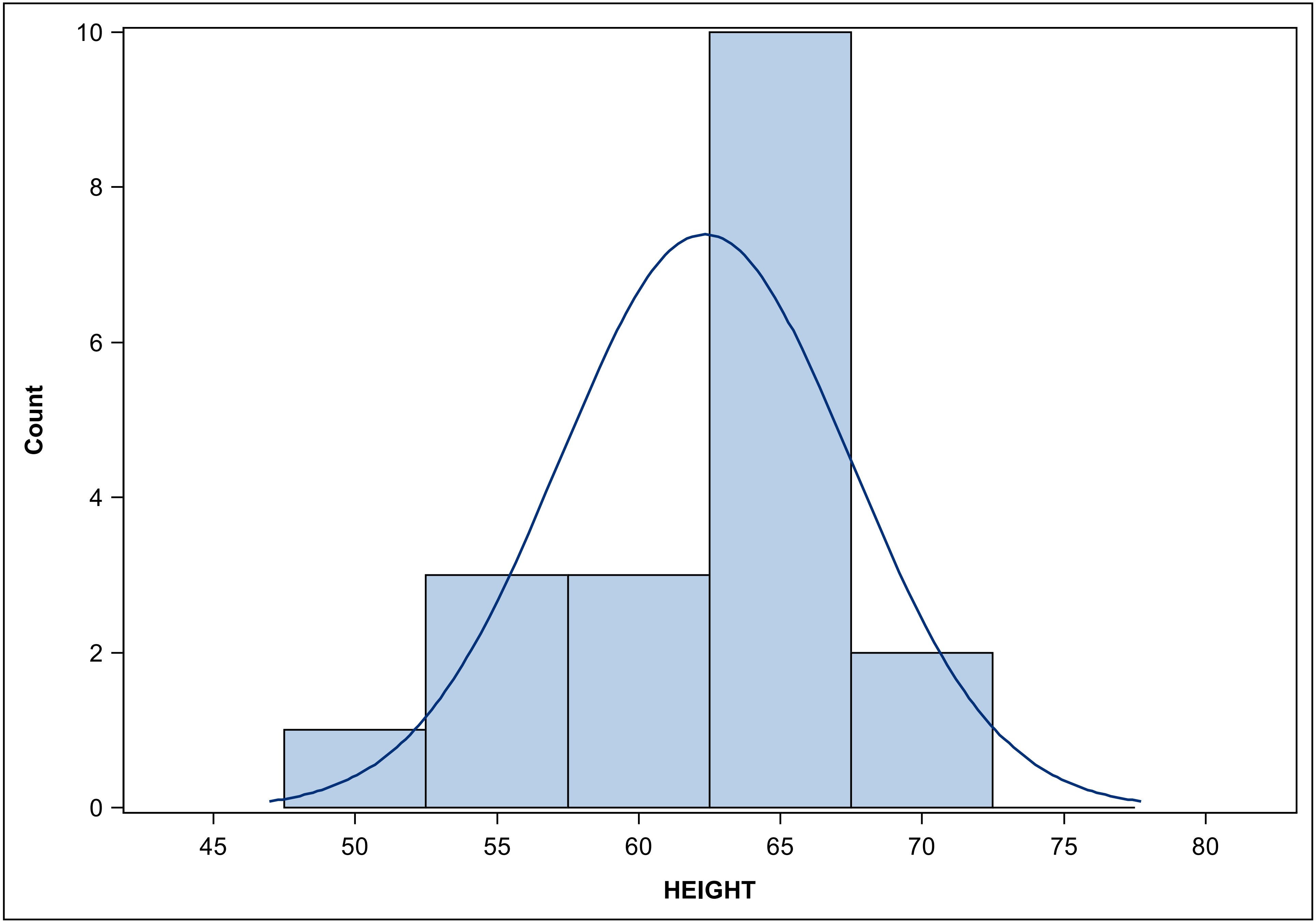

Separate Fit by Sex
WEIGHT
140
120
100
80
60
50
55
60
65
70
HEIGHT
SEX
F
M

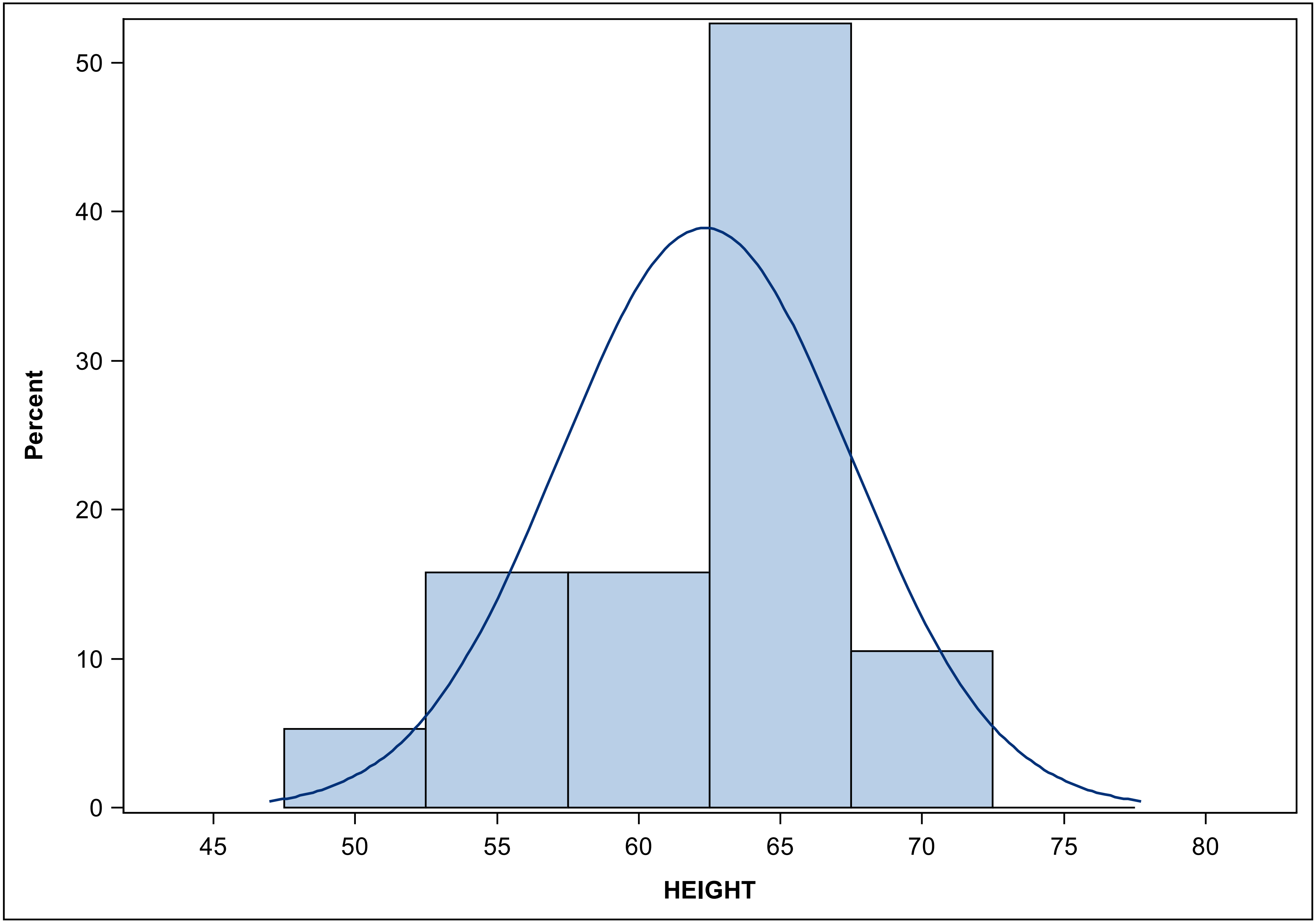
```
PROC TEMPLATE ;
DEFINE STATGRAPH hist_fringe;
BEGINGRAPH ;
ENTRYTITLE " Distribution of Weight ";
LAYOUT OVERLAY ;
HISTOGRAM Weight;
FRINGEPLOT WEIGHT;
ENDLAYOUT ;
```



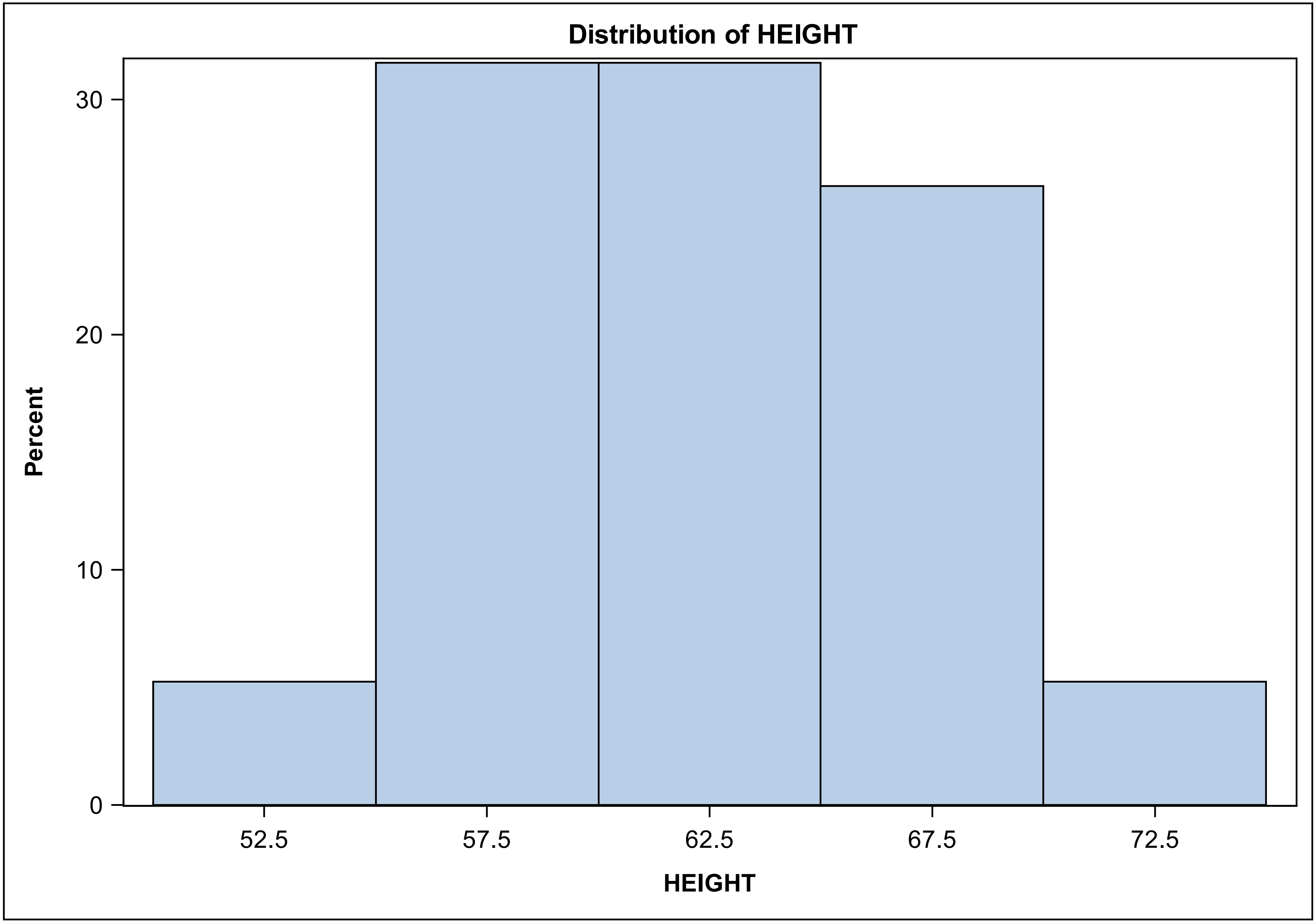
Distribution of Weight
Percent
WEIGHT
0
10
20
30
40
50
70
90
110
130
150

```
PROC TEMPLATE;
DEFINE STATGRAPH dynamic;
BEGINGRAPH;
MVAR scale;
NMVAR bins;
DYNAMIC var ;
LAYOUT OVERLAY ;
HISTOGRAM var / SCALE = scale NBINS = bins;
DENSITYPLOT var;
ENDLAYOUT;
ENDGRAPH;
END;
RUN;
%LET bins = 6;
%LET scale = count;
PROC SGRENDER DATA = sashelp.class TEMPLATE= dynamic;
DYNAMIC var = "Height";
RUN ;
%LET bins = 6;
%LET scale = percent;
PROC SGRENDER DATA = sashelp.class TEMPLATE= dynamic;
DYNAMIC var = "Height";
RUN ;
```

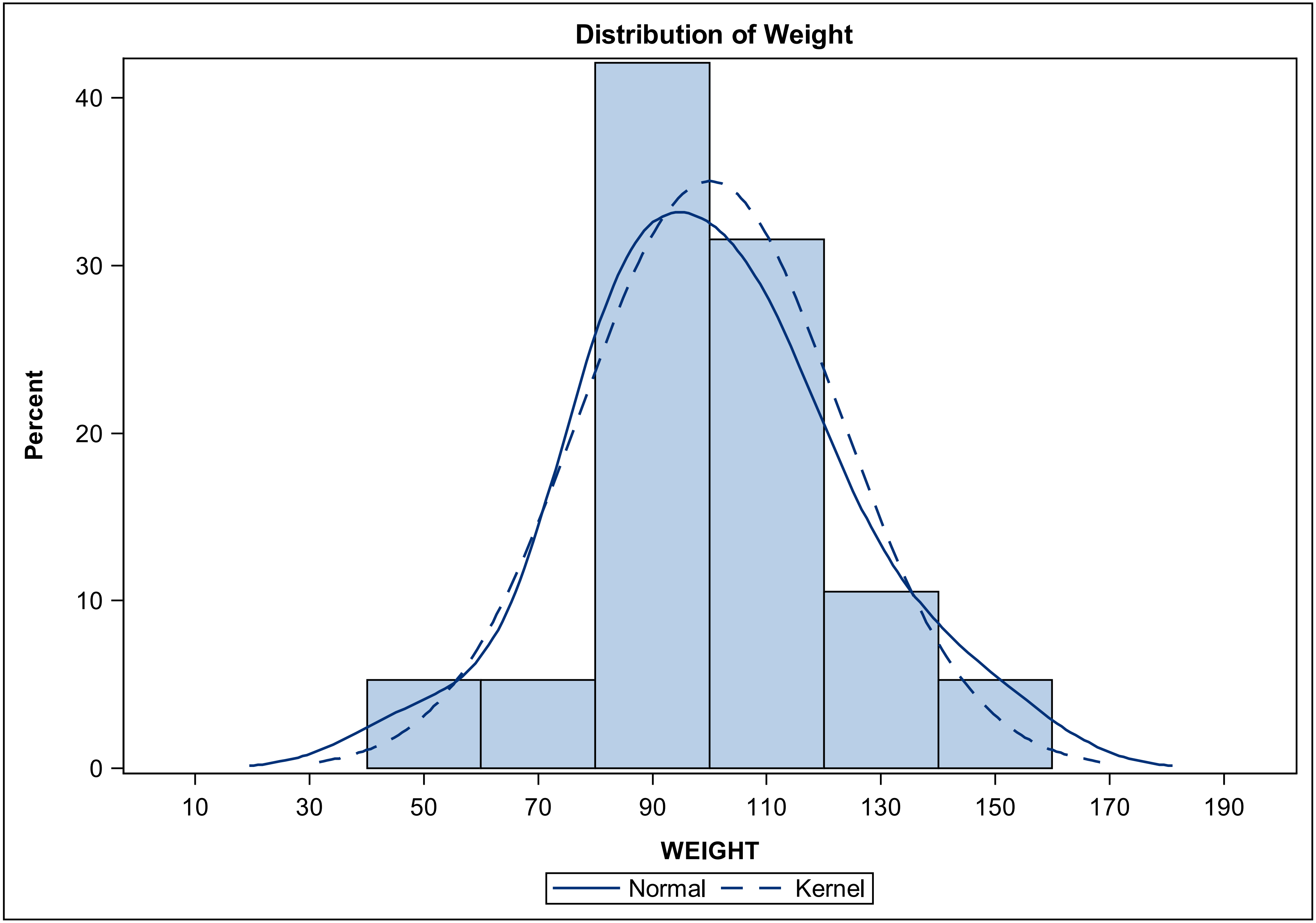

Count
0
2
4
6
8
10
45
50
55
60
65
70
75
80
HEIGHT


50
40
30
20
10
0
Percent
45
50
55
60
65
70
75
80
HEIGHT

```
PROC TEMPLATE ;
DEFINE STATGRAPH conditional;
DYNAMIC var curve;
BEGINGRAPH;
ENTRYTITLE " Distribution of " var;
LAYOUT OVERLAY ;
HISTOGRAM VAR ;
IF( UPCASE(curve) = "NONE" )
HISTOGRAM var;
ENDIF;
IF( UPCASE(curve) = "ALL" )
DENSITYPLOT VAR / KERNEL() NAME= "n" LEGENDLABEL= "Normal" ;
ENDIF;
IF (upcase(curve) = "ALL" )
DENSITYPLOT VAR / NORMAL() NAME = "p" LEGENDLABEL= "Kernel"
LINEATTRS = ( PATTERN = DASH );
ENDIF;
DISCRETELEGEND "n" "k" "p";
ENDLAYOUT;
ENDGRAPH;
END;
RUN;
PROC SGRENDER DATA = Sashelp.Class TEMPLATE = conditional;
DYNAMIC var = "HEIGHT" curve ="None";
run;
PROC SGRENDER DATA = Sashelp.Class TEMPLATE= conditional;
DYNAMIC var = "Weight" curve ="All";
run;
```



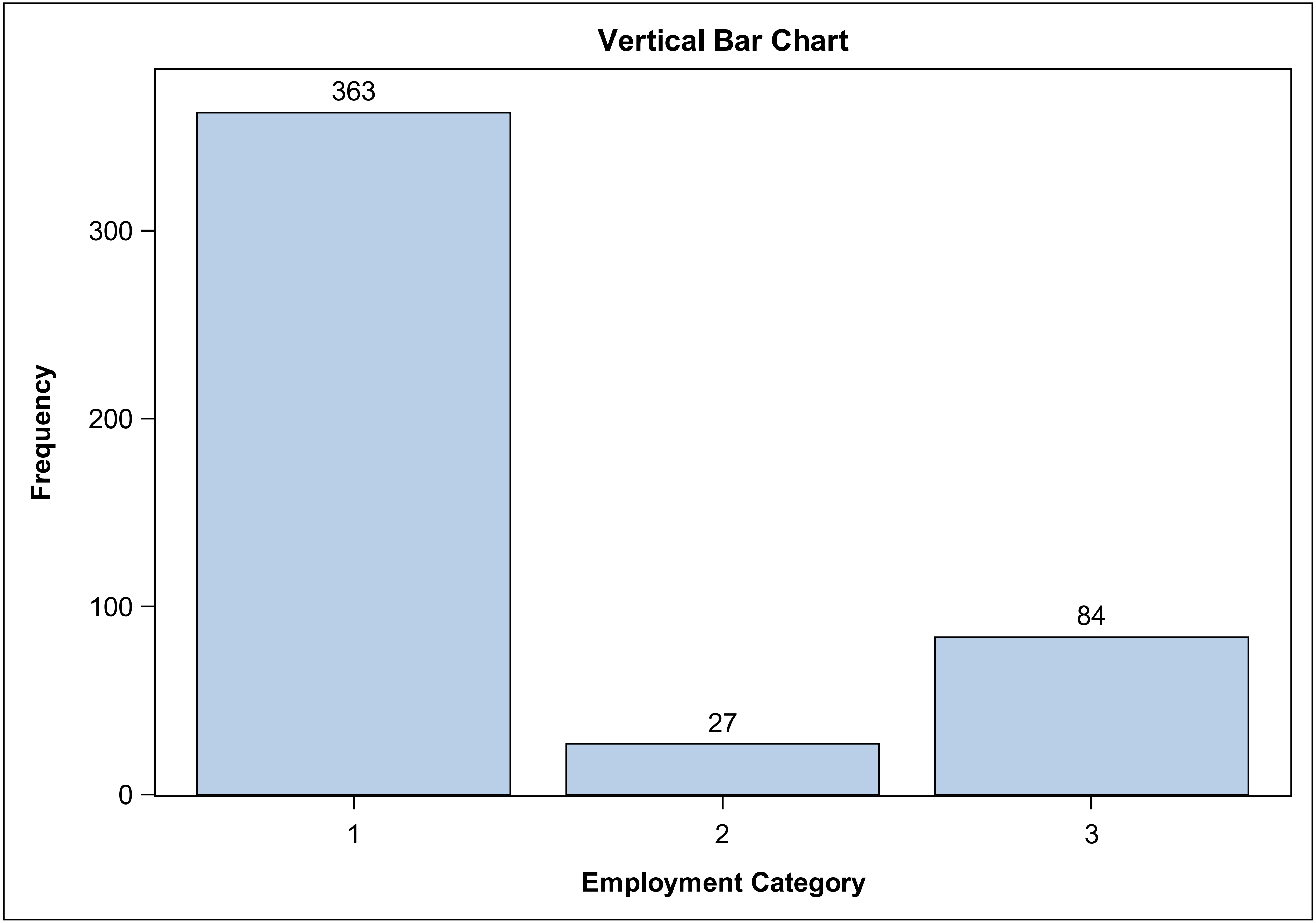
Distribution of HEIGHT
Percent
30
20
10
0
52.5
57.5
62.5
67.5
72.5
HEIGHT


Distribution of Weight
Percent
40
30
20
10
0
10
30
50
70
90
110
130
150
170
190
WEIGHT
Normal
Kernel

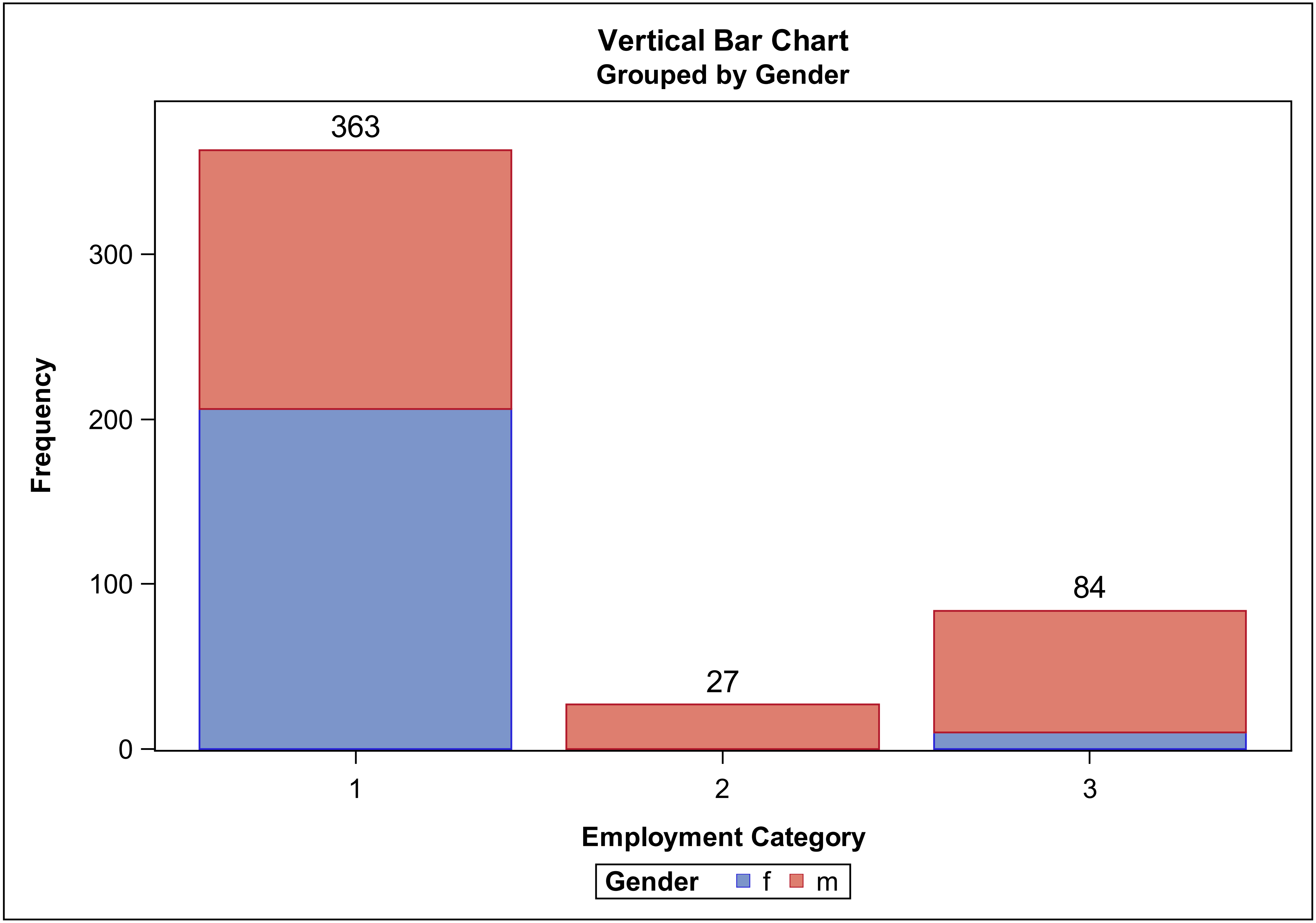
example-> 040

Bar Charts

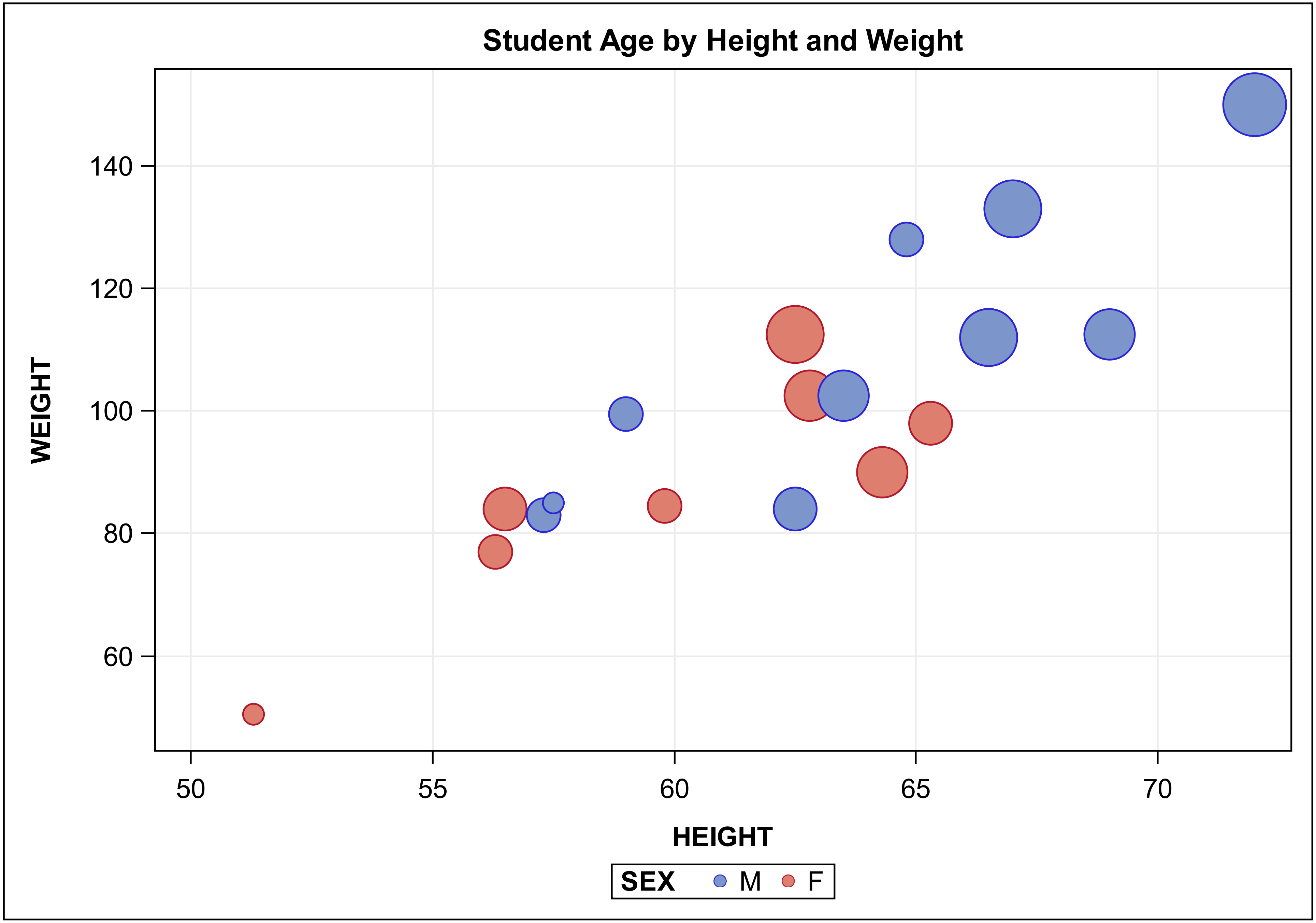
```
title "Vertical Bar Chart";
proc sgplot data=employee;
vbar jobcat / datalabel;
run;
```


Vertical Bar Chart
363
27
84
300
200
100
0
Frequency
1
2
3
Employment Category

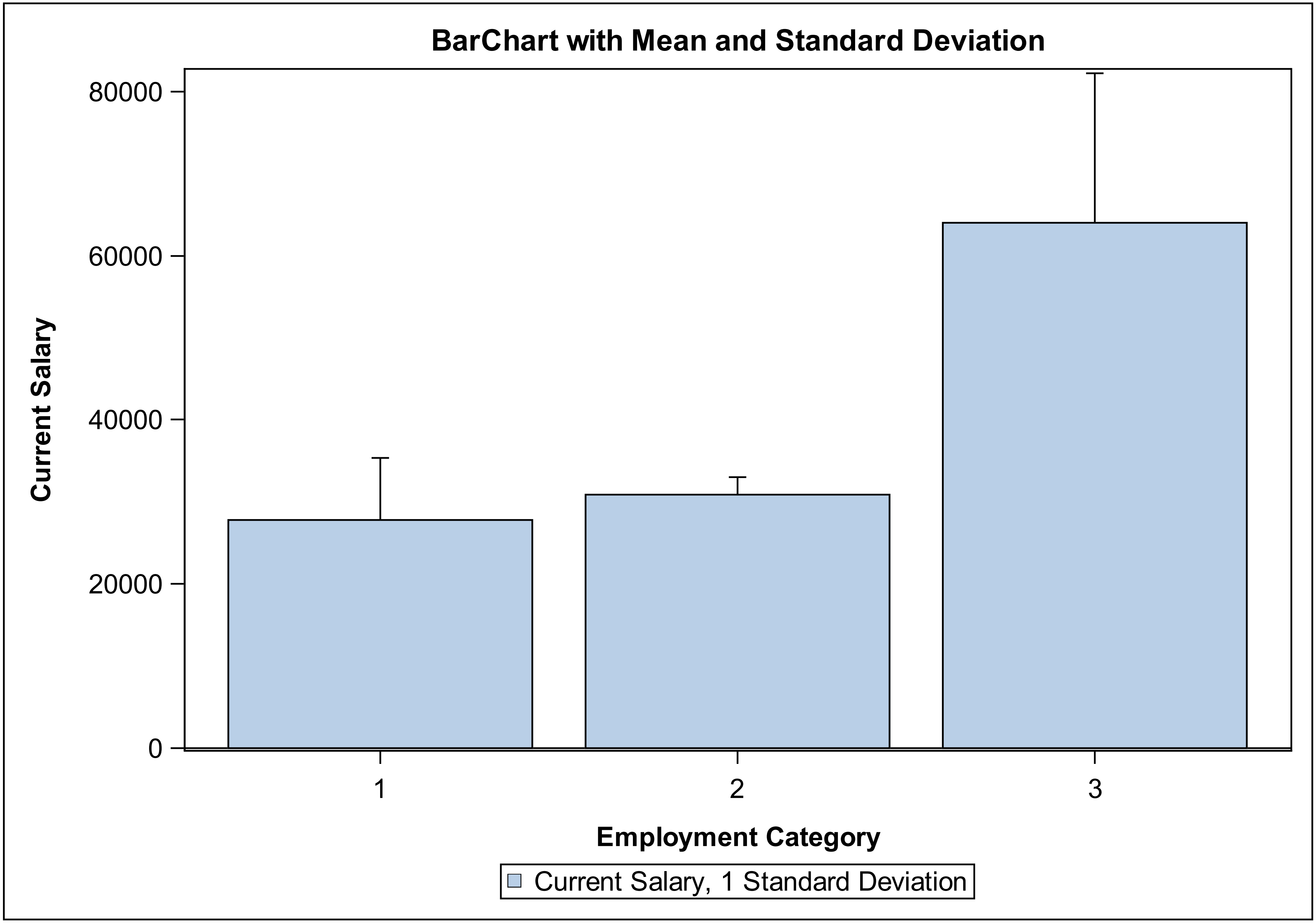
```
title "Vertical Bar Chart";
title2 "Grouped by Gender";
proc sgplot data=employee;
vbar jobcat /group=Gender datalabel;
run;
```


Vertical Bar Chart
Grouped by Gender
363
27
84
Frequency
300
200
100
0
1
2
3
Employment Category
Gender
f
m

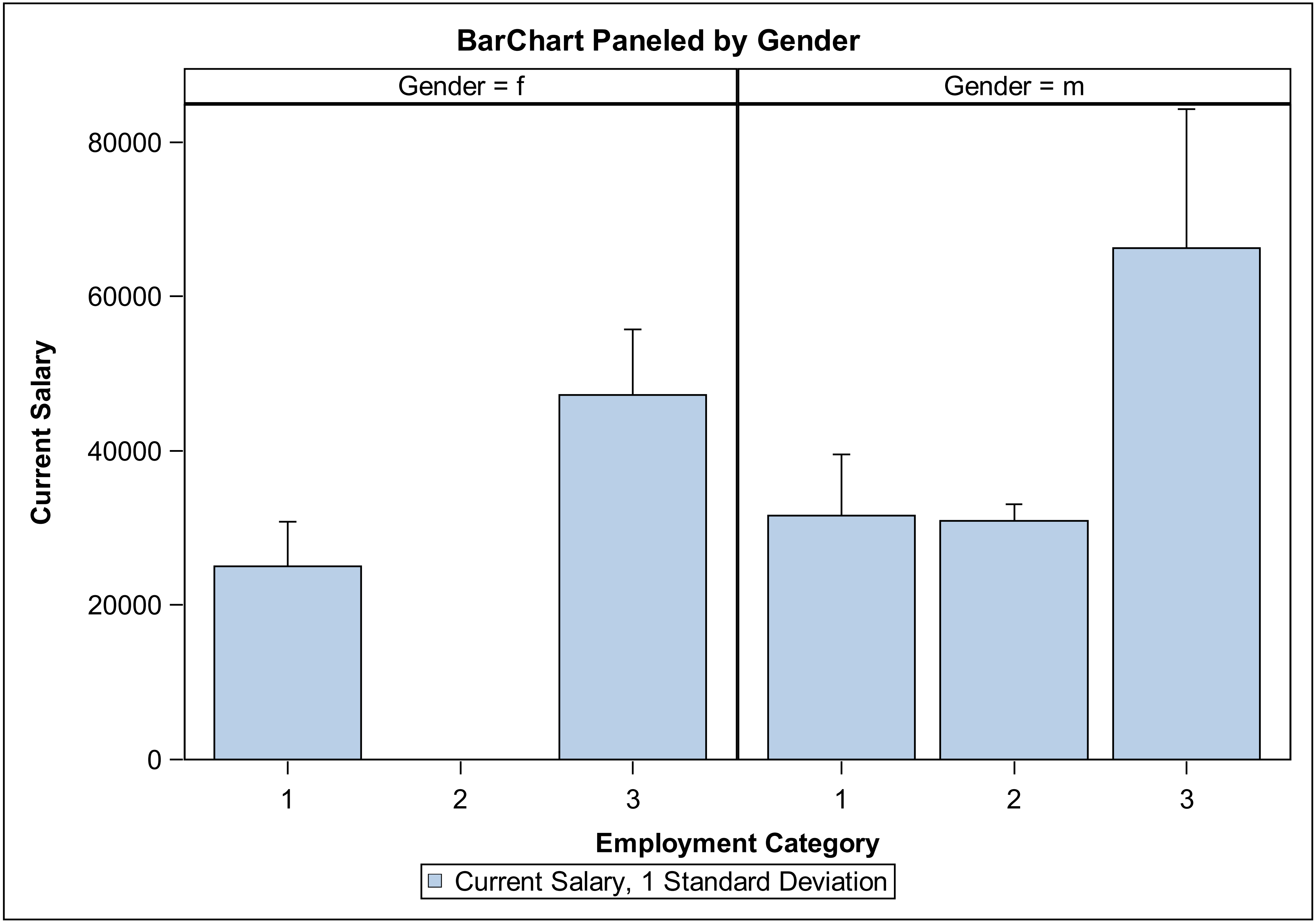
```
title "Student Age by Height and Weight";
proc sgplot data=sashelp.class;
bubble x=height y=weight size=age / group=sex;
xaxis grid; yaxis grid;
run;
```


Student Age by Height and Weight
WEIGHT
140
120
100
80
60
50
55
60
65
70
HEIGHT
SEX
M
F

```
title "BarChart with Mean and Standard Deviation";
proc sgplot data=employee;
vbar jobcat / response=salary limitstat = stddev
limits = upper stat=mean;
run;
```


BarChart with Mean and Standard Deviation
80000
60000
40000
20000
0
Current Salary
1
2
3
Employment Category
Current Salary, 1 Standard Deviation

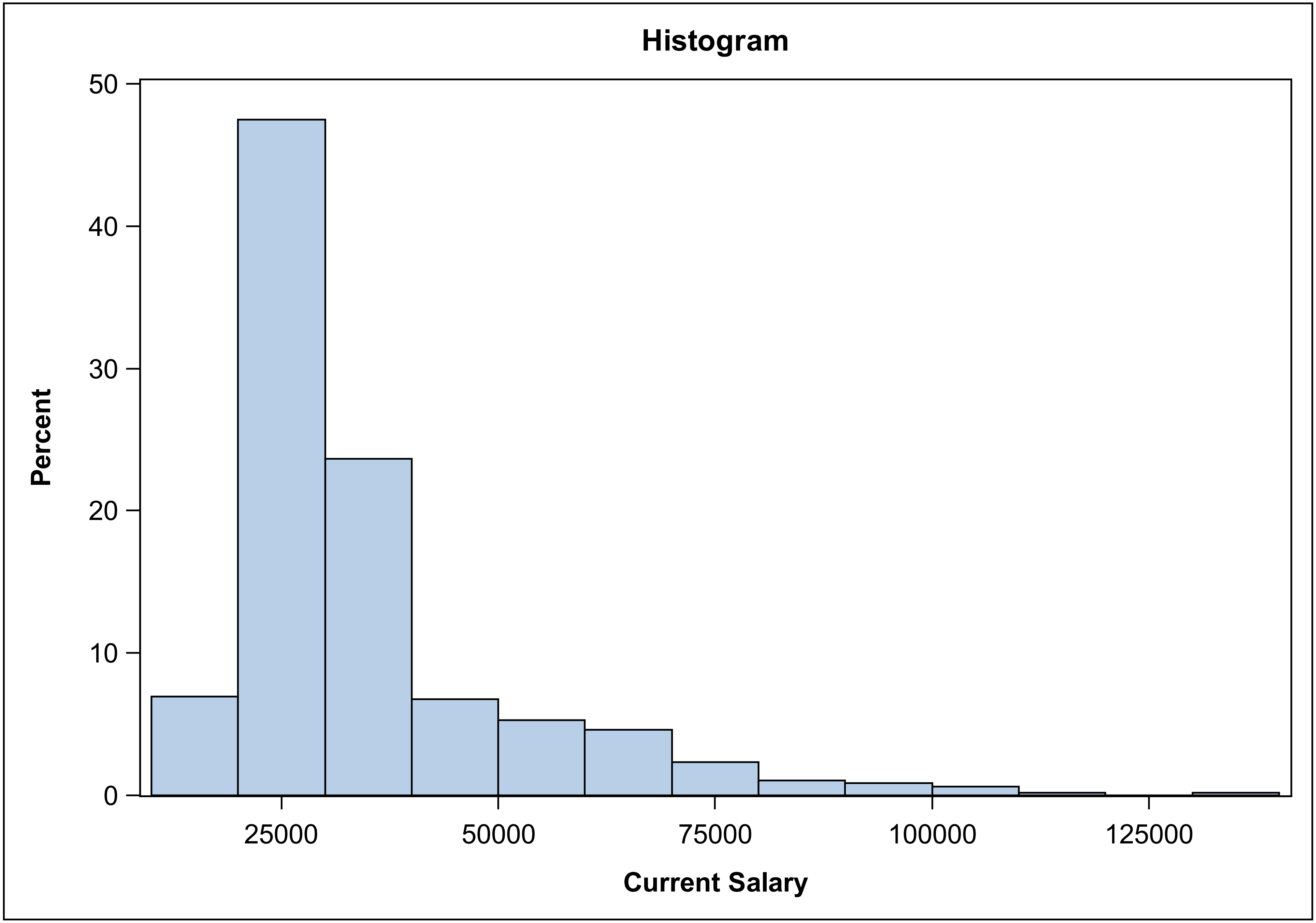
```
title "BarChart Paneled by Gender";
proc sgpanel data=employee;
panelby gender ;
vbar jobcat / response=salary limitstat = stddev
limits = upper stat=mean;

run;
```


BarChart Paneled by Gender
Gender = f
Gender = m
Current Salary
80000
60000
40000
20000
0
1
2
3
1
2
3
Employment Category
Current Salary, 1 Standard Deviation

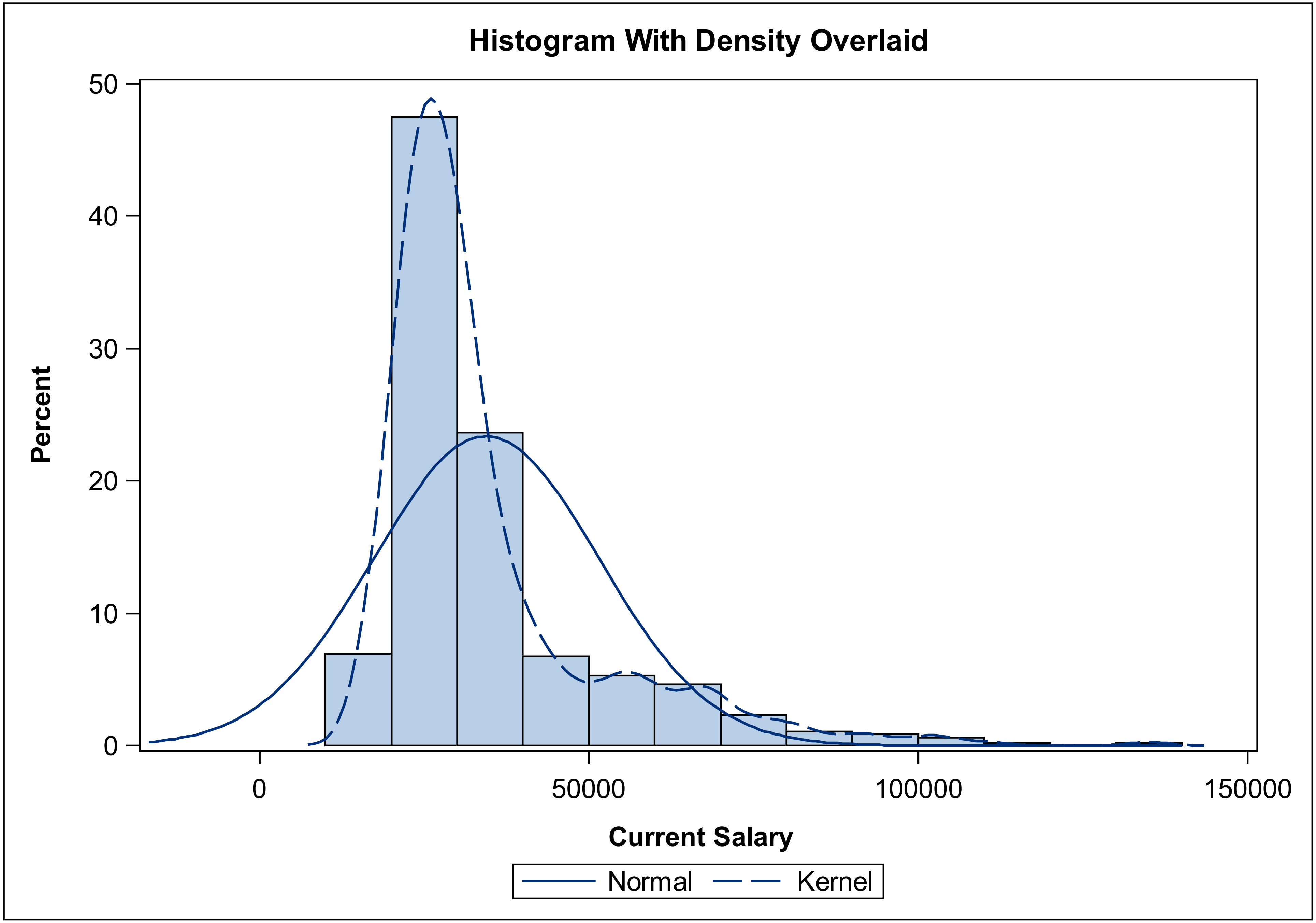
example-> 050

Histograms

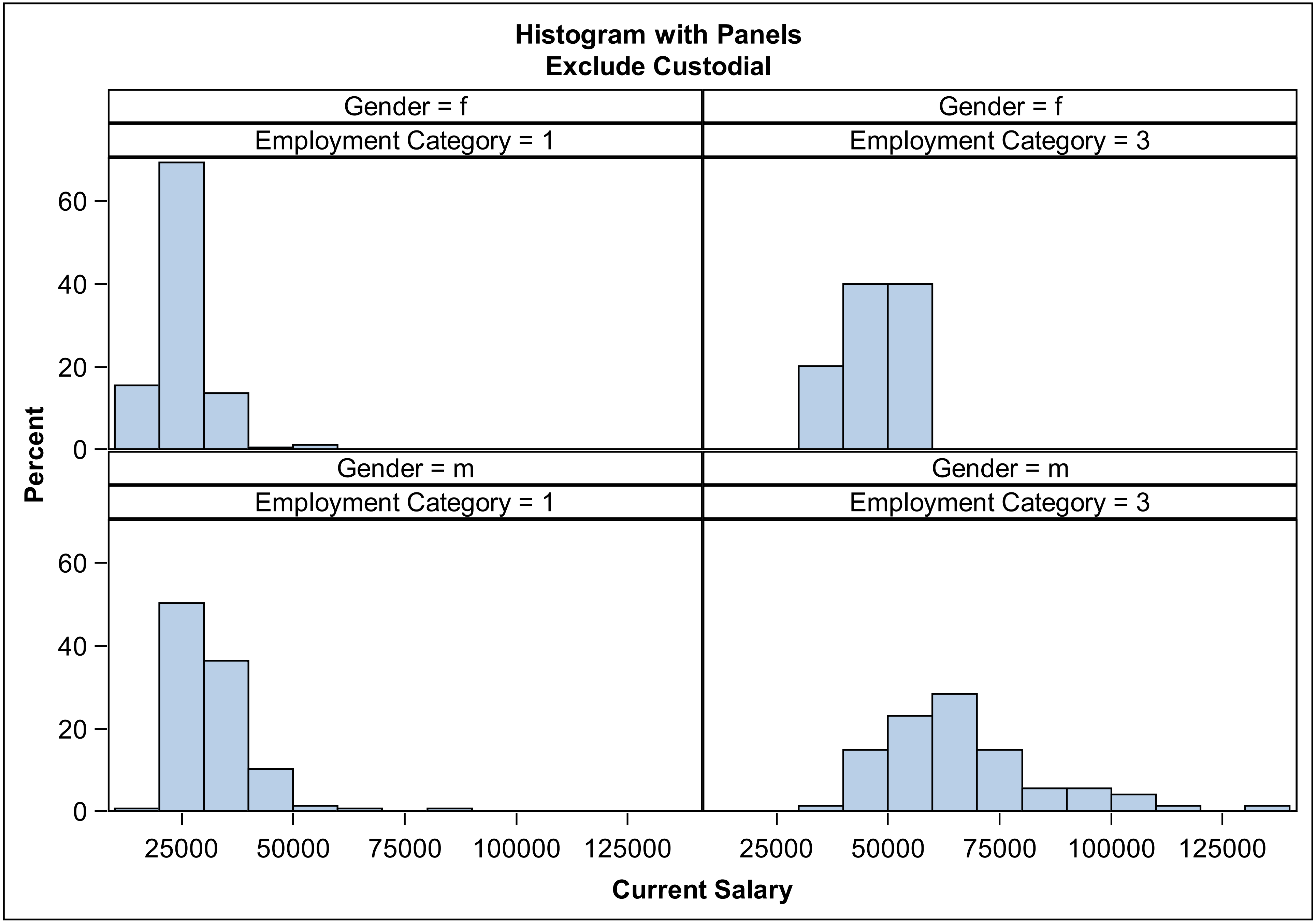
```
title "Histogram";
proc sgplot data=employee;
histogram salary ;
run;
```


Histogram
Percent
50
40
30
20
10
0
25000
50000
75000
100000
125000
Current Salary

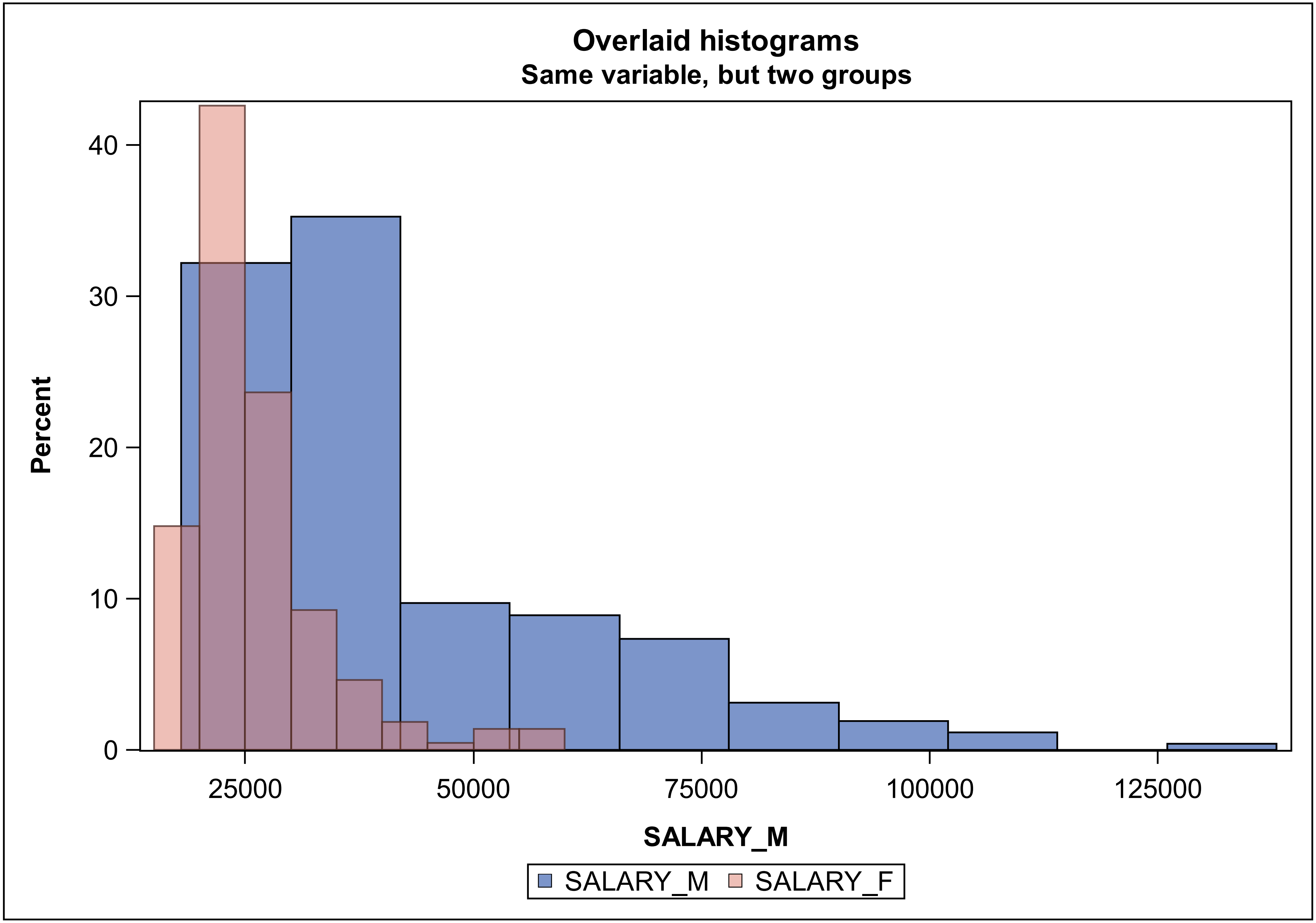
```
title "Histogram With Density Overlaid";
proc sgplot data=employee;
histogram salary ;
density salary;
density salary / type=kernel;

run;
```


Histogram With Density Overlaid
Percent
50
40
30
20
10
0
0
50000
100000
150000
Current Salary
Normal
Kernel

```
title "Histogram with Panels";
title2 "Exclude Custodial";
proc sgpanel data=employee;
where jobcat not=2;
panelby   gender jobcat/  rows=2 columns = 2     ;

histogram salary;
run;
```


Histogram with Panels
Exclude Custodial
Gender = f
Employment Category = 1
Gender = f
Employment Category = 3
Gender = m
Employment Category = 1
Gender = m
Employment Category = 3
Percent
0
20
40
60
25000
50000
75000
100000
125000
Current Salary

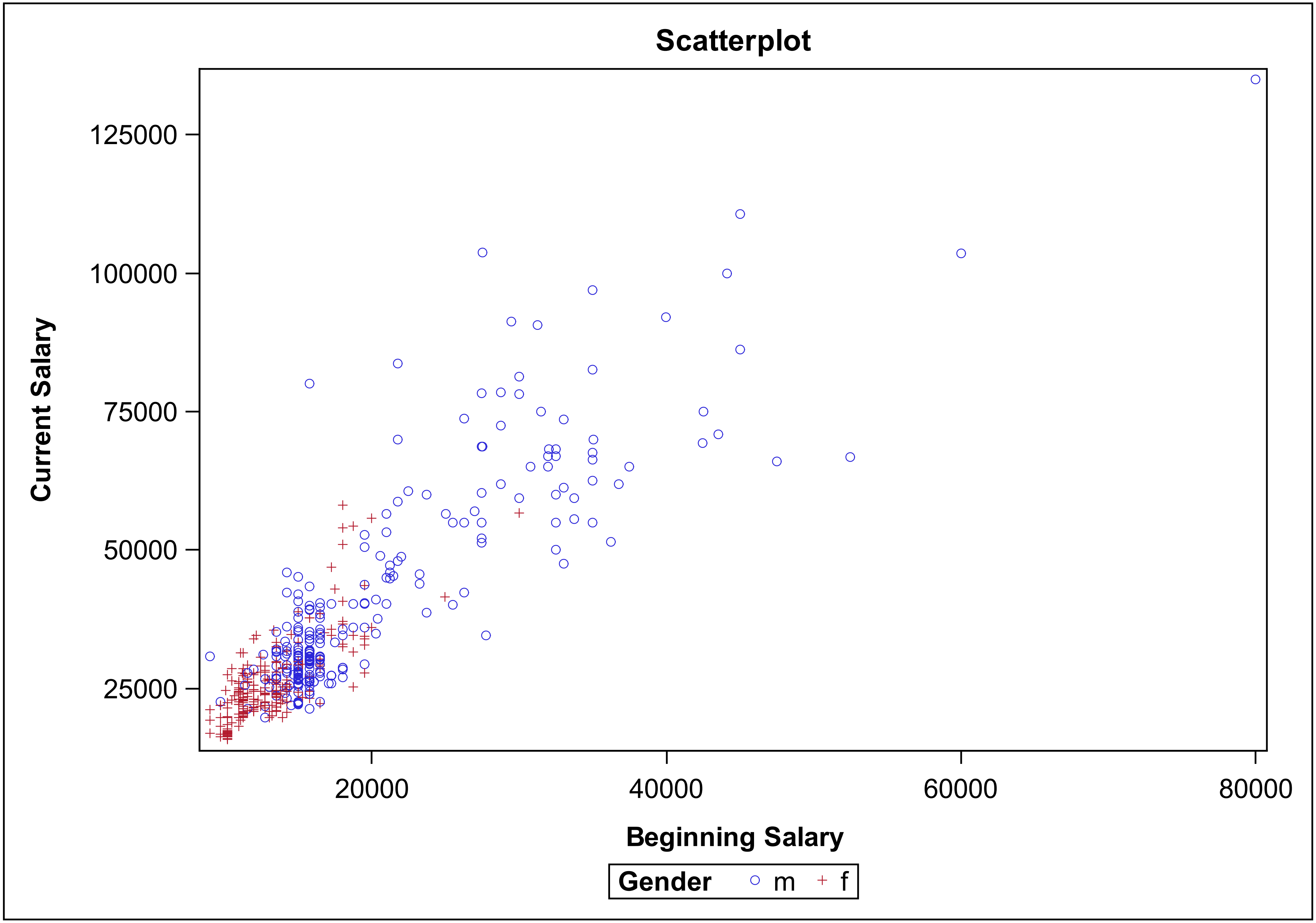
```
title "Overlaid histograms";
title2 "Same variable, but two groups ";
proc sgplot data=employee2;
histogram salary_m;
histogram salary_f / transparency=.5;

run;
```


Overlaid histograms
Same variable, but two groups
Percent
40
30
20
10
0
25000
50000
75000
100000
125000
SALARY_M
SALARY_M
SALARY_F

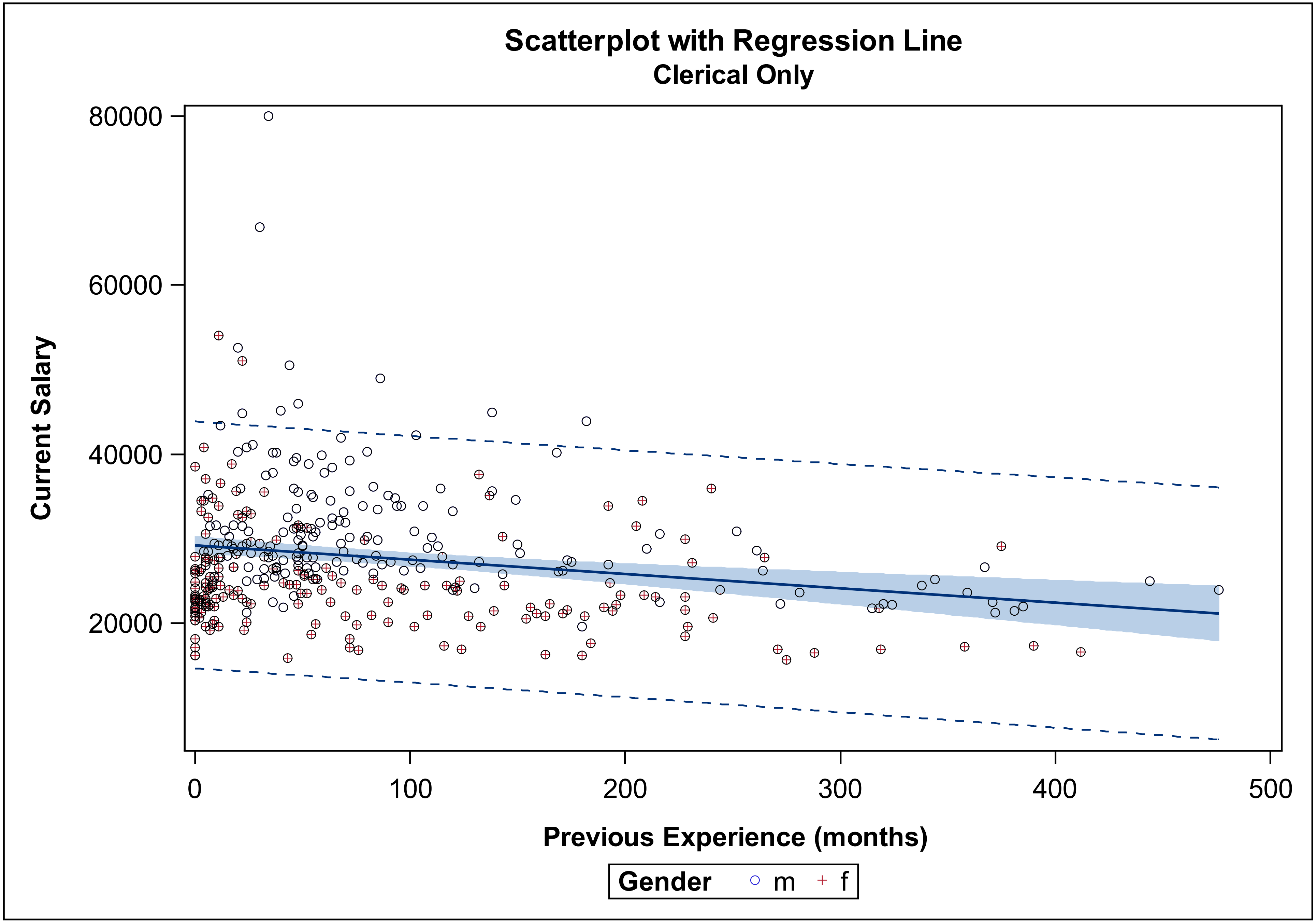
example-> 060

Scatterplot

```
title "Scatterplot";
proc sgplot data=employee;
scatter x=salbegin y=salary / group=gender ;
run;
```

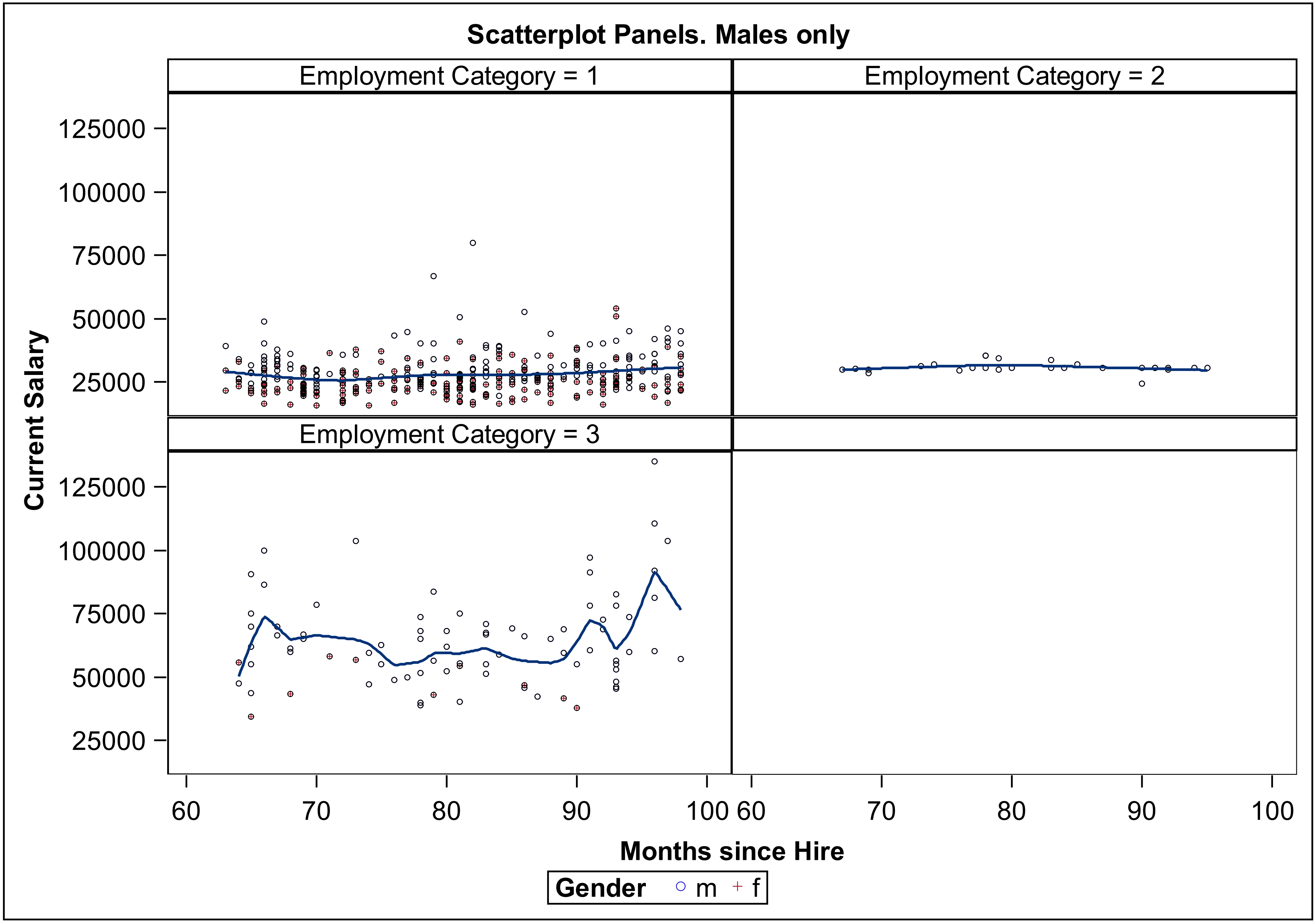

Scatterplot
Current Salary
125000
100000
75000
50000
25000
20000
40000
60000
80000
Beginning Salary
Gender
m
f

```
title "Scatterplot with Regression Line";
title2 "Clerical Only";
proc sgplot data=employee;
where jobcat=1;
scatter x=prevexp y=salary / group=gender ;

reg x=prevexp y=salary / cli clm;
run;
```



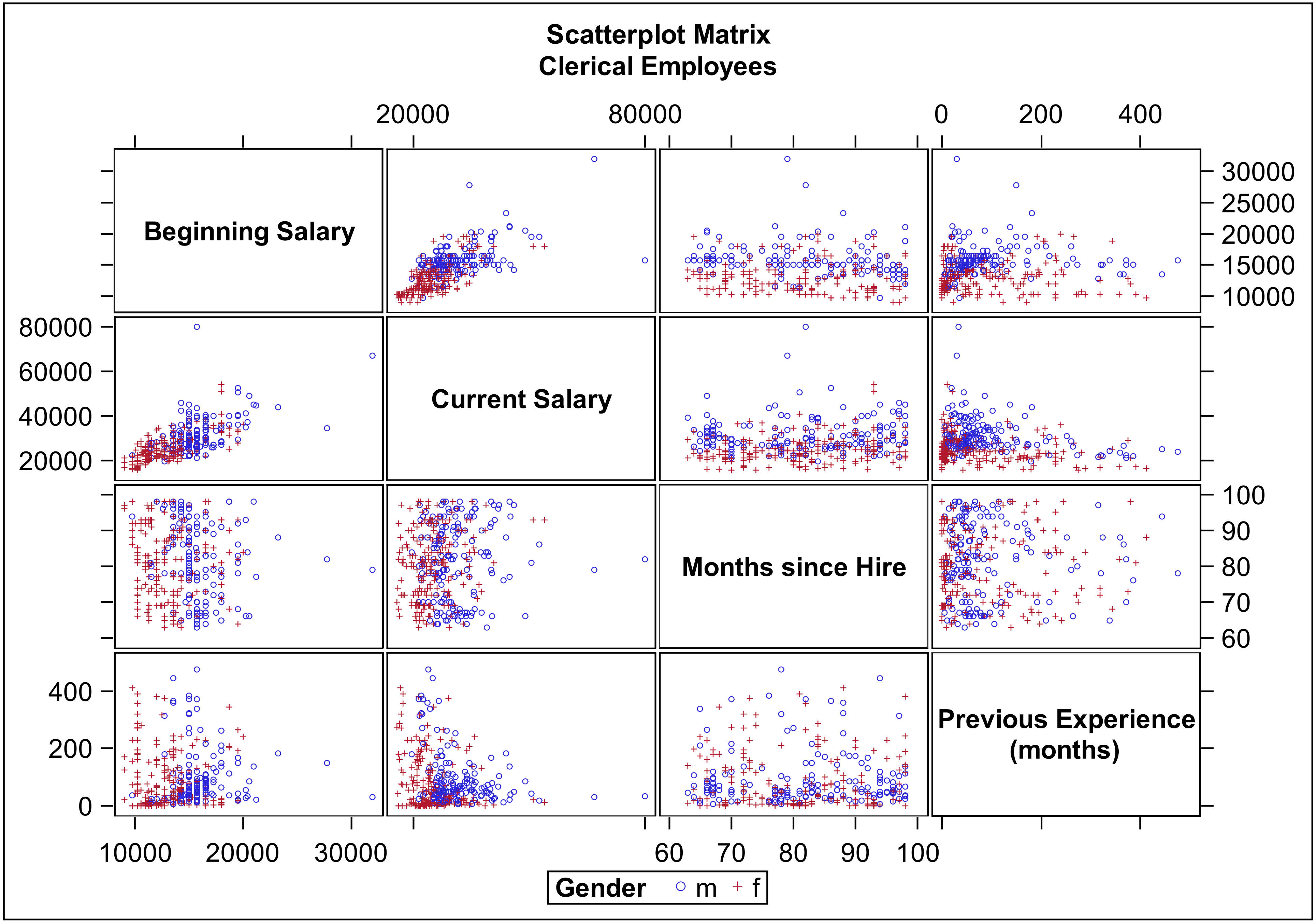
Scatterplot with Regression Line
Clerical Only
Current Salary
80000
60000
40000
20000
0
100
200
300
400
500
Previous Experience (months)
Gender
m
f

```
title "Scatterplot Panels. Males only";
proc sgpanel data=employee;
panelby jobcat;
scatter x=jobtime y=salary / group=gender;
loess x=jobtime y=salary ;

run;
```



Scatterplot Panels. Males only
Employment Category = 1
Employment Category = 2
Employment Category = 3
Current Salary
125000
100000
75000
50000
25000
60
70
80
90
100
Months since Hire
Gender
m
f

```
title "Scatterplot Matrix";
title2 "Clerical Employees";
proc sgscatter data=employee;
where jobcat=1;
matrix salbegin salary jobtime prevexp / group=gender;

run;
```

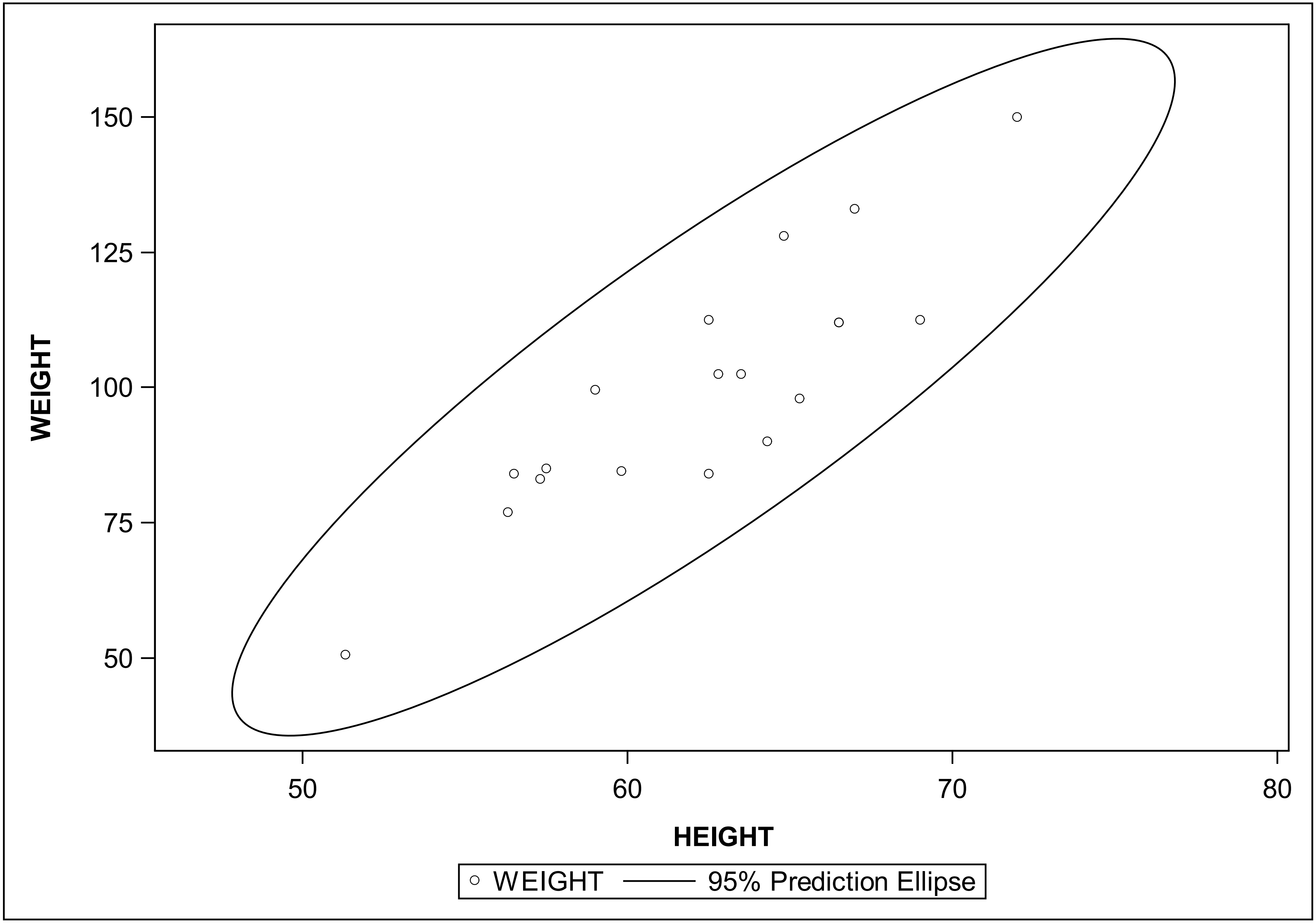


Scatterplot Matrix
Clerical Employees
Beginning Salary
Current Salary
Months since Hire
Previous Experience (months)
10000
20000
30000
80000
60000
40000
0
200
400
25000
15000
100
90
80
70
60
Gender m f

example-> 070

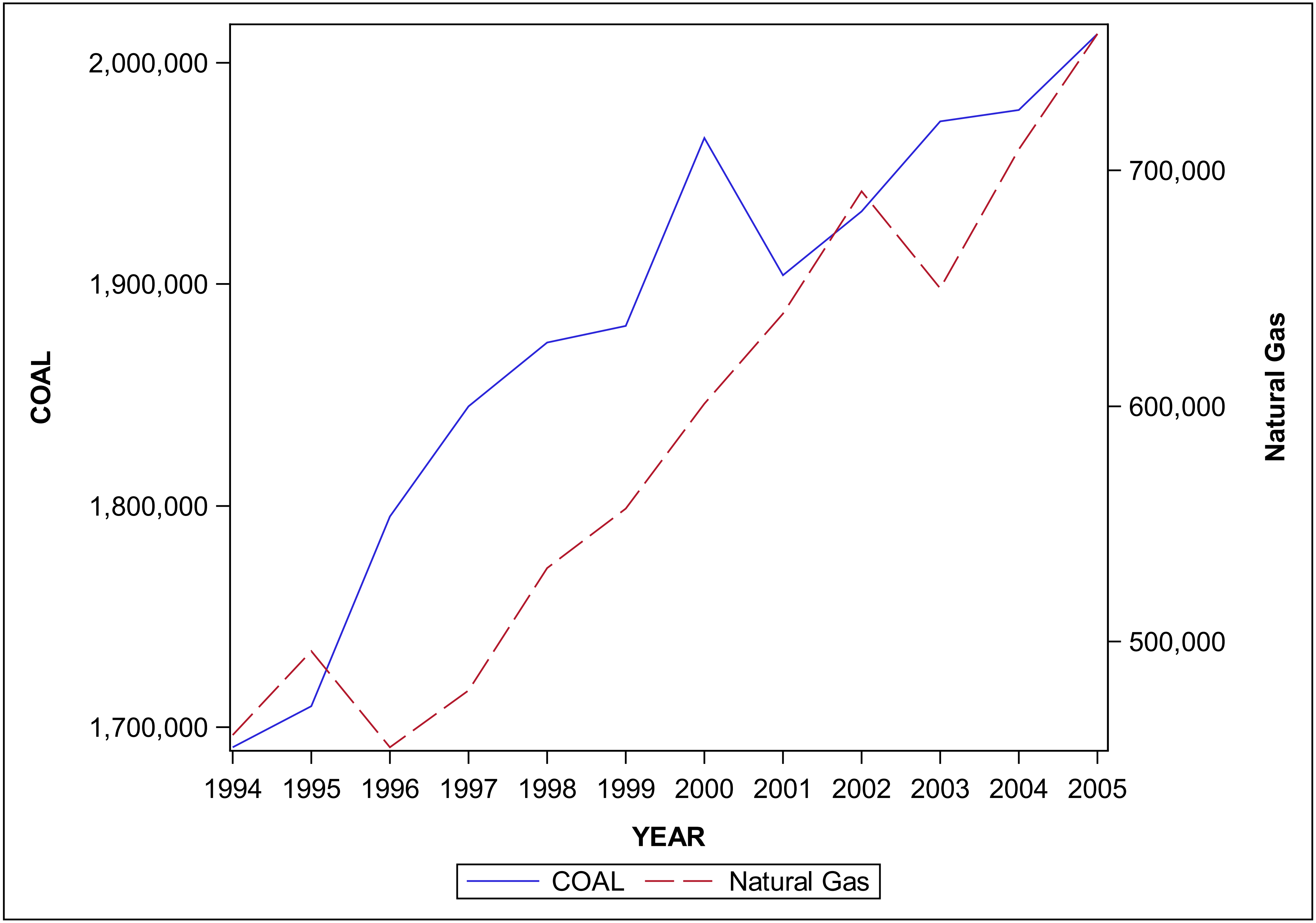
Misc

```
proc sgplot data=sashelp.class;
scatter x=height y=weight;
ellipse x=height y=weight;
run;quit;
```



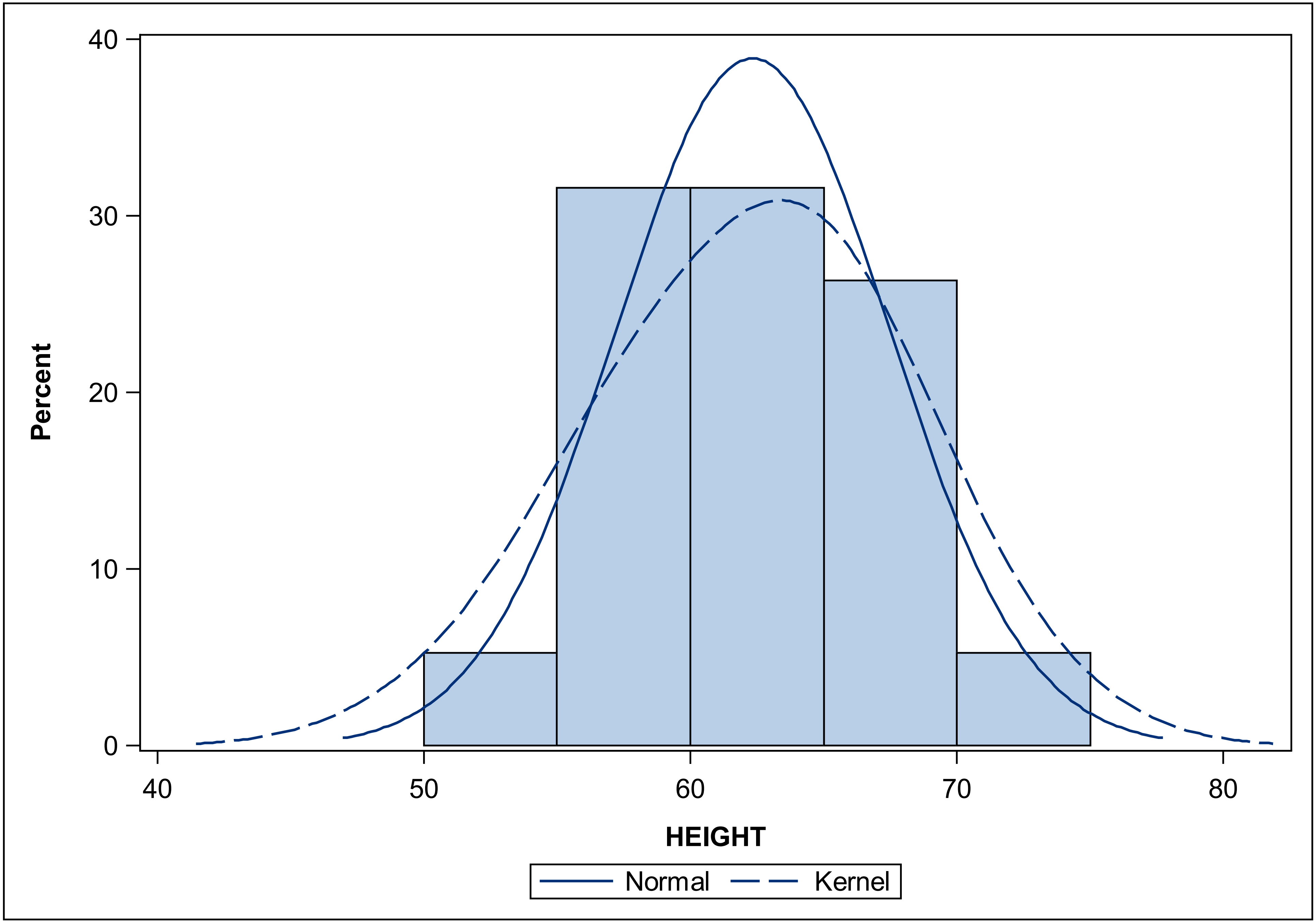
150
125
100
75
50
WEIGHT
50
60
70
80
HEIGHT
WEIGHT
95% Prediction Ellipse

```
proc sgplot data=sashelp.electric(
where=(customer="Residential"));
xaxis type=discrete;
series x=year y=coal;
series x=year y=naturalgas / y2axis;

run;quit;
```



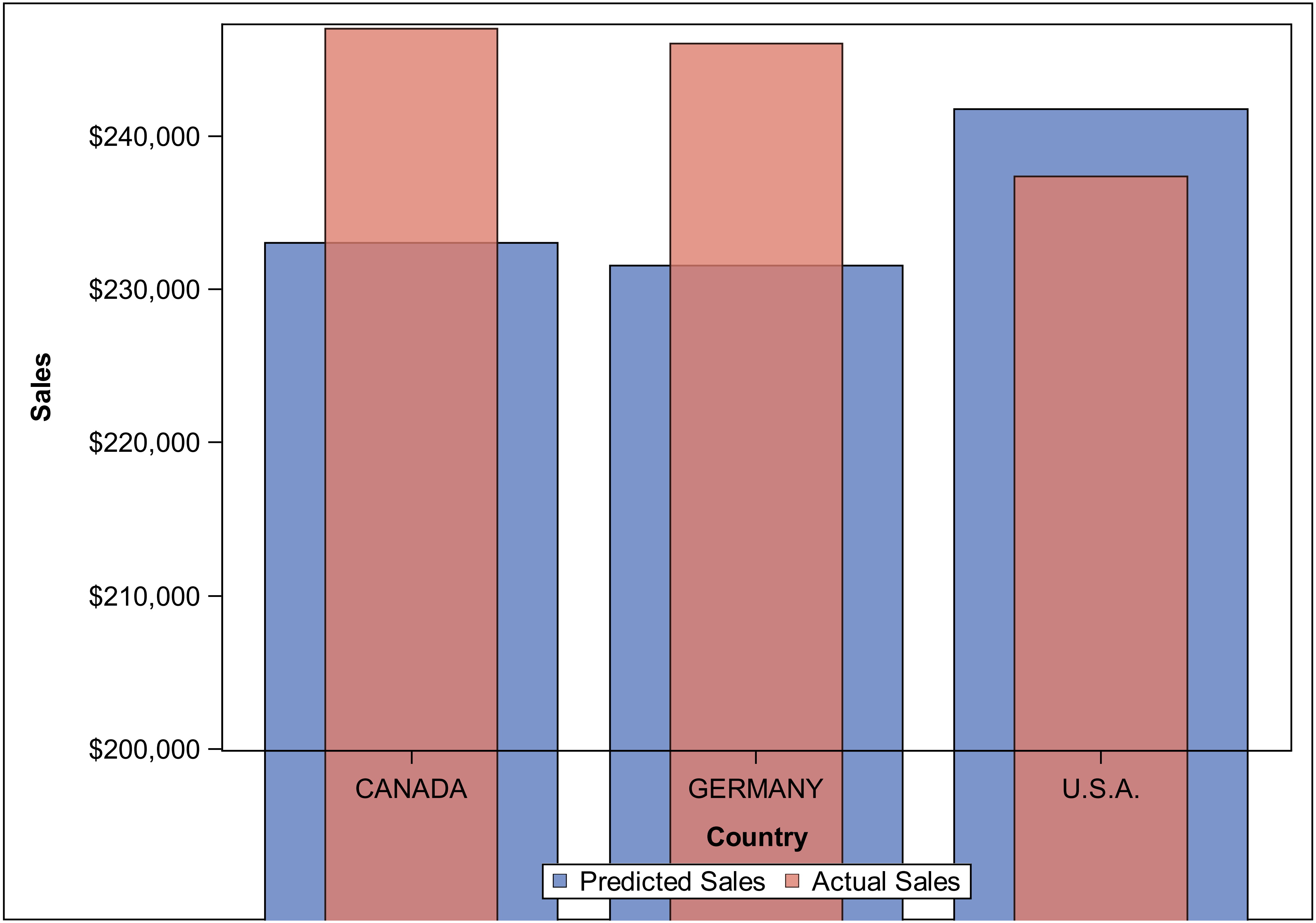
2,000,000
1,900,000
1,800,000
1,700,000
COAL
700,000
600,000
500,000
Natural Gas
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
YEAR
COAL
Natural Gas

```
proc sgplot data=sashelp.class;
histogram height;
density height;
density height / type=kernel;
run;quit;
```



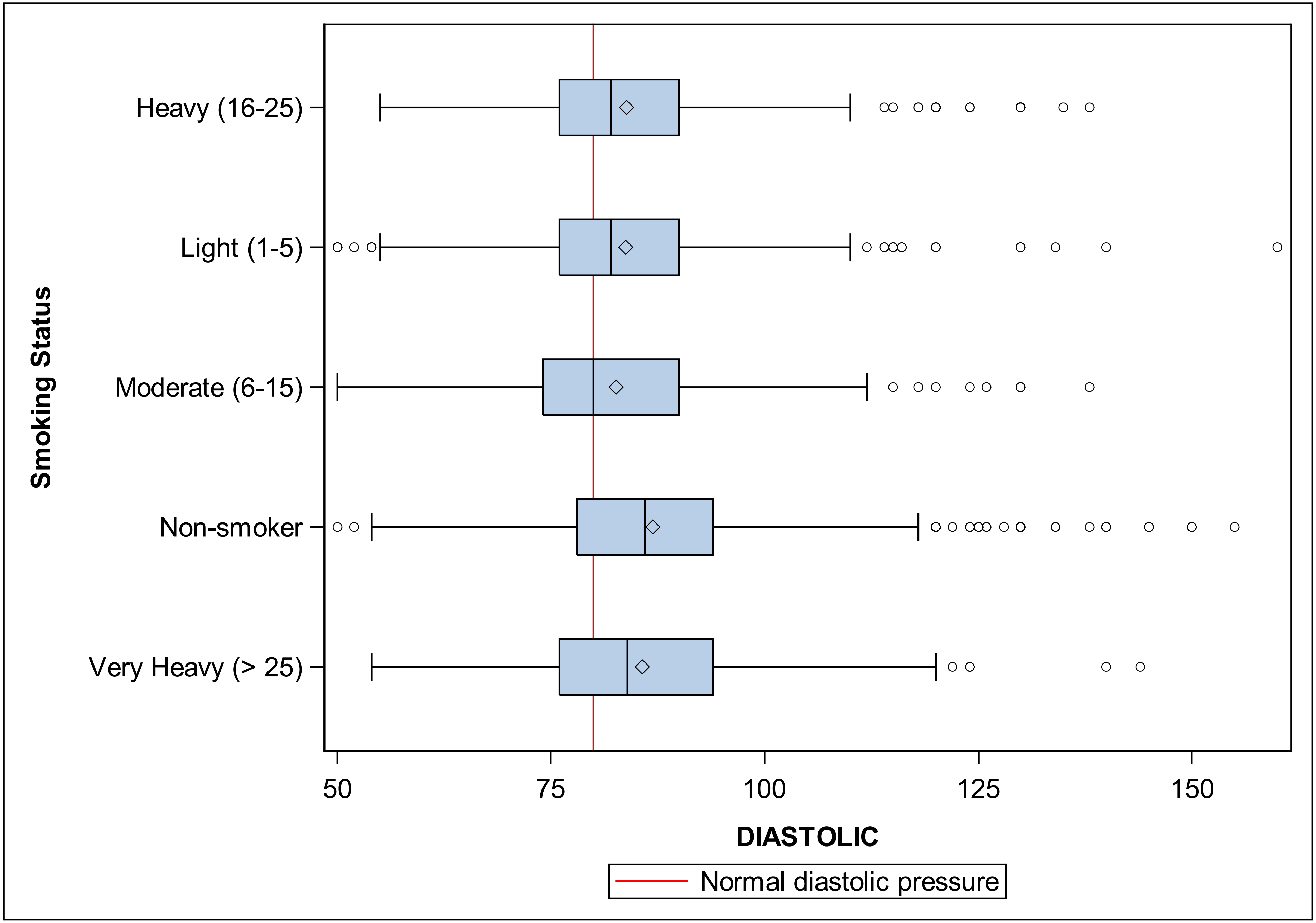
Percent
40
30
20
10
0
40
50
60
70
80
HEIGHT
Normal
Kernel

```
proc sgplot data=sashelp.prdsale;
yaxis label="Sales" min=200000;
vbar country / response=predict;
vbar country / response=actual
barwidth=0.5

transparency=0.2;
run;quit;
```



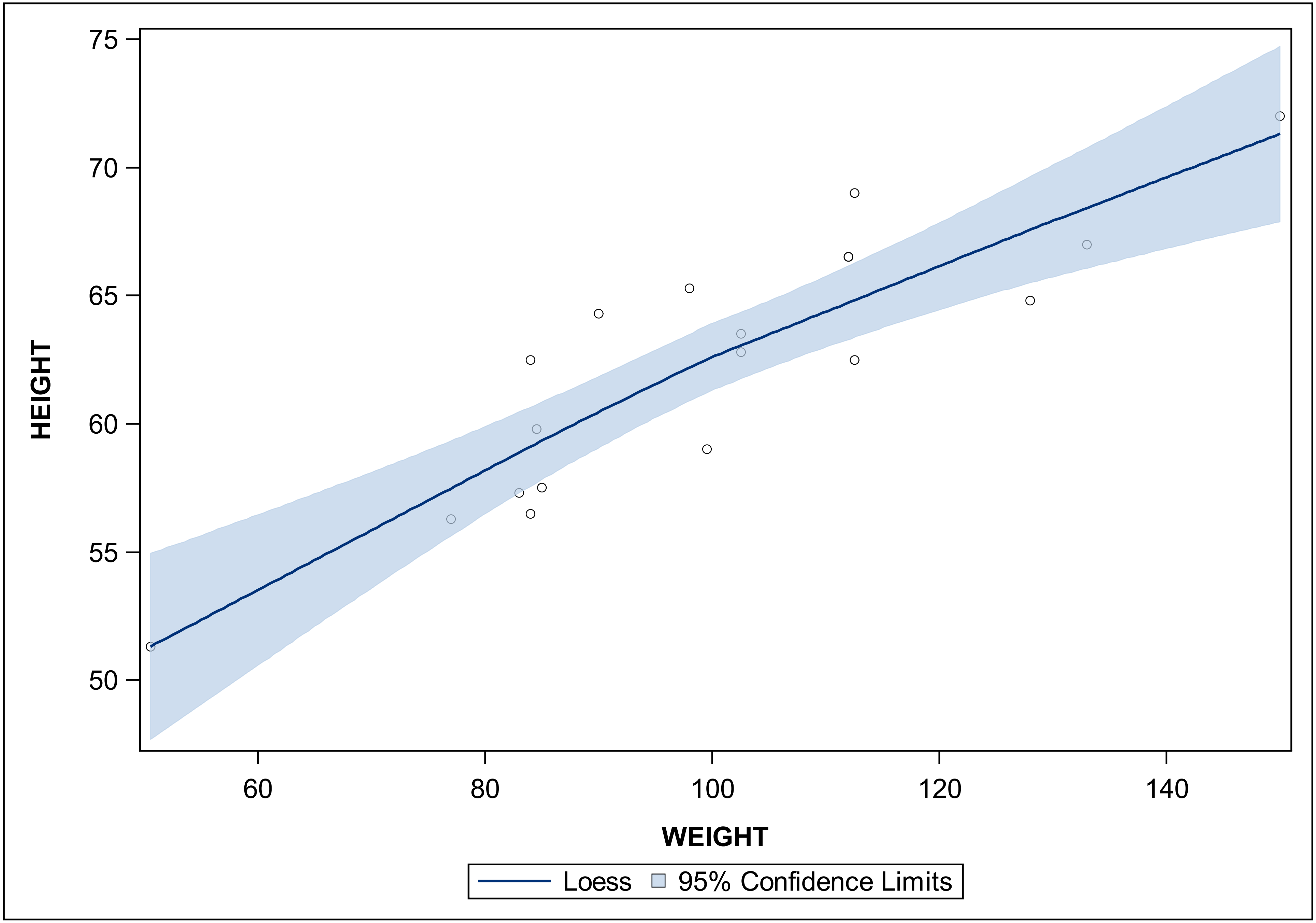
$240,000
$230,000
$220,000
$210,000
$200,000
Sales
CANADA
GERMANY
U.S.A.
Country
Predicted Sales
Actual Sales

```
proc sgplot data=sashelp.heart (where=(smoking_status ne " "));
refline 80 / axis=x name="normal" lineattrs=(color=red)
legendlabel="Normal diastolic pressure";
hbox diastolic / category=smoking_status;
keylegend "normal";

run;quit;
```

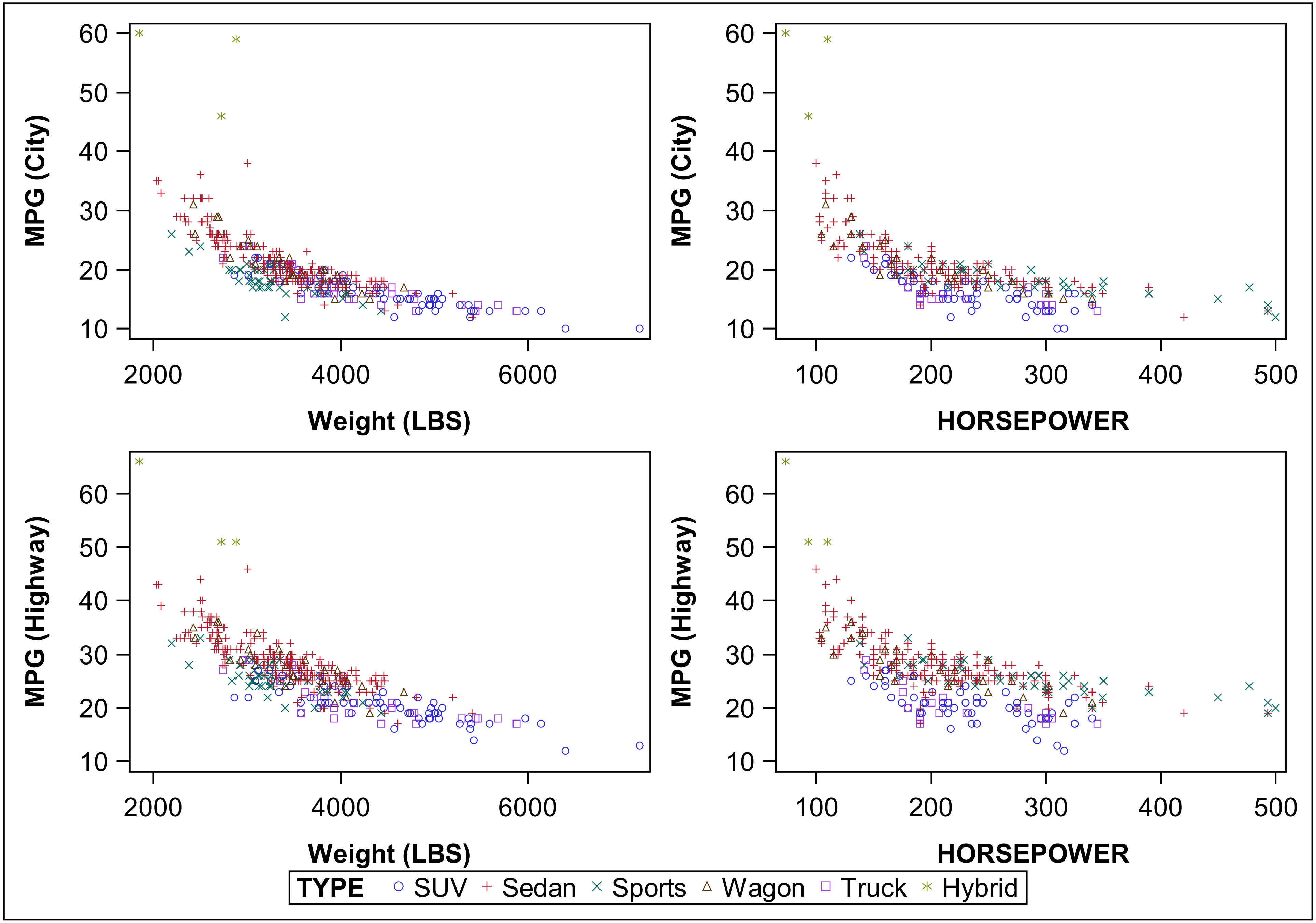


Heavy (16-25)
Light (1-5)
Moderate (6-15)
Non-smoker
Very Heavy (> 25)
Smoking Status
50
75
100
125
150
DIASTOLIC
Normal diastolic pressure

```
proc sgplot data=sashelp.class;
scatter x=weight y=height;
loess x=weight y=height / clm nomarkers clmtransparency=0.3 name="loess";
keylegend "loess";
run;quit;
```

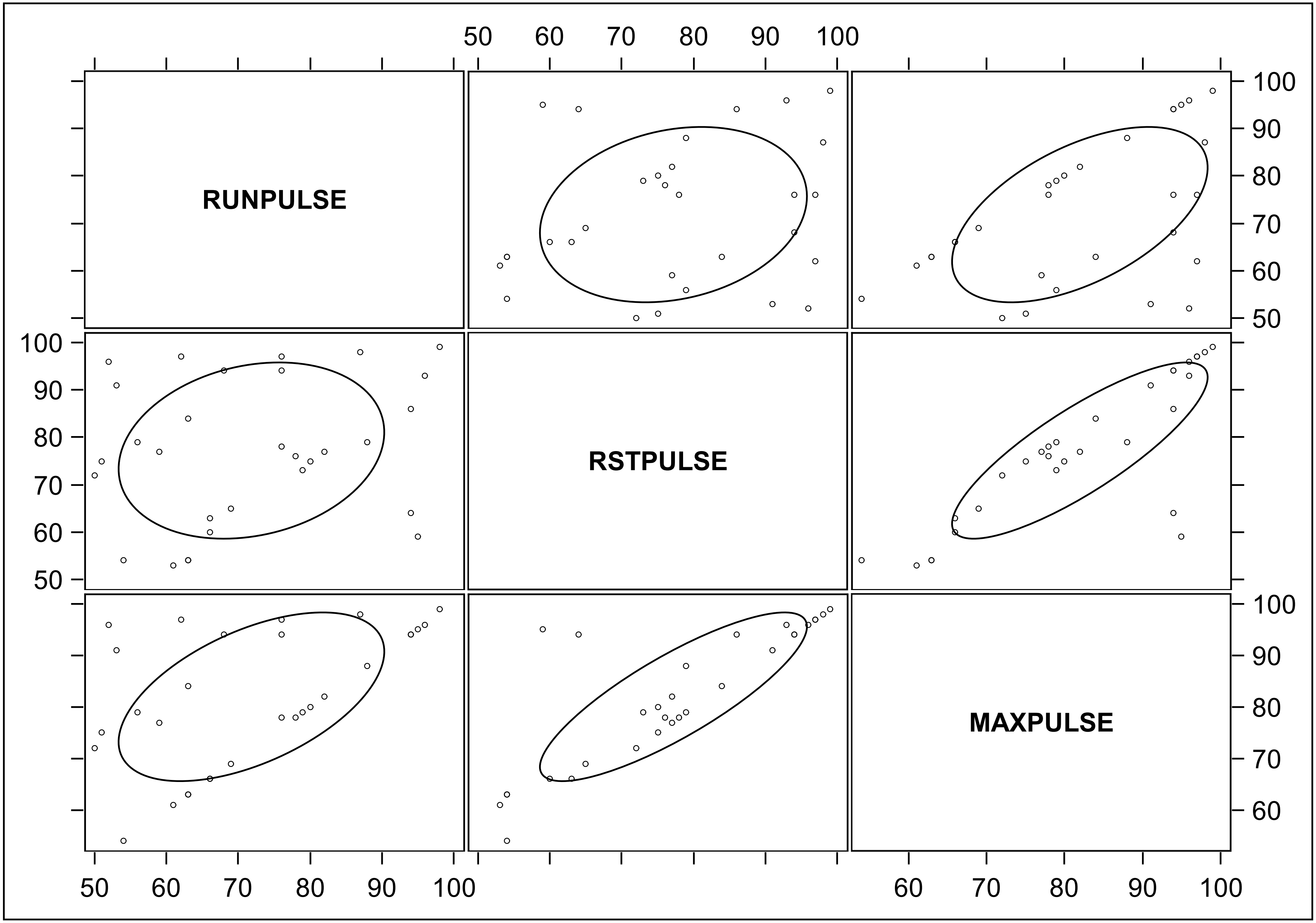

75
70
65
60
55
50
HEIGHT
60
80
100
120
140
WEIGHT
Loess
95% Confidence Limits

```
proc sgscatter data=sashelp.cars;
plot (mpg_city mpg_highway)*(weight horsepower) / group=type;
run;quit;
```

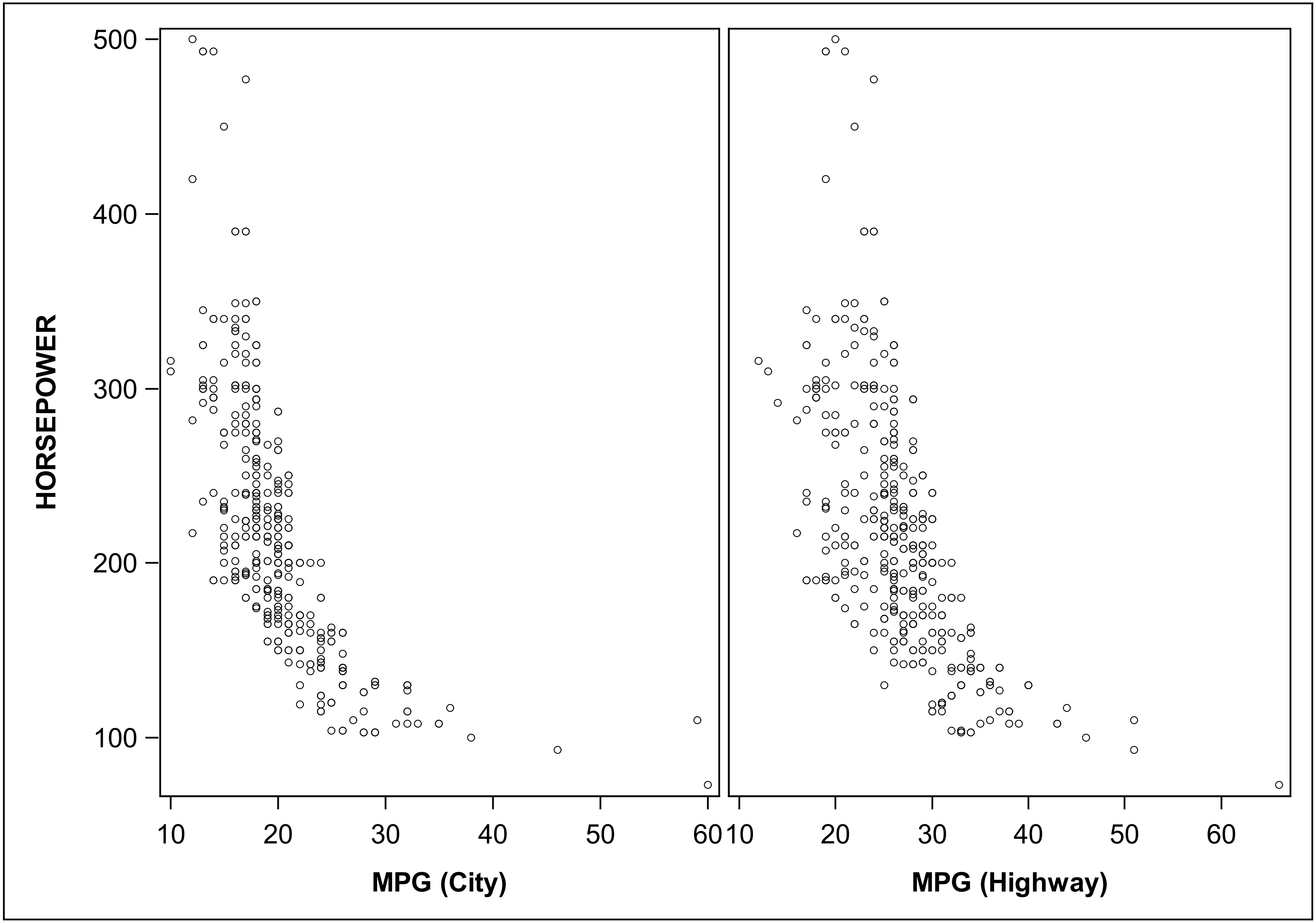


MPG (City)
Weight (LBS)
MPG (City)
HORSEPOWER
MPG (Highway)
Weight (LBS)
MPG (Highway)
HORSEPOWER
10
20
30
40
50
60
2000
4000
6000
100
200
300
400
500
TYPE
SUV
Sedan
Sports
Wagon
Truck
Hybrid

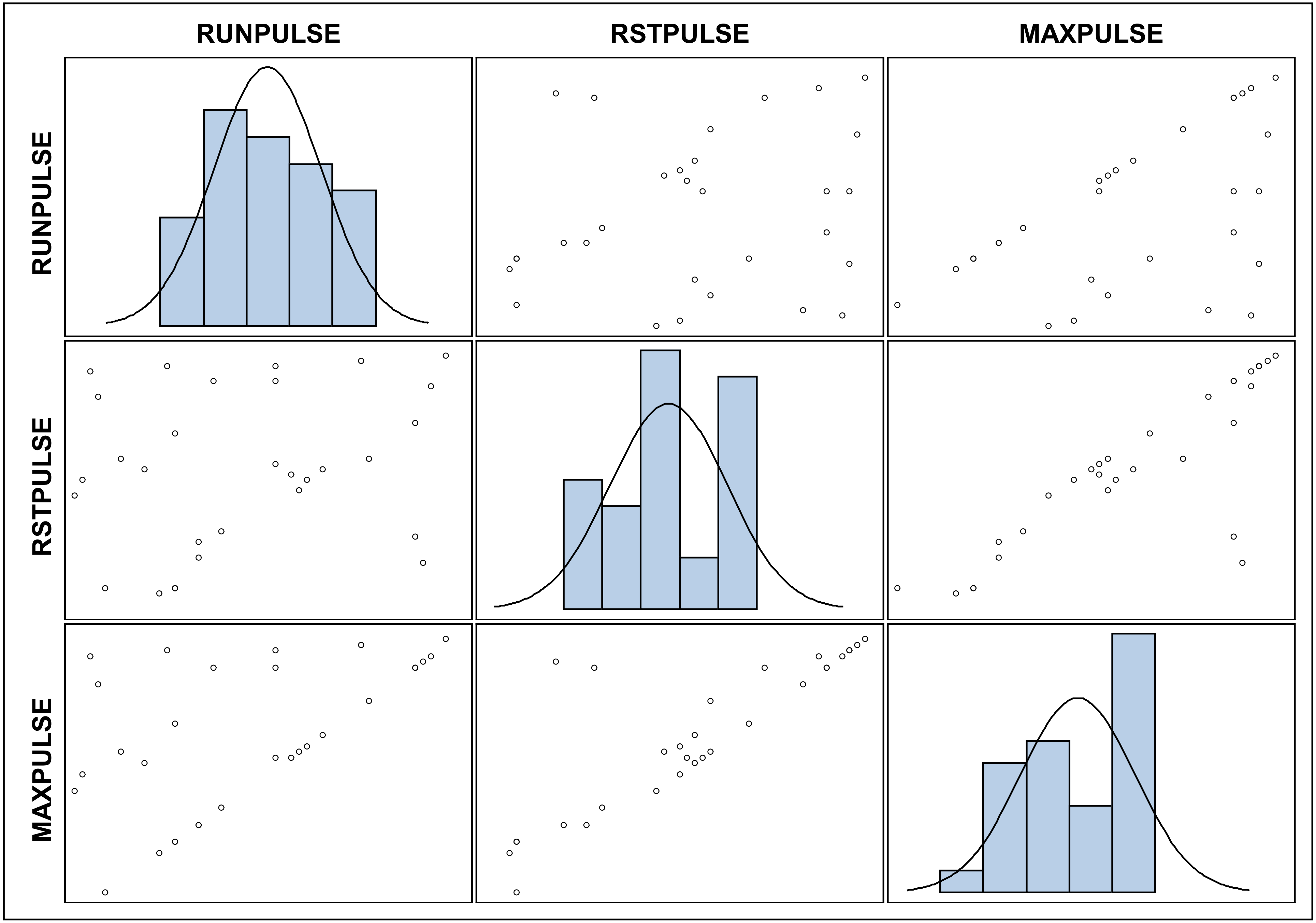
```
proc sgscatter data=fitness;
matrix runpulse rstpulse maxpulse / ellipse=(alpha=0.5);
run;quit;
```


RUNPULSE
RSTPULSE
MAXPULSE
50
60
70
80
90
100

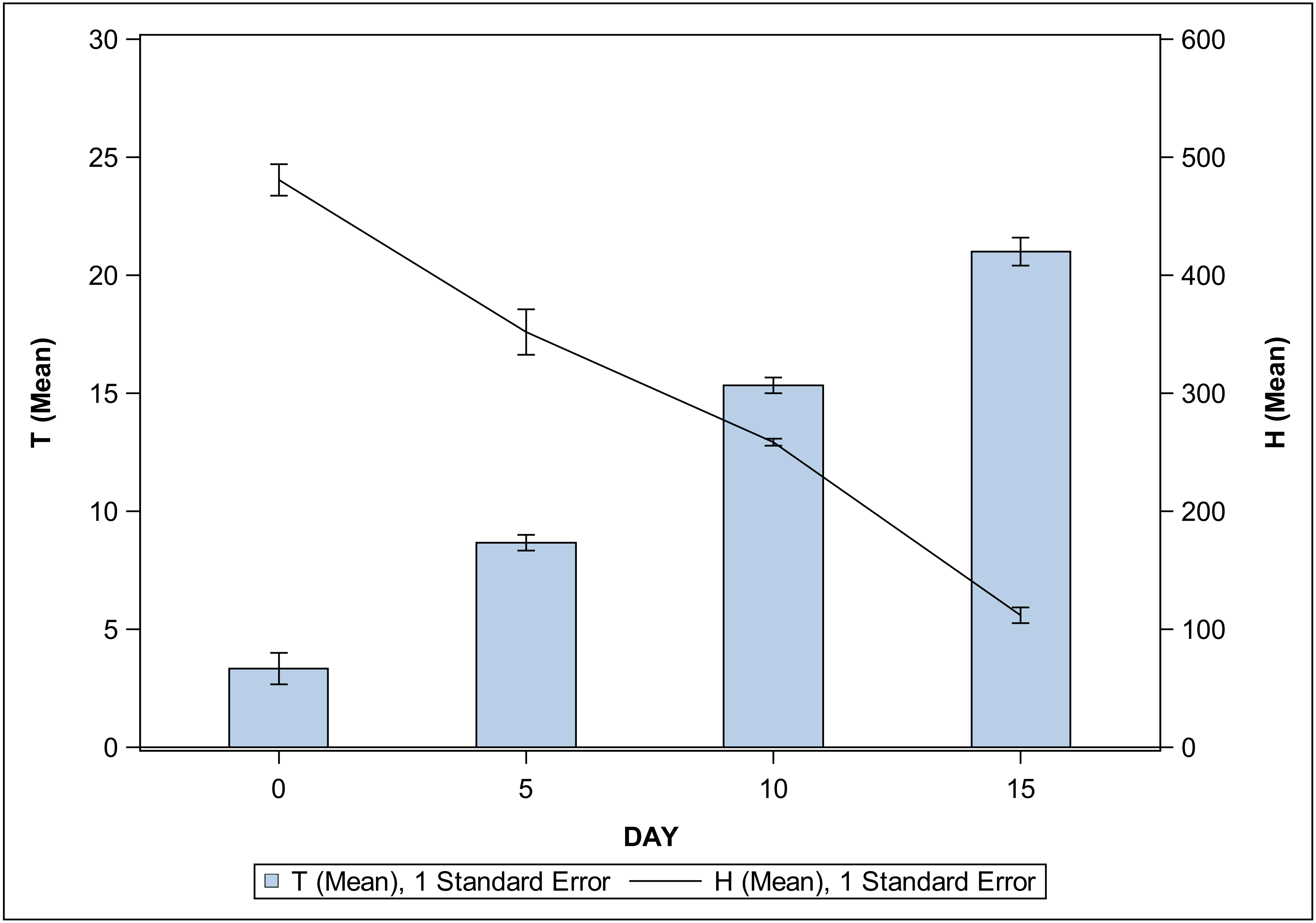
```
proc sgscatter data=sashelp.cars;
compare x=(mpg_city mpg_highway) y=horsepower;
run;quit;
```


HORSEPOWER
500
400
300
200
100
10
20
30
40
50
60
MPG (City)
MPG (Highway)

```
proc sgscatter data=fitness;
matrix runpulse rstpulse maxpulse / diagonal=(histogram normal);
run;quit;
```

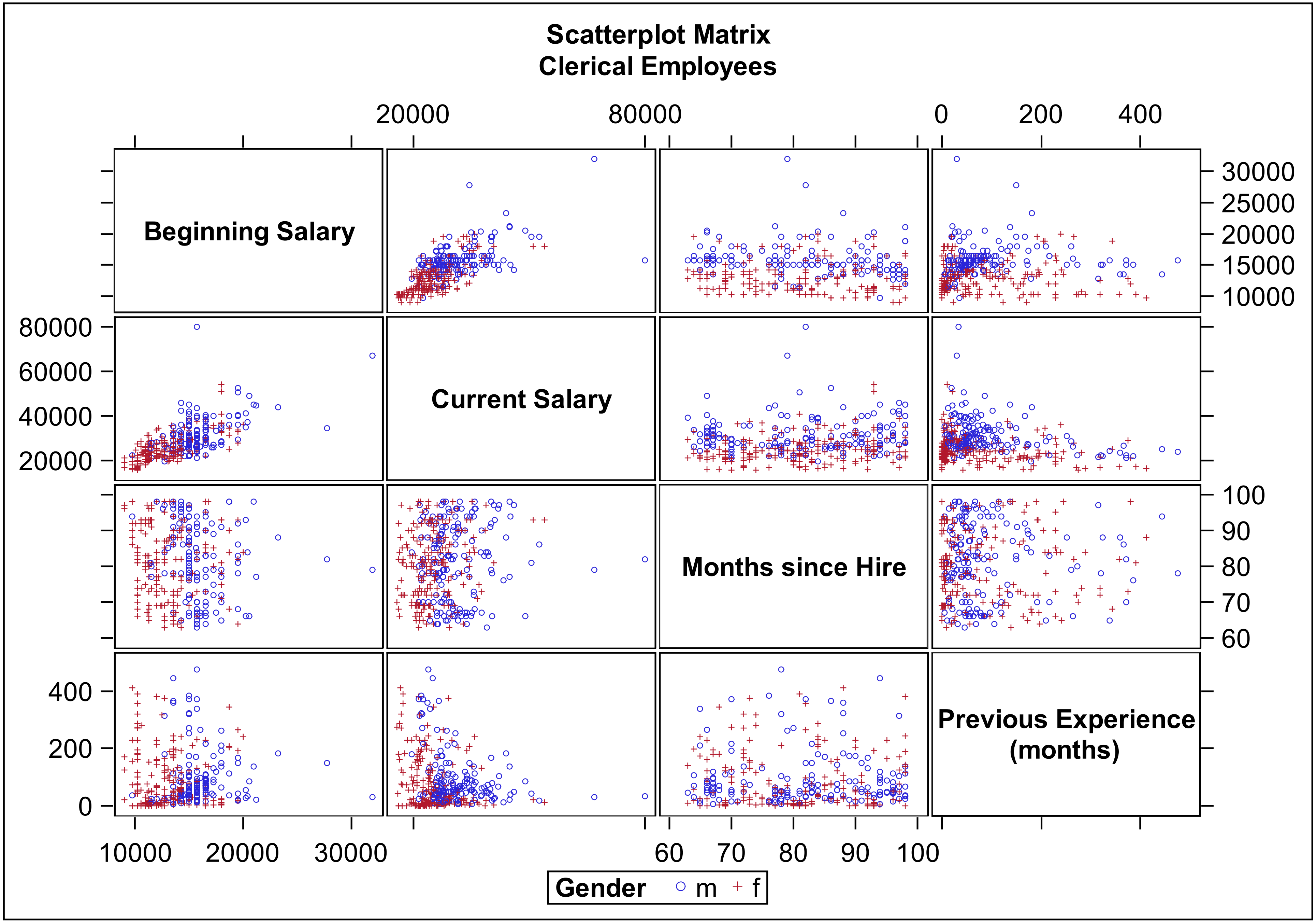

RUNPULSE
RSTPULSE
MAXPULSE
RUNPULSE
RSTPULSE
MAXPULSE

```
proc sgplot data=ex;
vbar day / response=t stat=mean limits=both limitstat=stderr barwidth=0.4 ;
vline day / response=h stat=mean limits=both limitstat=stderr y2axis;
yaxis min=0 max=30 ;
y2axis min=0 max=600 ;

run;quit;
```



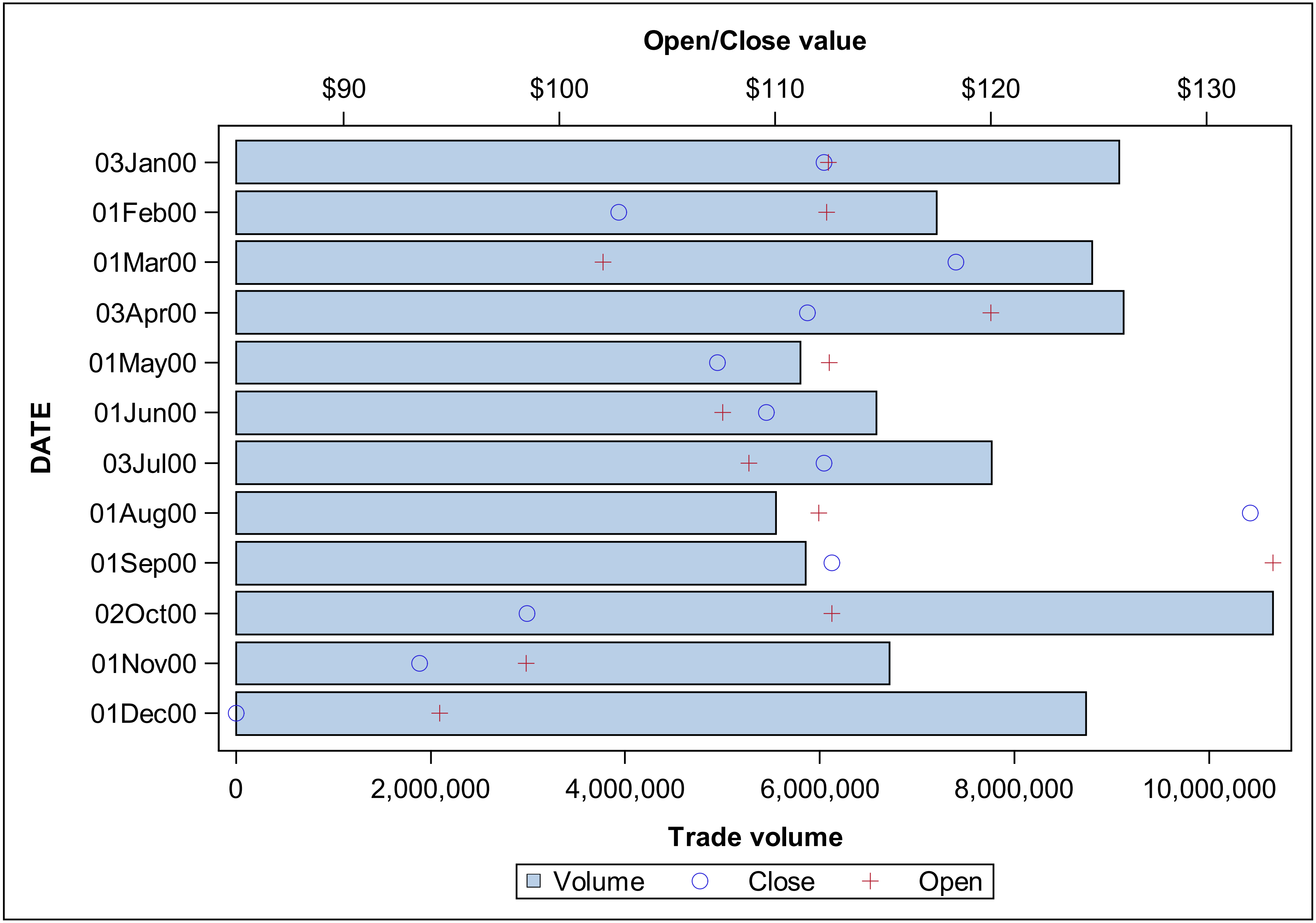
T (Mean)
H (Mean)
DAY
30
25
20
15
10
5
0
600
500
400
300
200
100
0
0
5
10
15
T (Mean), 1 Standard Error
H (Mean), 1 Standard Error

```
title "Scatterplot Matrix";
title2 "Clerical Employees";
proc sgscatter data=employee;
where jobcat=1;
matrix salbegin salary jobtime prevexp / group=gender;

run;
```

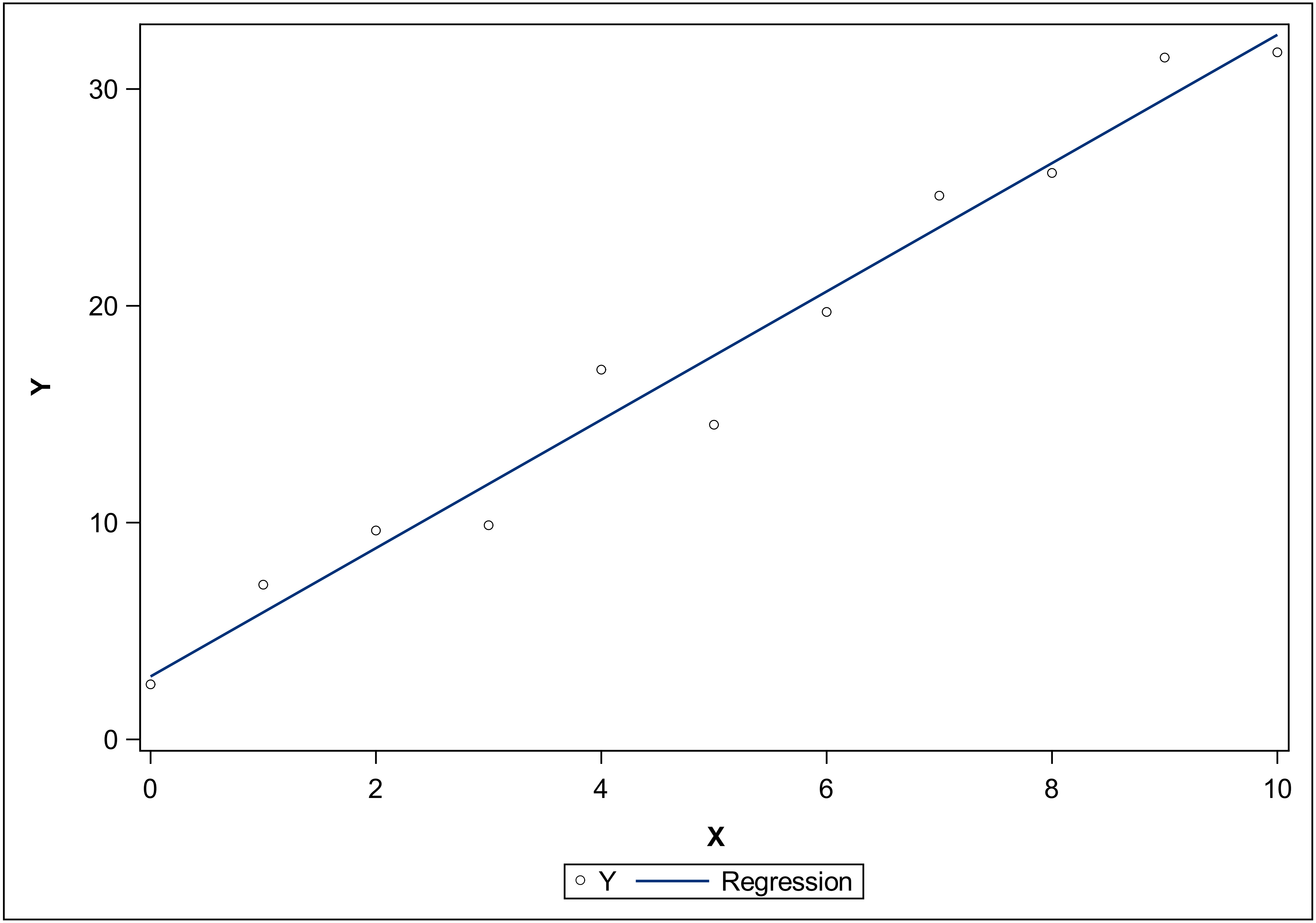


Scatterplot Matrix
Clerical Employees
Beginning Salary
Current Salary
Months since Hire
Previous Experience (months)
20000
80000
0
200
400
30000
25000
20000
15000
10000
80000
60000
40000
20000
100
90
80
70
60
400
200
0
10000
20000
30000
60
70
80
90
100
Gender
m
f

```
proc sgplot data=sashelp.stocks (where=(date >= "01jan2000"d
and date <= "01jan2001"d
and stock = "IBM"));
hbar date /
response=volume legendlabel="Volume";
hline date /
response=close x2axis
markers markerattrs=(size=12)
lineattrs=(thickness=0) legendlabel="Close";
hline date /
response=open x2axis
markers markerattrs=(size=12)
lineattrs=(thickness=0) legendlabel="Open";
x2axis label="Open/Close value";
xaxis label="Trade volume";
run;quit;
```

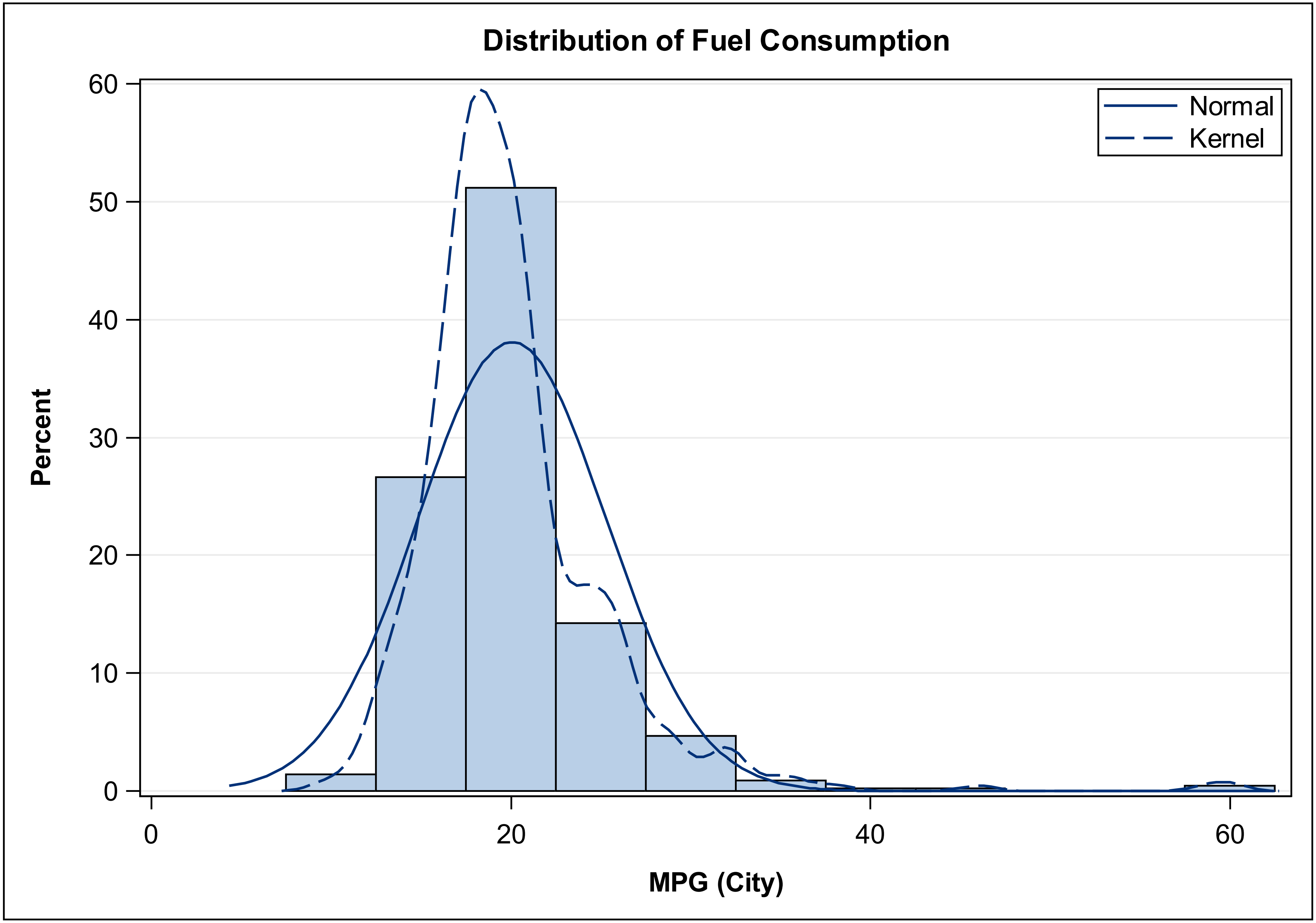

Open/Close value
$90
$100
$110
$120
$130
DATE
03Jan00
01Feb00
01Mar00
03Apr00
01May00
01Jun00
03Jul00
01Aug00
01Sep00
02Oct00
01Nov00
01Dec00
0
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
Trade volume
Volume
Close
Open

```
proc sgplot data=first_example;
scatter x=x y=y;
reg x=x y=y;
run;quit;
```



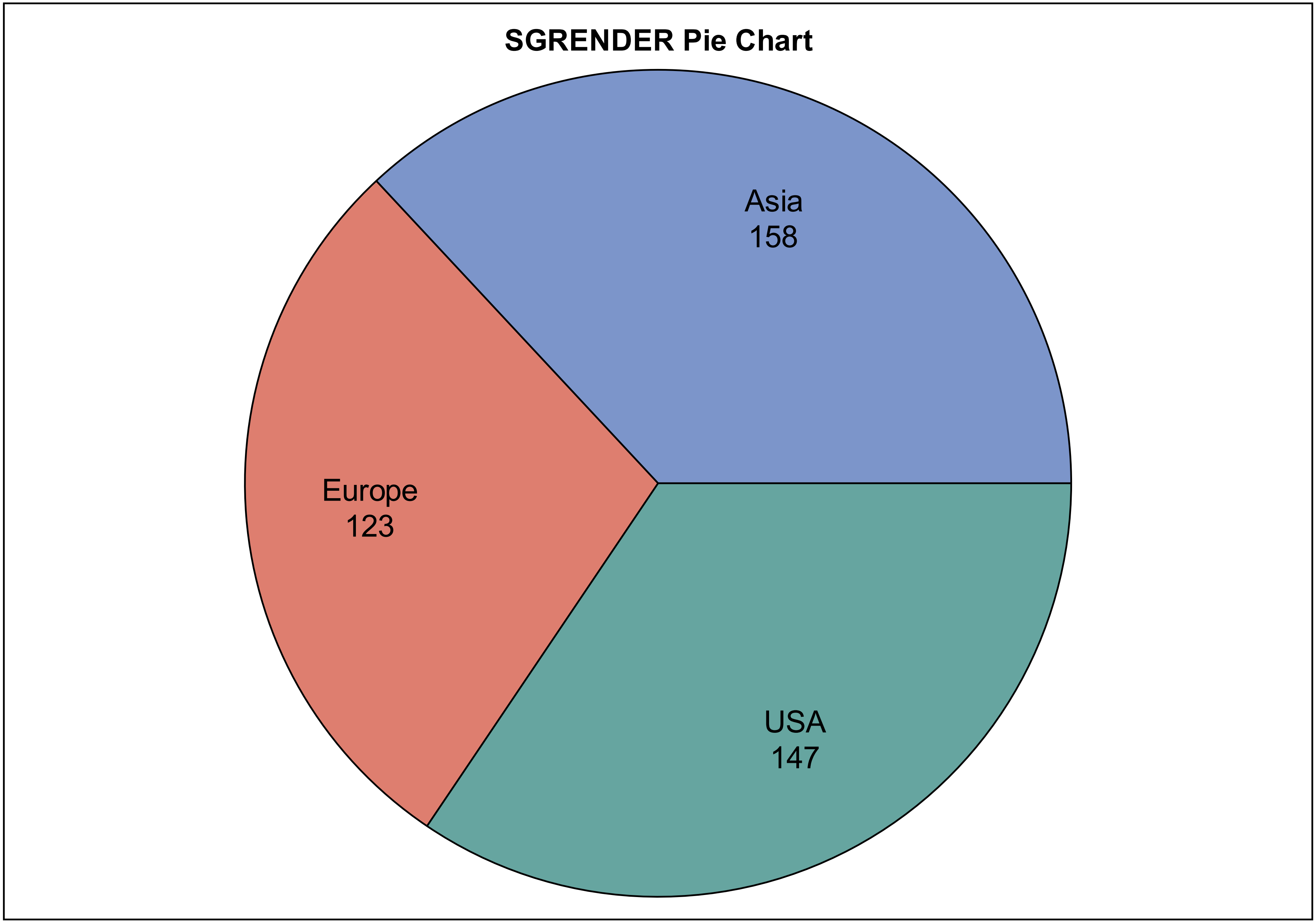
30
20
10
0
Y
0
2
4
6
8
10
X
Y
Regression

```
title "Distribution of Fuel Consumption";
proc sgplot data=sashelp.cars;
histogram mpg_city;
density mpg_city;
density mpg_city / type=kernel;
keylegend / location = inside
position=TopRight
across=1;
yaxis grid;
run;quit;
```

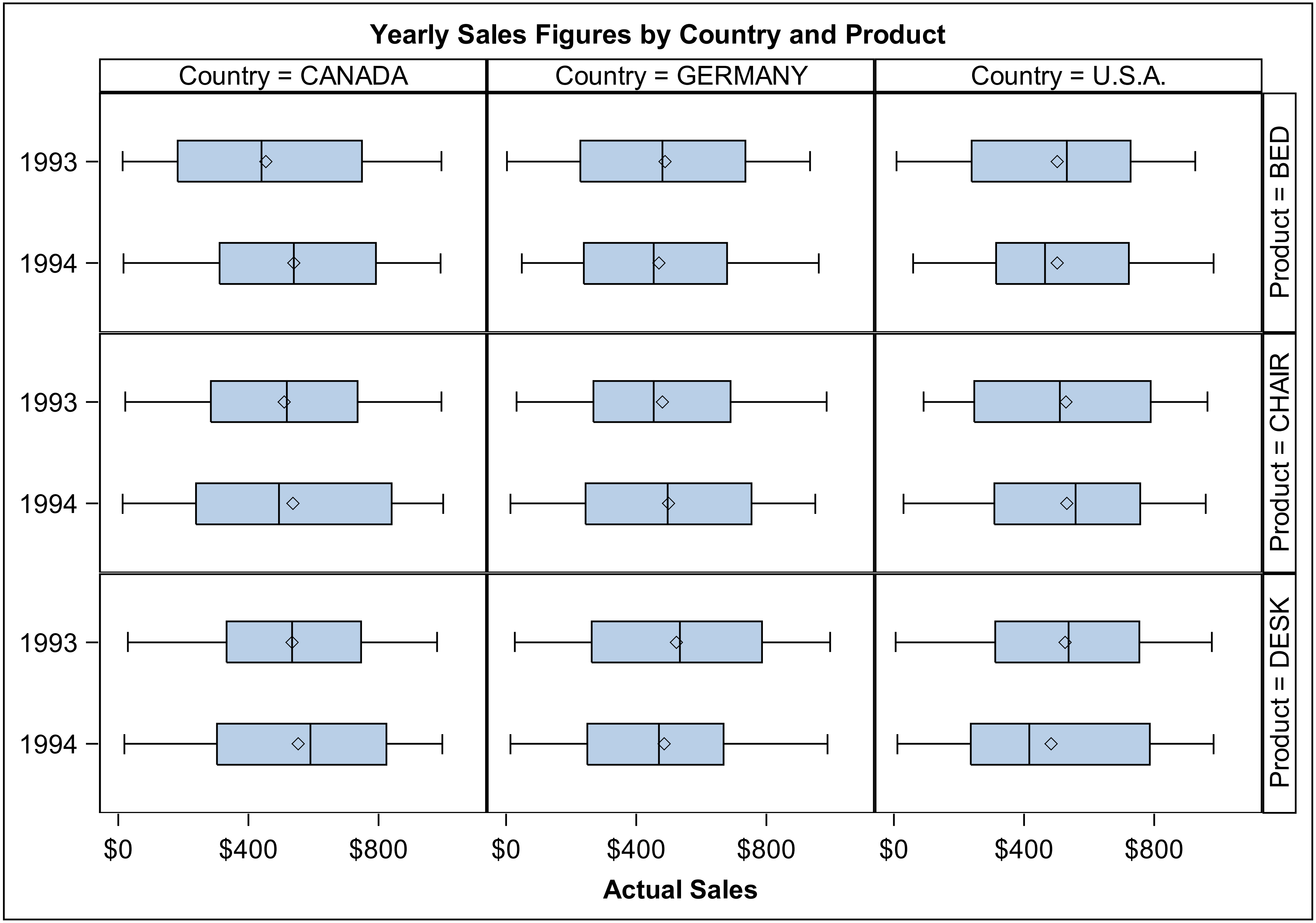


Distribution of Fuel Consumption
Normal
Kernel
Percent
0
10
20
30
40
50
60
0
20
40
60
MPG (City)

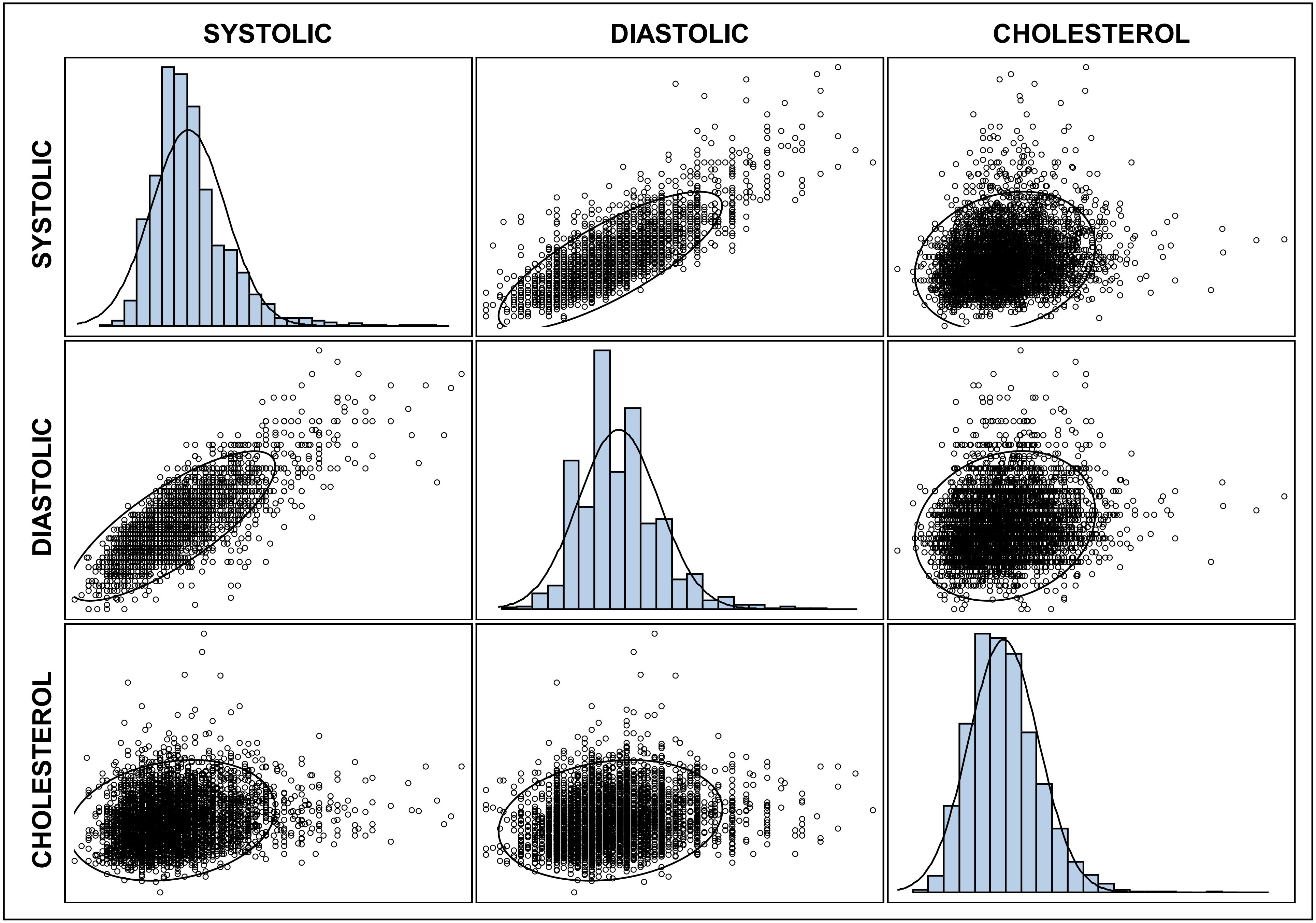
```
PROC TEMPLATE;
DEFINE STATGRAPH simplepie;
BEGINGRAPH;
ENTRYTITLE "SGRENDER Pie Chart" ;
LAYOUT REGION;
PIECHART CATEGORY=ORIGIN /
DATALABELLOCATION=INSIDE datalabelattrs=(size=15);
ENDLAYOUT;
ENDGRAPH;
END;
RUN;
PROC SGRENDER DATA=sashelp.cars
TEMPLATE=simplepie;
RUN;
```


SGRENDER Pie Chart
Asia
158
Europe
123
USA
147

```
title "Yearly Sales Figures by Country and Product";
proc sgpanel data=sashelp.prdsale;
where product in ("BED","CHAIR","DESK");
panelby country product/
layout=lattice;
hbox actual/
category=year;
rowaxis  display=(nolabel);
run;quit;
```

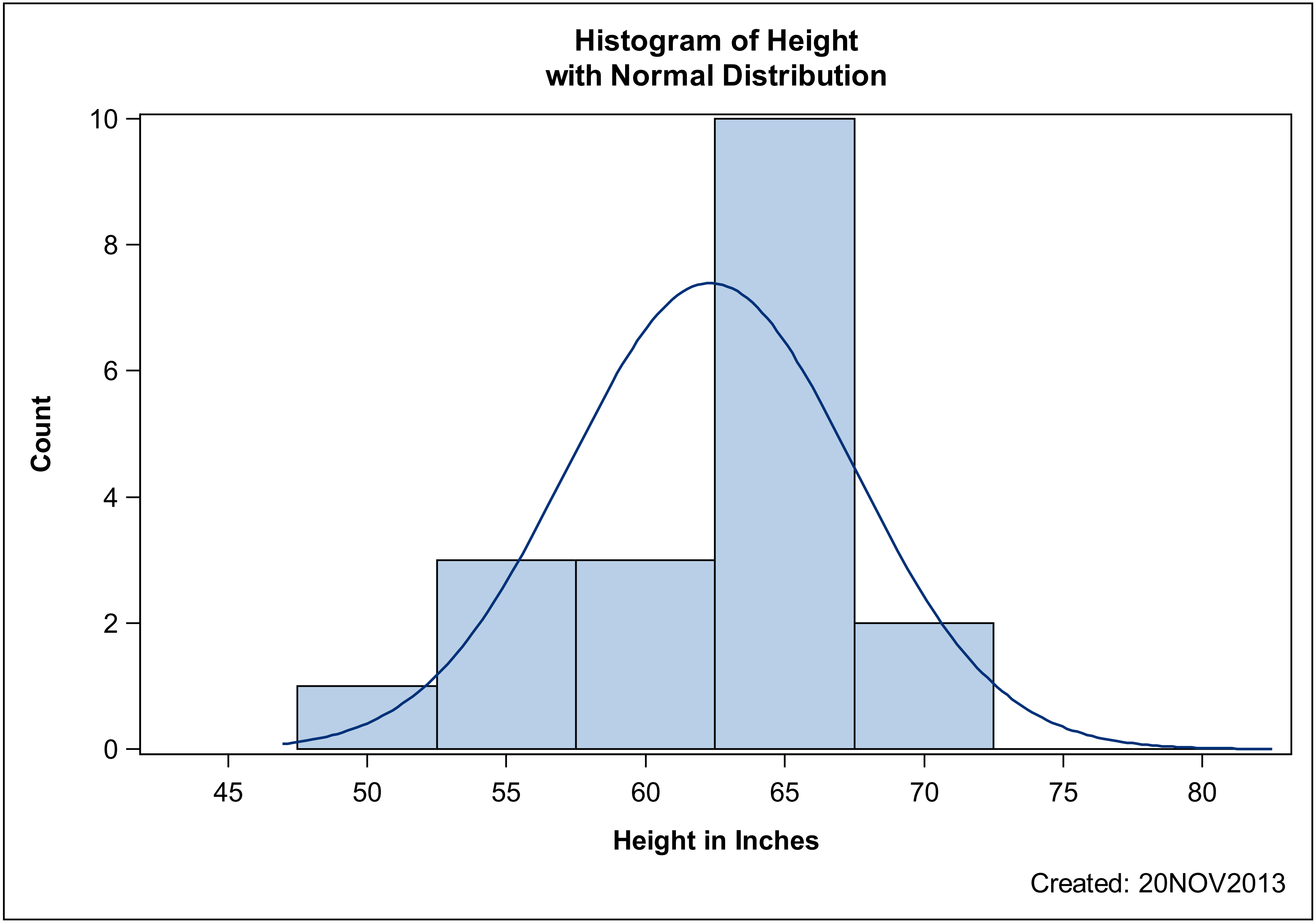

Yearly Sales Figures by Country and Product
Country = CANADA
Country = GERMANY
Country = U.S.A.
Product = BED
Product = CHAIR
Product = DESK
1993
1994
1993
1994
1993
1994
$0
$400
$800
$0
$400
$800
$0
$400
$800
Actual Sales

```
proc sgscatter data=sashelp.heart;
matrix systolic diastolic
cholesterol /
ellipse=(alpha=0.05 type=predicted)
diagonal=(histogram normal);
run;quit;
```


SYSTOLIC
DIASTOLIC
CHOLESTEROL
SYSTOLIC
DIASTOLIC
CHOLESTEROL

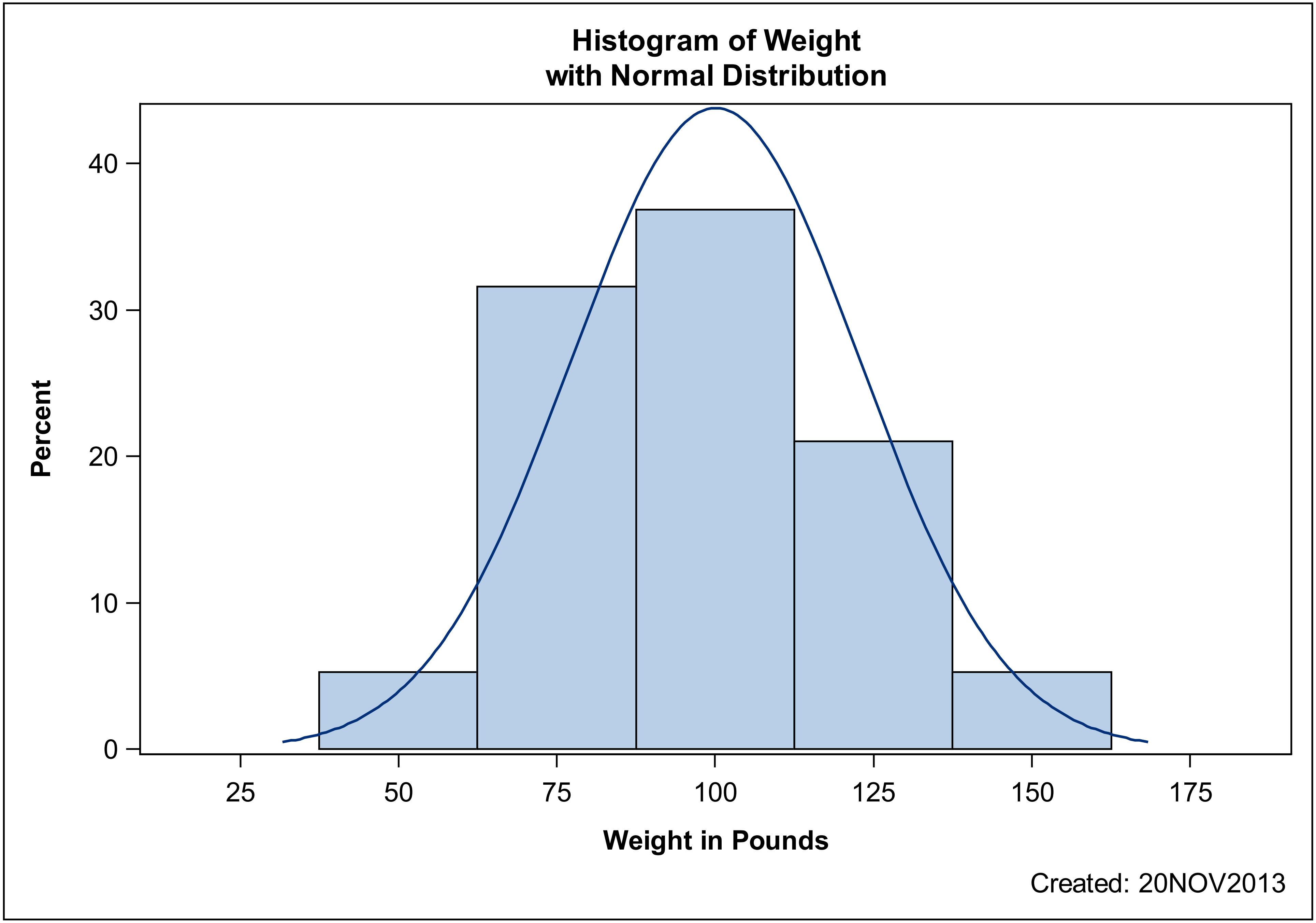
```
proc template;
define statgraph dynamics;
begingraph;
mvar SYSDATE9 SCALE;
nmvar BINS;
dynamic VAR VARLABEL;
entrytitle "Histogram of " VAR;
entrytitle "with Normal Distribution";
layout overlay / xaxisopts=(label=VARLABEL);
histogram VAR / scale=SCALE nbins=BINS;
densityplot VAR / normal();
endlayout;
entryfootnote halign=right "Created: " SYSDATE9 / textattrs=GraphValueText;
endgraph;
end;
run;quit;
```

```
let bins=7;
let scale=count;
proc sgrender data=sashelp.class template=dynamics;
dynamic var="Height" varlabel="Height in Inches";
run;quit;
```



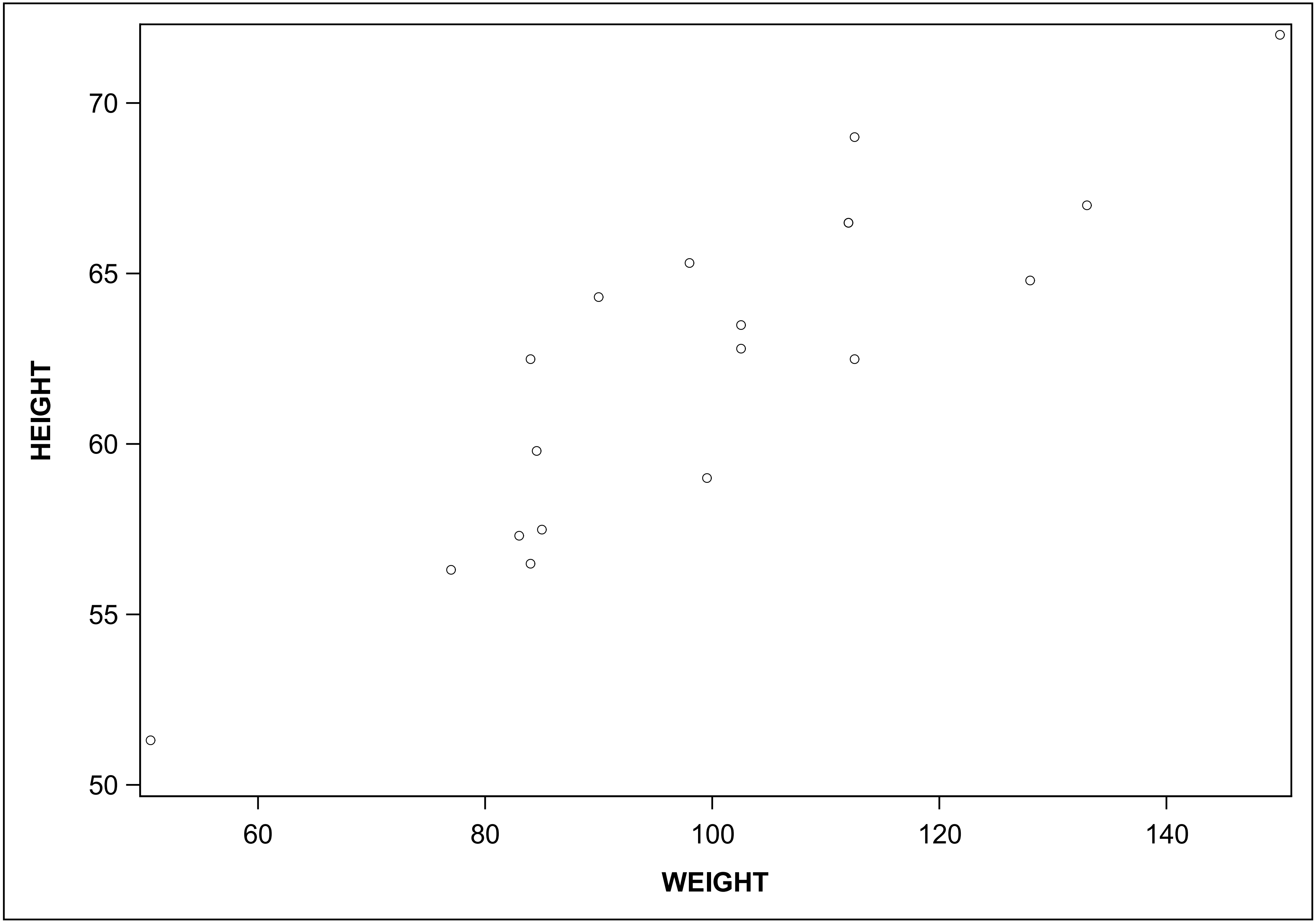
Histogram of Height
with Normal Distribution
Count
10
8
6
4
2
0
45
50
55
60
65
70
75
80
Height in Inches
Created: 20NOV2013

```
let bins=5;
let scale=percent;
proc sgrender data=sashelp.class template=dynamics;
dynamic var="Weight" varlabel="Weight in Pounds";
run;quit;
```


Histogram of Weight
with Normal Distribution
Percent
0
10
20
30
40
25
50
75
100
125
150
175
Weight in Pounds
Created: 20NOV2013

```
proc template;
define style myfont;
parent=styles.default;
style GraphFonts /
"GraphDataFont" = ("Helvetica",6pt)
"GraphUnicodeFont" = ("Helvetica",6pt)
"GraphValueFont" = ("Helvetica",16pt)
"GraphLabelFont" = ("Helvetica",8pt,bold)
"GraphFootnoteFont" = ("Helvetica",6pt,bold)
"GraphTitleFont" = ("Helvetica",6pt,bold)
"GraphAnnoFont" = ("Helvetica",6pt);
end;
run;quit;
```

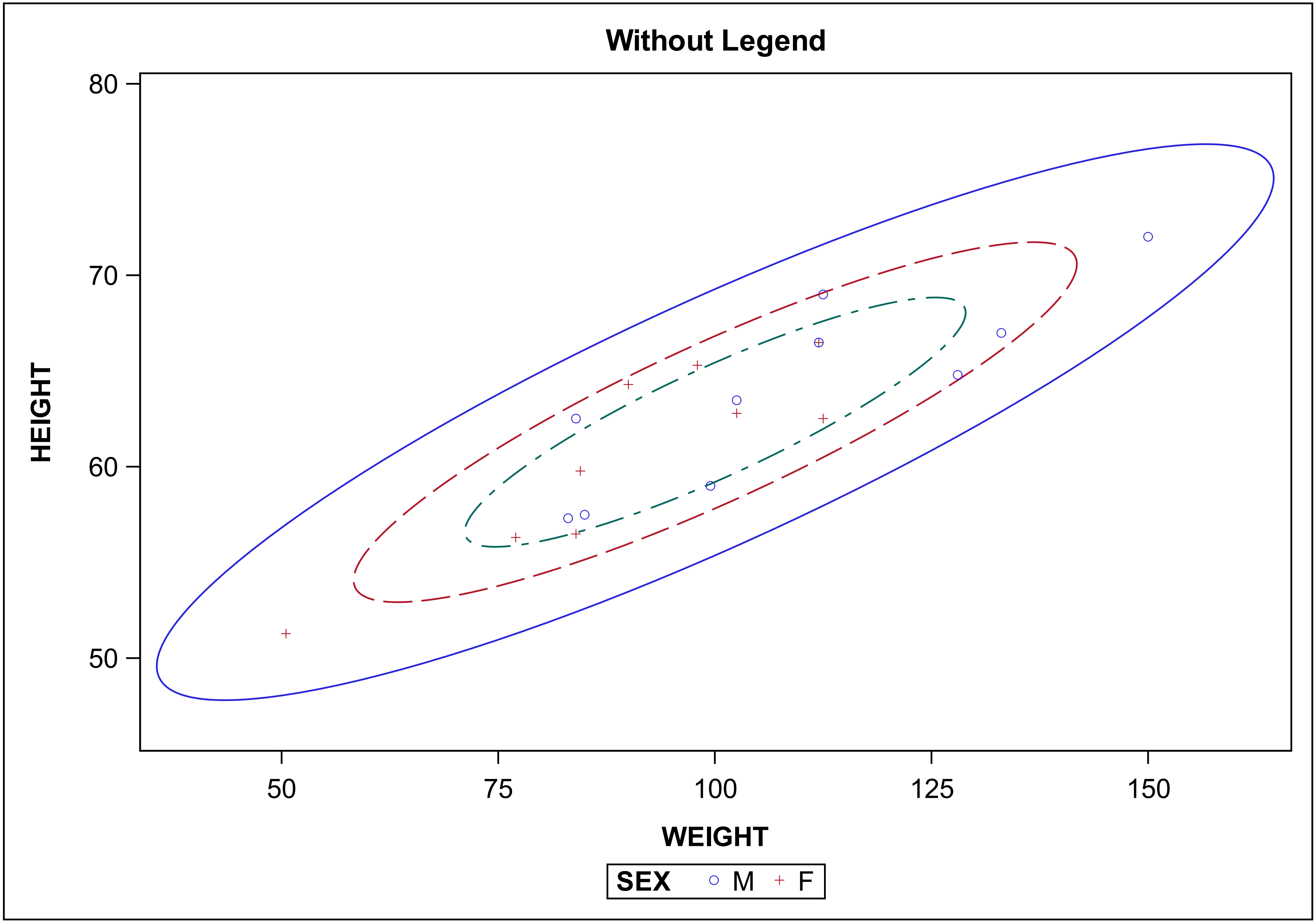
```
proc sgplot data=sashelp.class;
scatter x=weight y=height;
run;quit;
```


HEIGHT
70
65
60
55
50
60
80
100
120
140
WEIGHT

example-> 080

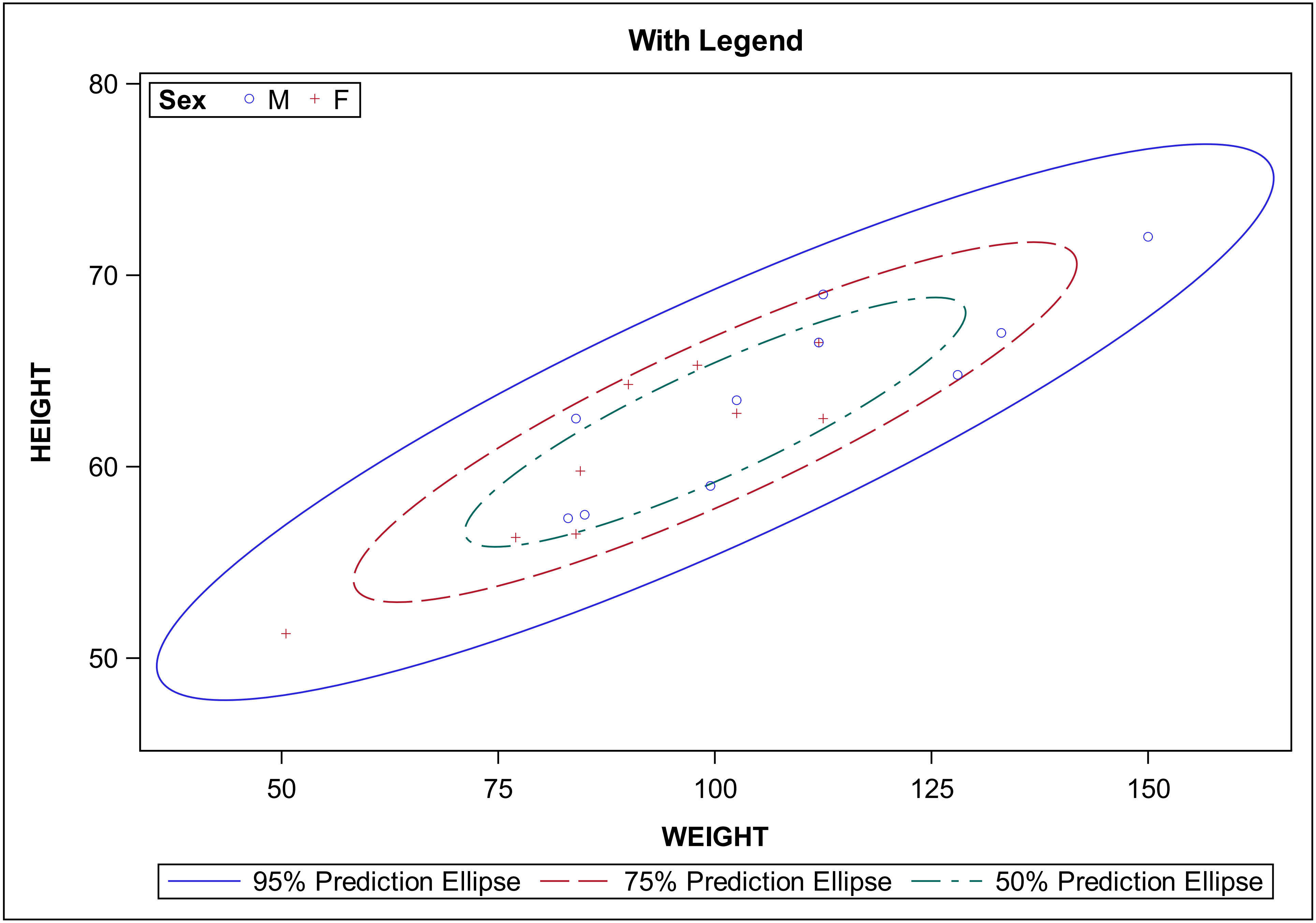
Advanced 1

```
proc sgplot data=sashelp.class;
title "Without Legend";
ellipse x=weight y=height / alpha=0.05;
ellipse x=weight y=height / alpha=0.25;
ellipse x=weight y=height / alpha=0.5;
scatter x=weight y=height / group=sex;
run;quit;
```

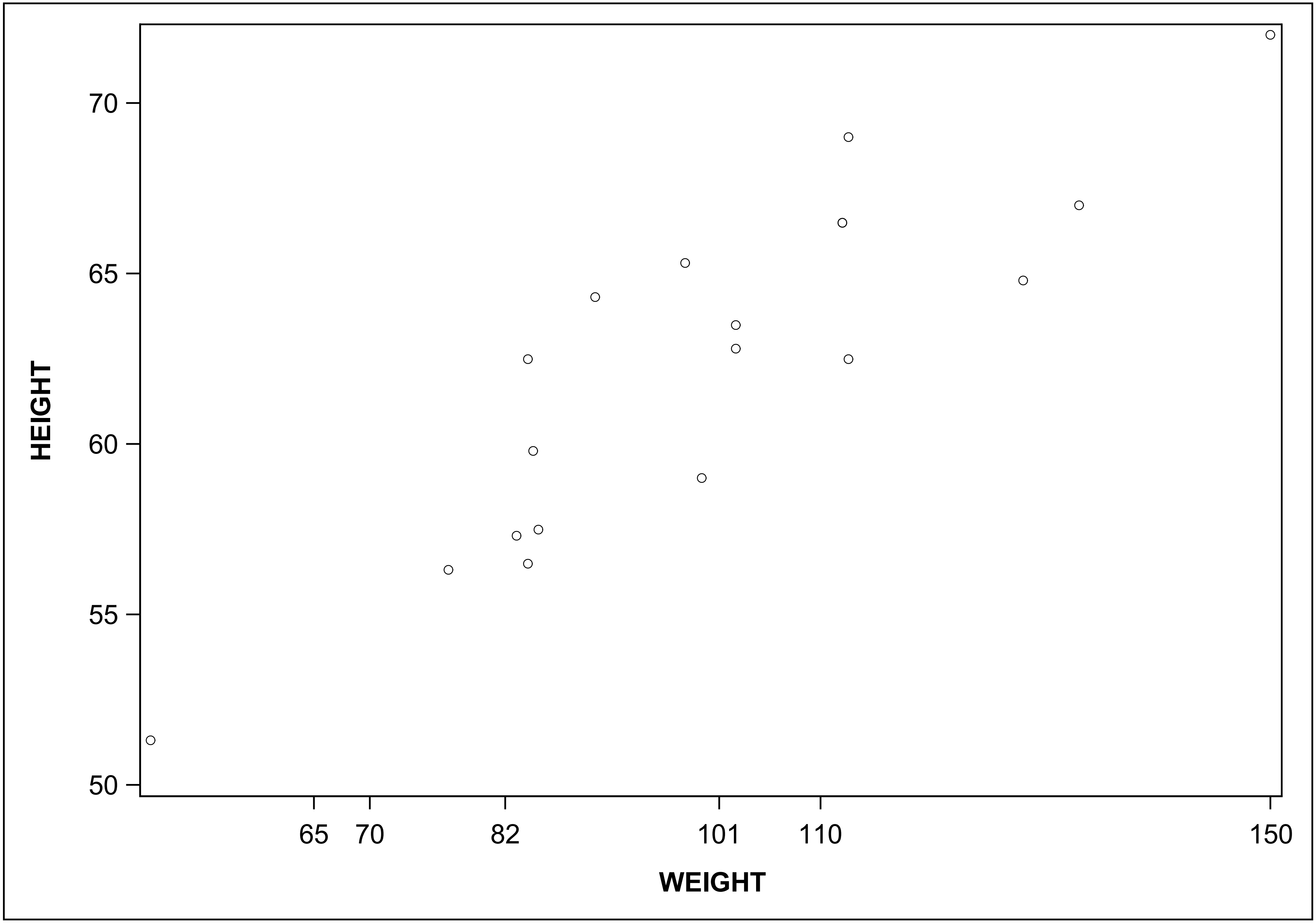


Without Legend
80
70
60
50
HEIGHT
50
75
100
125
150
WEIGHT
SEX M F

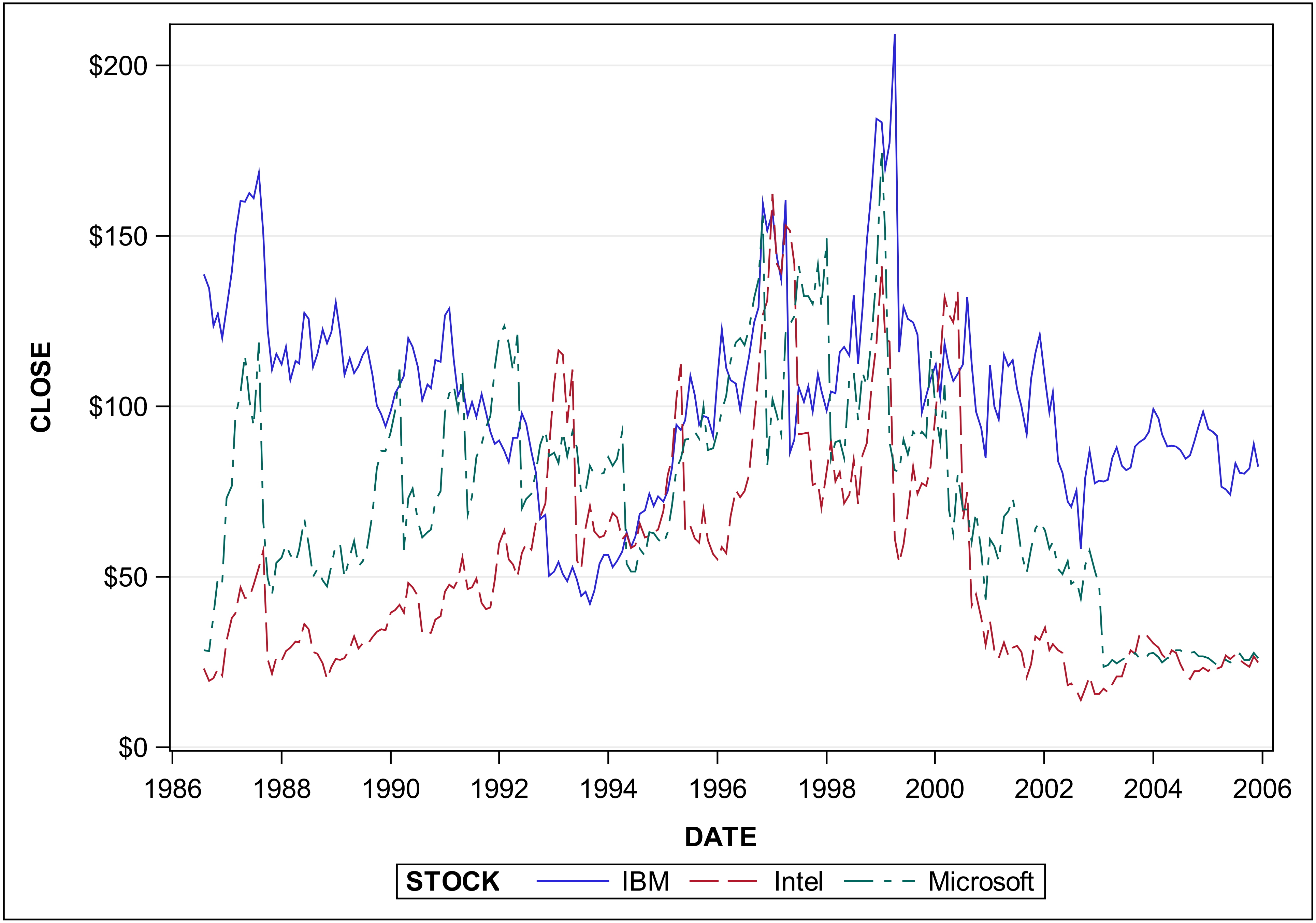
```
proc sgplot data=sashelp.class;
title "With Legend";
ellipse x=weight y=height / alpha=0.05 name="e1";
ellipse x=weight y=height / alpha=0.25 name="e2";
ellipse x=weight y=height / alpha=0.5 name="e3";
scatter x=weight y=height / group=sex name="s1";
keylegend "e1" "e2" "e3";
keylegend "s1" / location=inside position=topleft title="Sex";
run;
```


With Legend
Sex M F
80
70
60
50
HEIGHT
50
75
100
125
150
WEIGHT
95% Prediction Ellipse
75% Prediction Ellipse
50% Prediction Ellipse

```
proc sgplot data=sashelp.class;
xaxis values=(65,70,82,101,110,150) valueshint;
scatter x=weight y=height;
run;
```

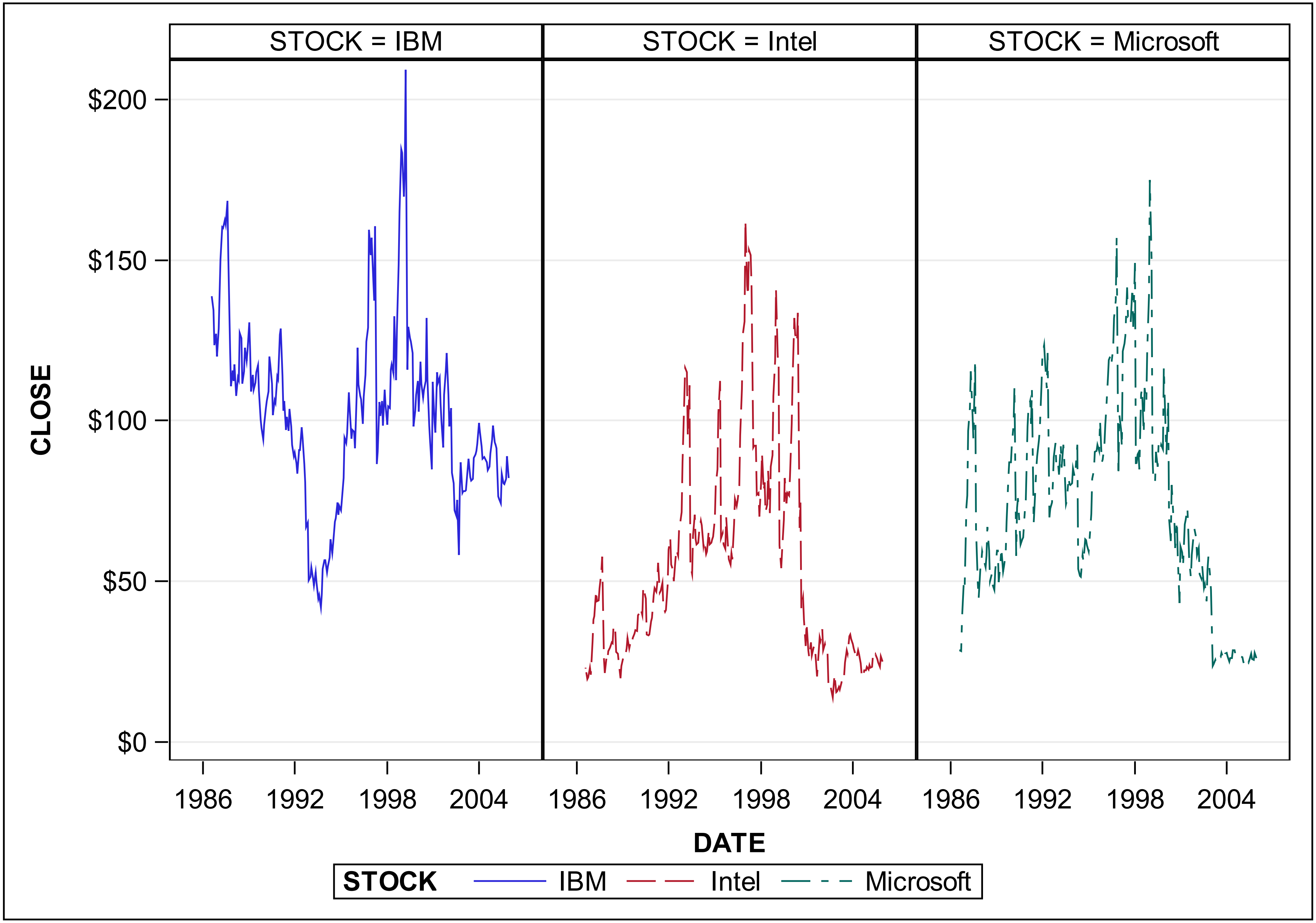

70
65
60
55
50
HEIGHT
65
70
82
101
110
150
WEIGHT

```
proc sgplot data=sashelp.stocks;
yaxis grid;
series x=date y=close / group=stock;
run;quit;
```



$200
$150
$100
$50
$0
CLOSE
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
DATE
STOCK
IBM
Intel
Microsoft

```
proc sgpanel data=sashelp.stocks;
panelby stock / rows=1;
rowaxis grid;
series x=date y=close / group=stock;
run;quit;
```

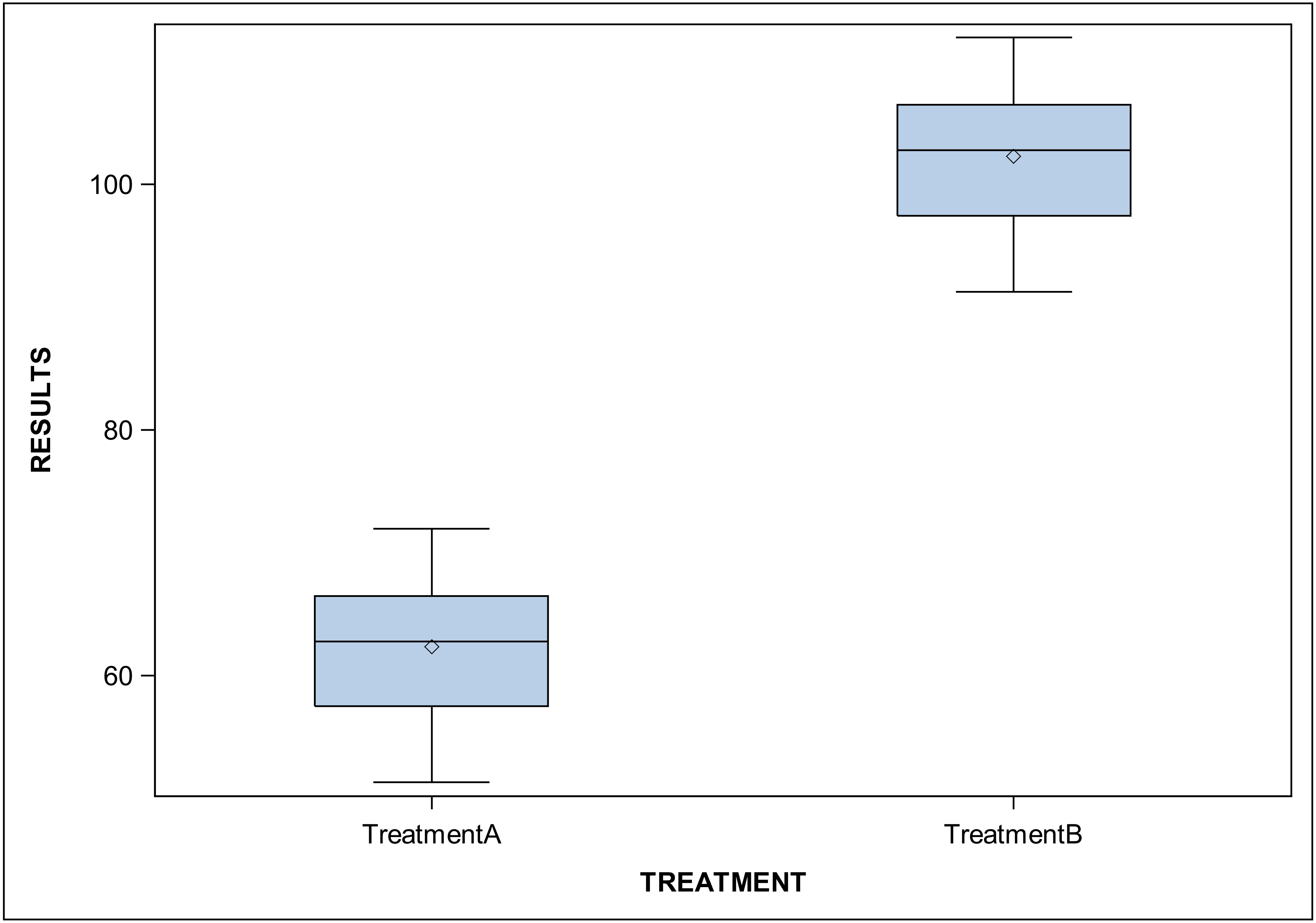


STOCK = IBM
STOCK = Intel
STOCK = Microsoft
$200
$150
$100
$50
$0
CLOSE
1986
1992
1998
2004
1986
1992
1998
2004
1986
1992
1998
2004
DATE
STOCK
IBM
Intel
Microsoft

```
example-> 090
```

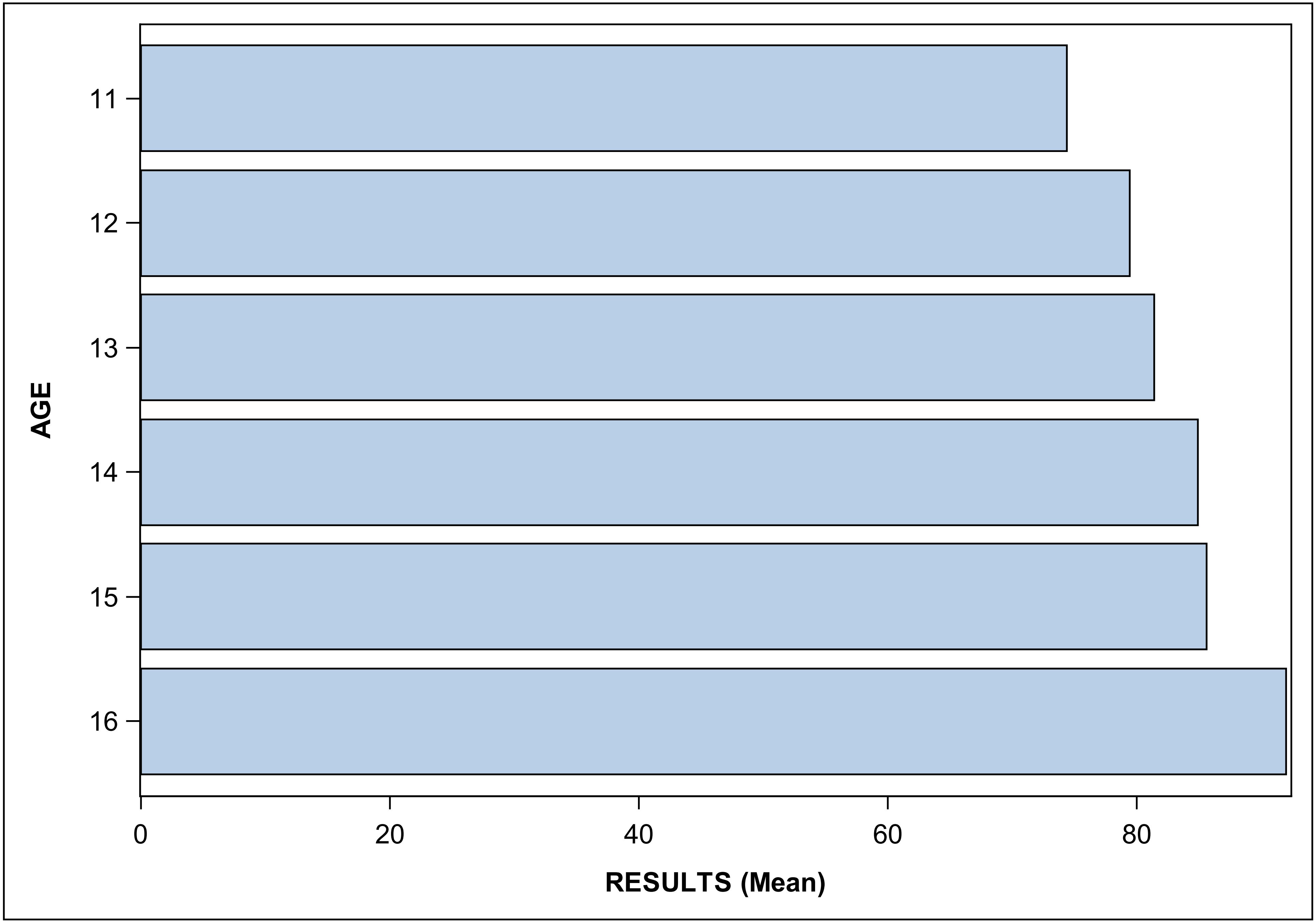
Advanced 2

```
proc sgplot data=boxplots;
vbox results / category=treatment;
run;quit;
```



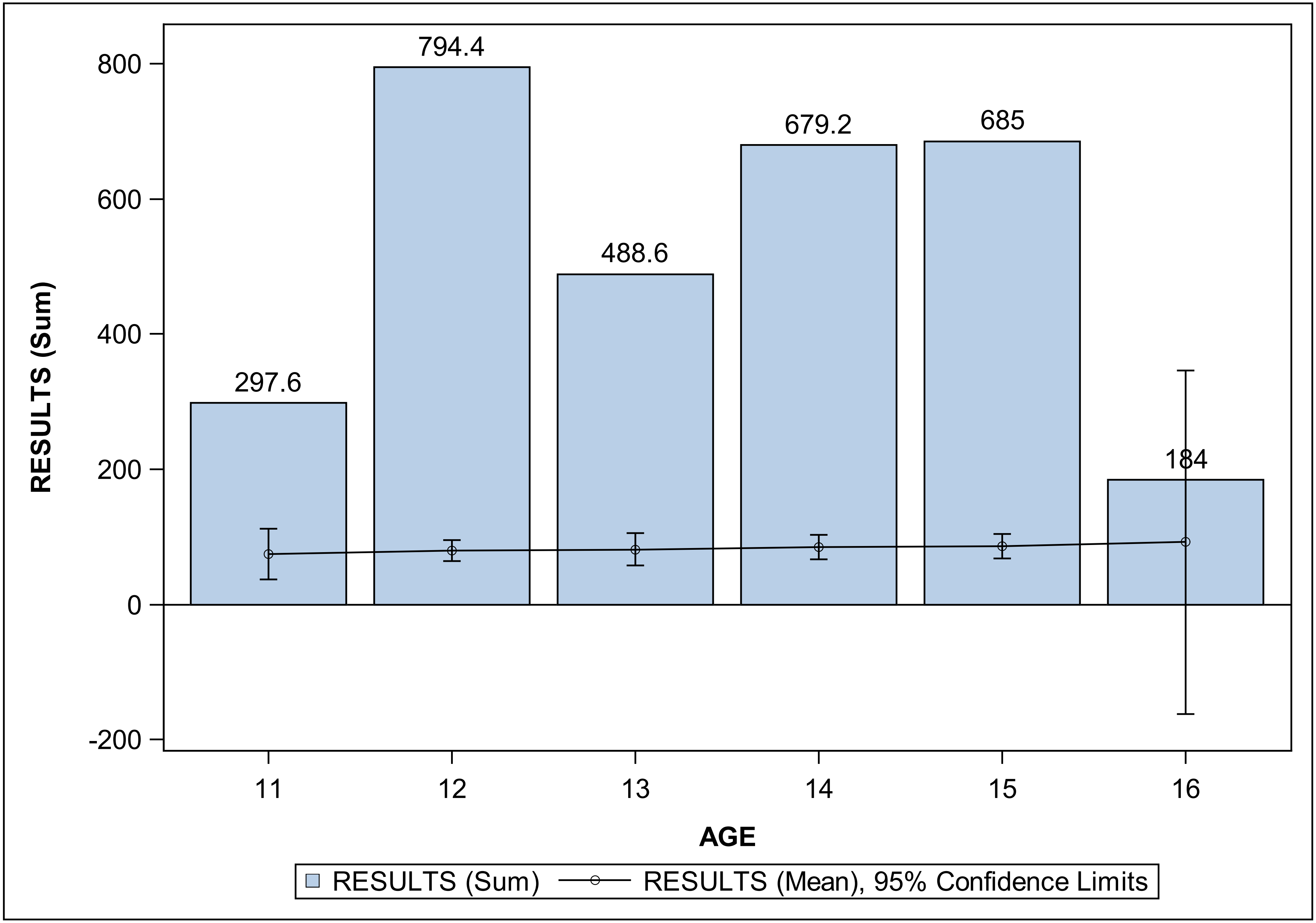
100
80
60
RESULTS
TreatmentA
TreatmentB
TREATMENT

```
proc sgplot data=boxplots;
hbar age / response=results stat=mean;
run;quit;
```



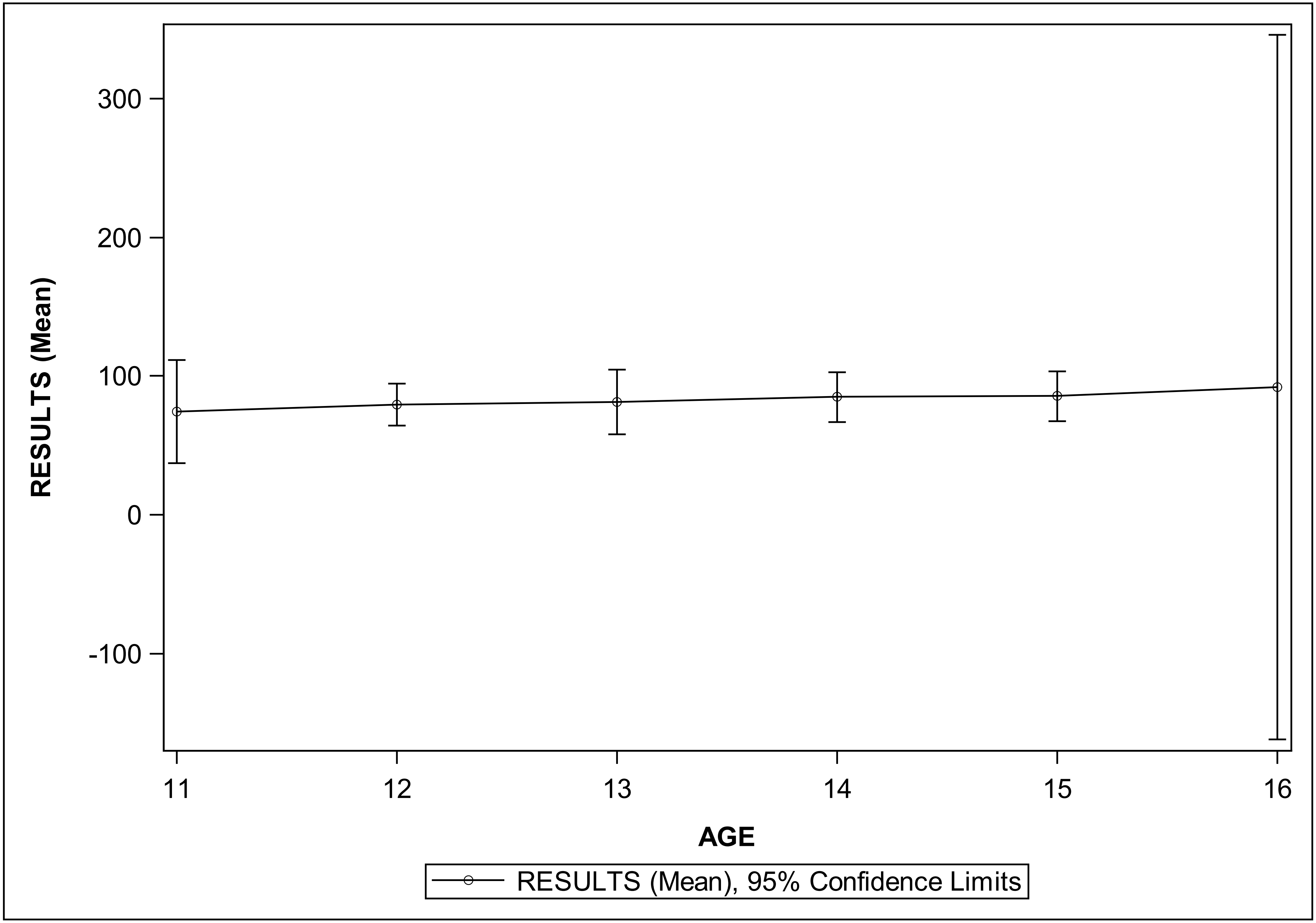
AGE
11
12
13
14
15
16
0
20
40
60
80
RESULTS (Mean)

```
proc sgplot data=boxplots;
vbar age / response=results stat=sum datalabel;
vline age / response=results stat=mean
limitstat=clm markers;
run;quit;
```

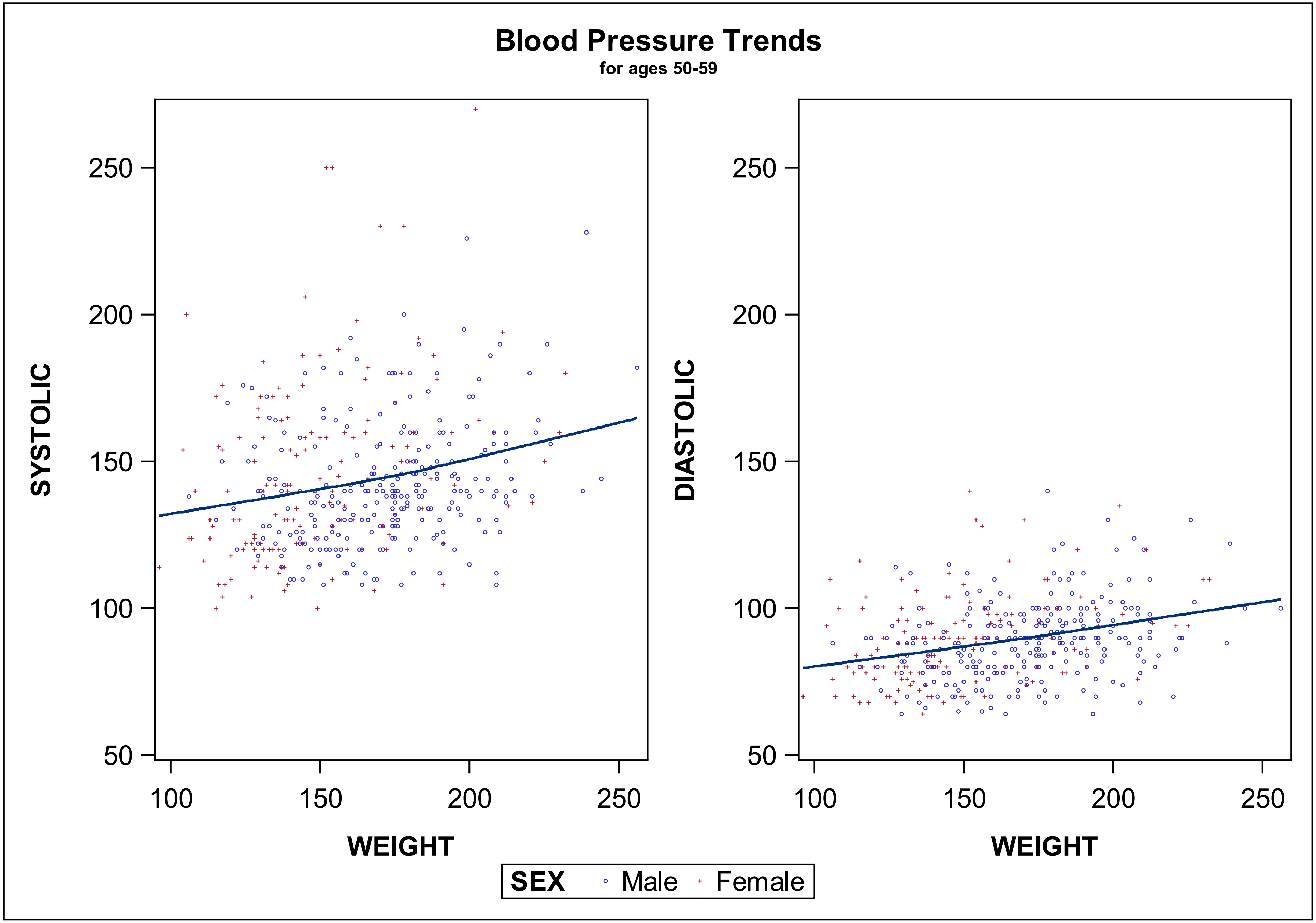


800
600
400
200
0
-200
794.4
679.2
685
488.6
297.6
184
RESULTS (Sum)
11
12
13
14
15
16
AGE
RESULTS (Sum)
RESULTS (Mean), 95% Confidence Limits

```
proc sgplot data=boxplots;
vline age / response=results stat=mean
limitstat=clm markers;
run;quit;
```

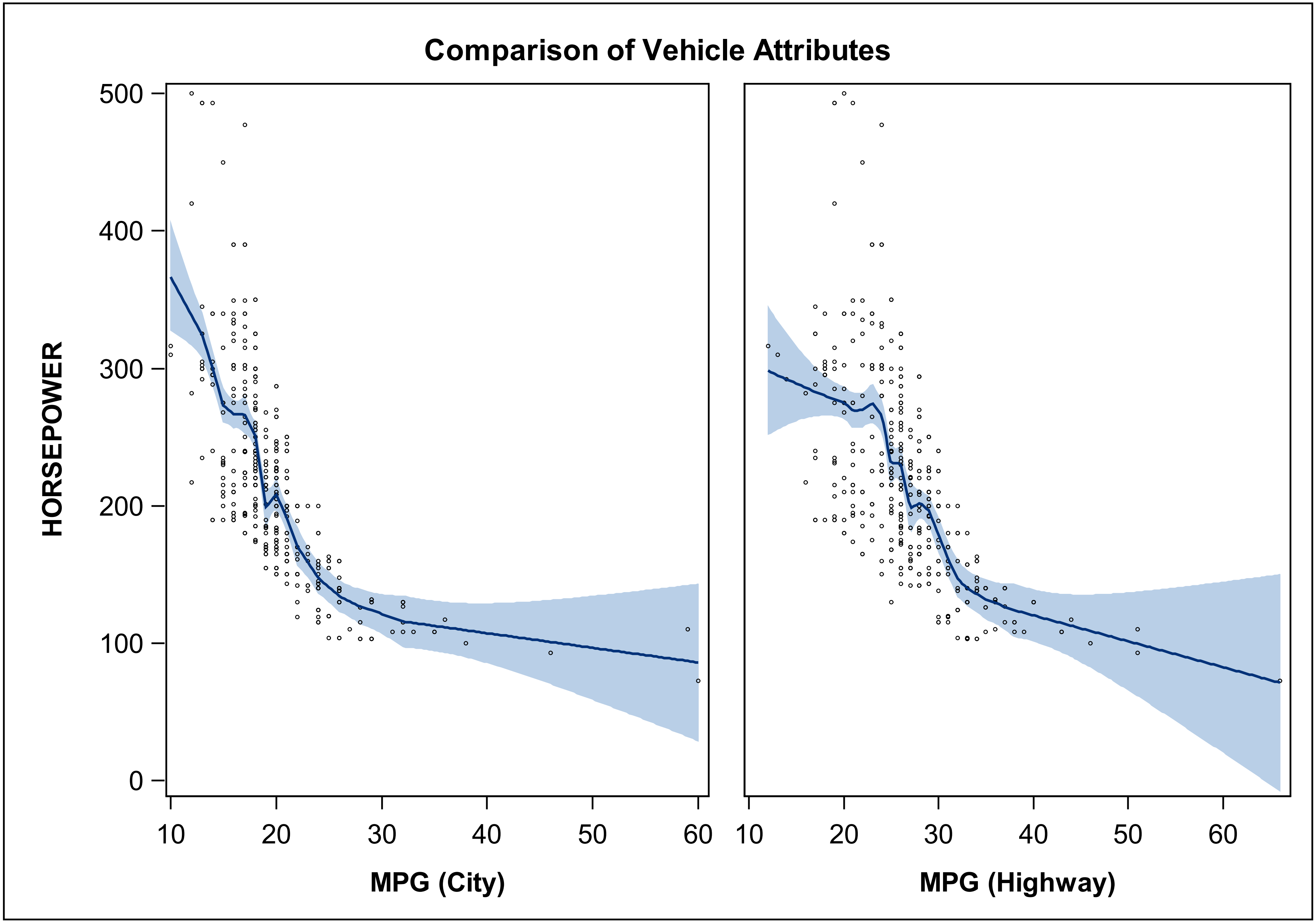

RESULTS (Mean)
300
200
100
0
-100
11
12
13
14
15
16
AGE
RESULTS (Mean), 95% Confidence Limits

```
title1 "Blood Pressure Trends";
title2 h=8pt "for ages 50-59";
proc sgscatter data=sashelp.heart;
where AgeCHDdiag>=50 and AgeCHDdiag<60;
plot (systolic diastolic)*weight / group=sex loess=(nogroup)
uniscale=Y markerattrs=(size=3);
run;
```

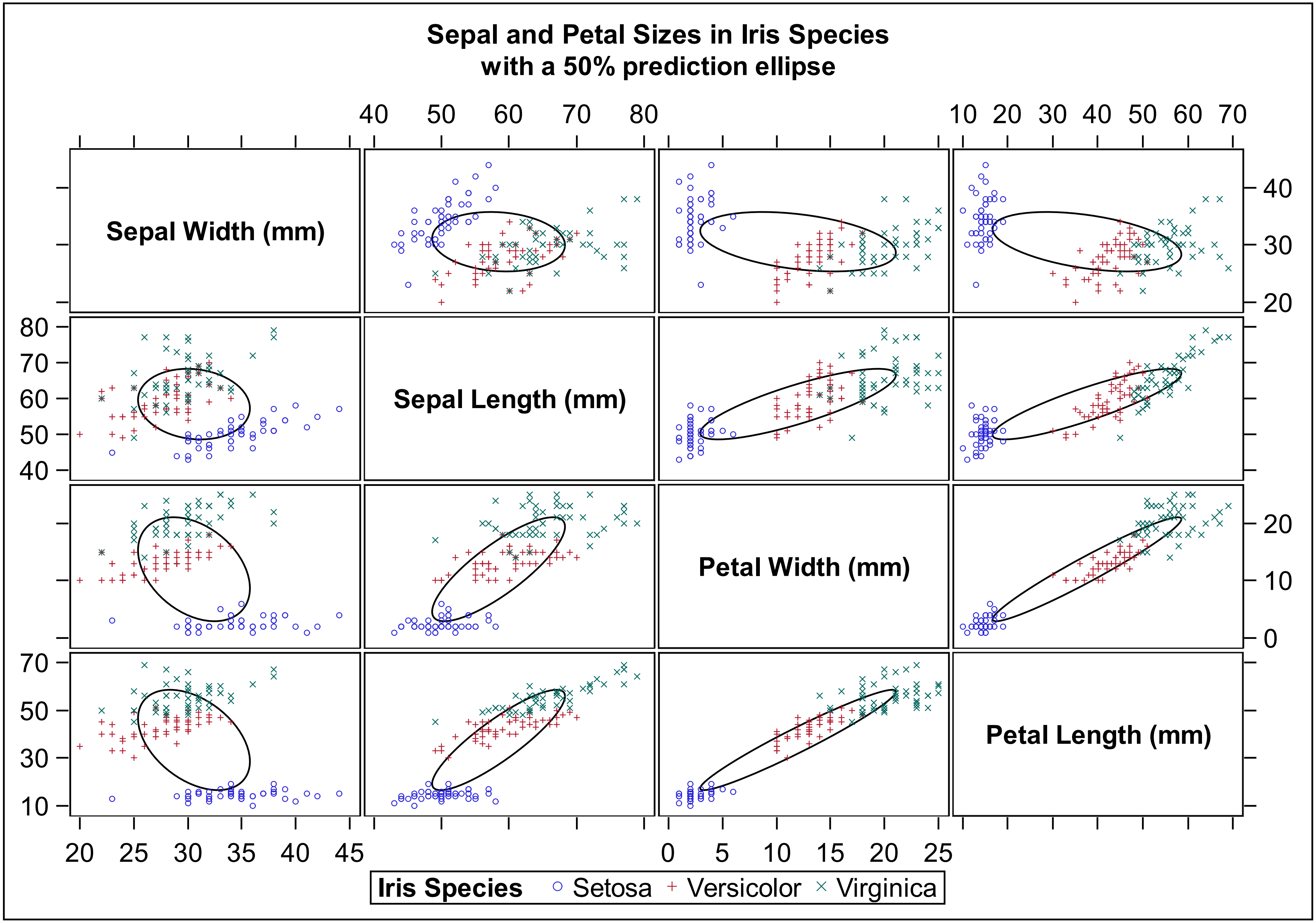


Blood Pressure Trends
for ages 50-59
SYSTOLIC
DIASTOLIC
250
200
150
100
50
100
150
200
250
WEIGHT
WEIGHT
SEX
Male
Female

```
title1 "Comparison of Vehicle Attributes";
proc sgscatter data=sashelp.cars;
compare y=horsepower x=(mpg_city mpg_highway)
/ markerattrs=(size=3) loess=(clm) spacing=10;
run;
```

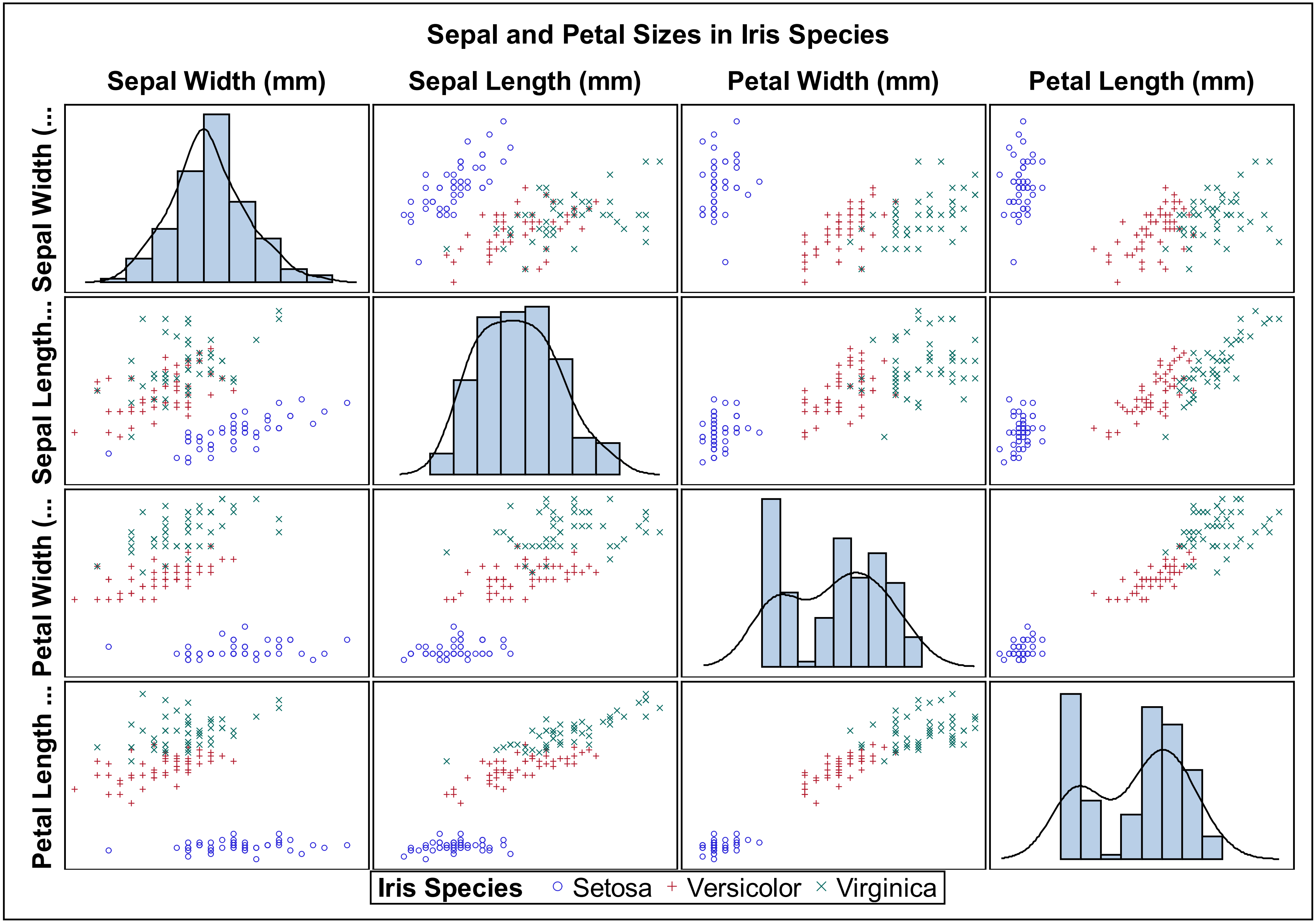

Comparison of Vehicle Attributes
HORSEPOWER
500
400
300
200
100
0
10
20
30
40
50
60
MPG (City)
10
20
30
40
50
60
MPG (Highway)

```
title1 "Sepal and Petal Sizes in Iris Species";
title2 "with a 50% prediction ellipse";
proc sgscatter data=sashelp.iris;
matrix sepalwidth sepallength petalwidth petallength
/ group=species ellipse=(alpha=.5);
run;
```



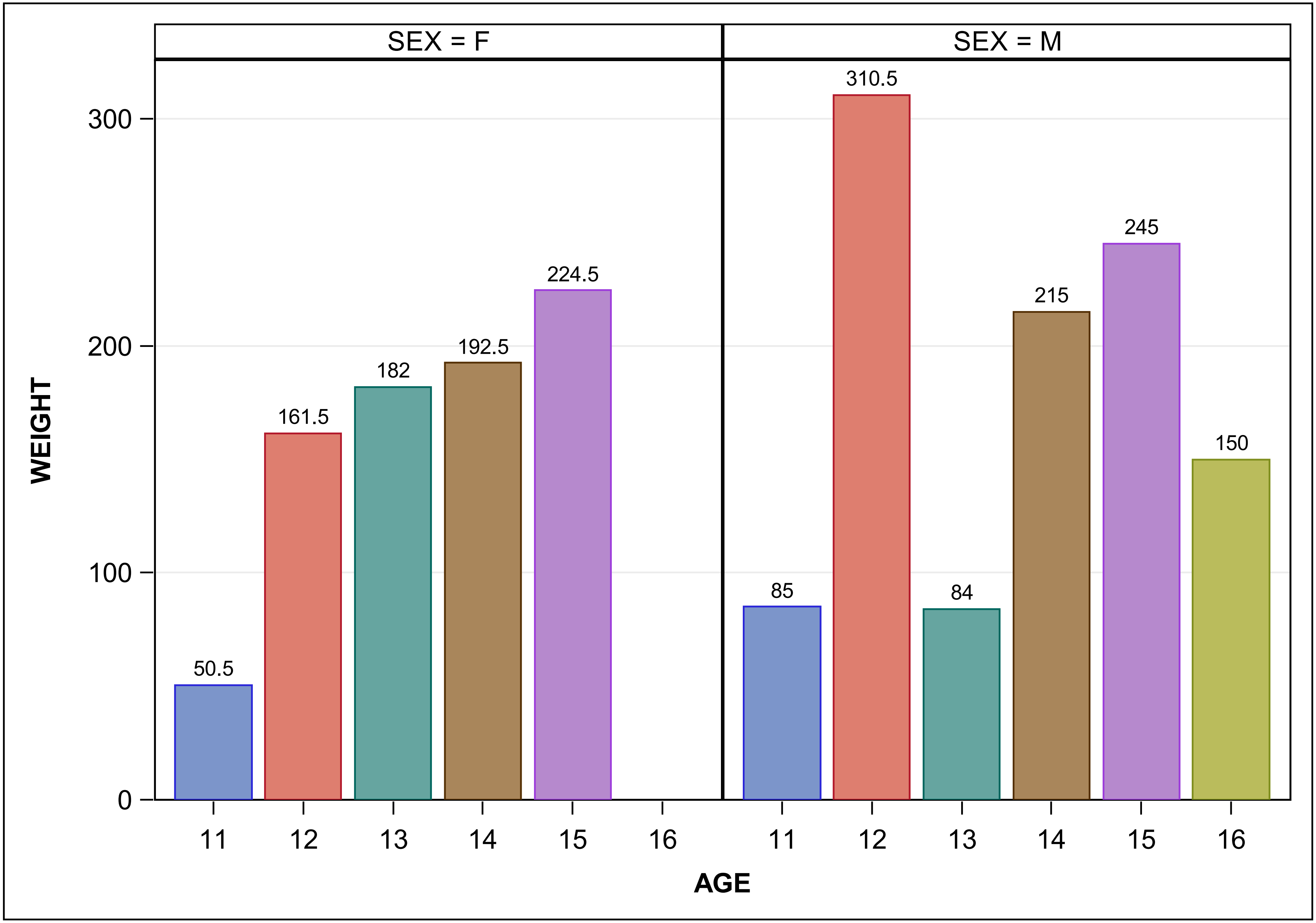
Sepal and Petal Sizes in Iris Species
with a 50% prediction ellipse
Sepal Width (mm)
Sepal Length (mm)
Petal Width (mm)
Petal Length (mm)
Iris Species
Setosa
Versicolor
Virginica

```
title1 "Sepal and Petal Sizes in Iris Species";
proc sgscatter data=sashelp.iris;
matrix sepalwidth sepallength petalwidth
petallength / group=species
diagonal=(histogram kernel);
run;
```

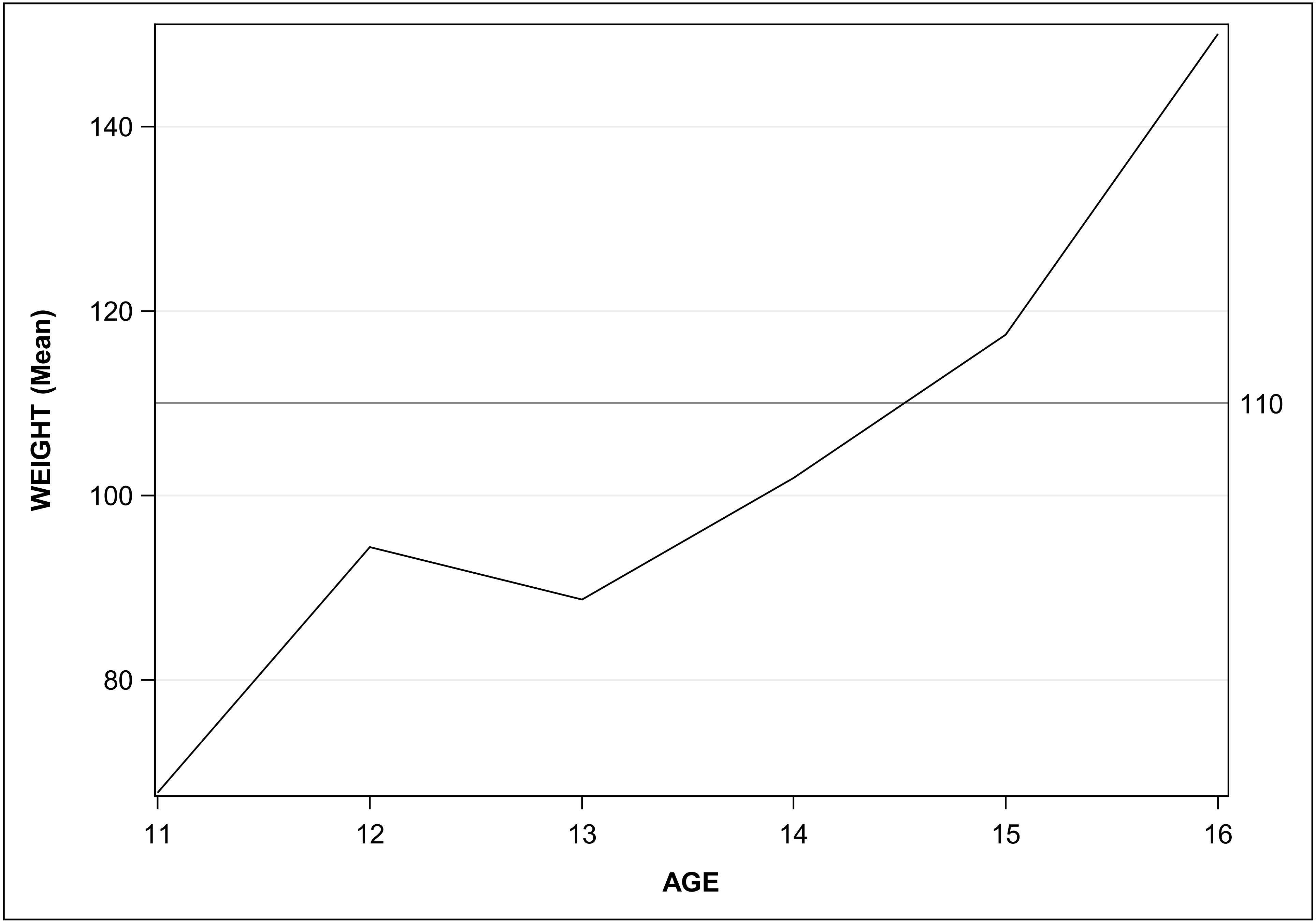


Sepal and Petal Sizes in Iris Species
Sepal Width (mm)
Sepal Length (mm)
Petal Width (mm)
Petal Length (mm)
Sepal Width (...
Sepal Length...
Petal Width (...
Petal Length ...
Iris Species
Setosa
Versicolor
Virginica

```
proc sgpanel data=percent_data
noautolegend;
where percentage ne .;
panelby sex;
rowaxis grid;
vbar age / group=age datalabel
response=percentage
nostatlabel;
run;
```

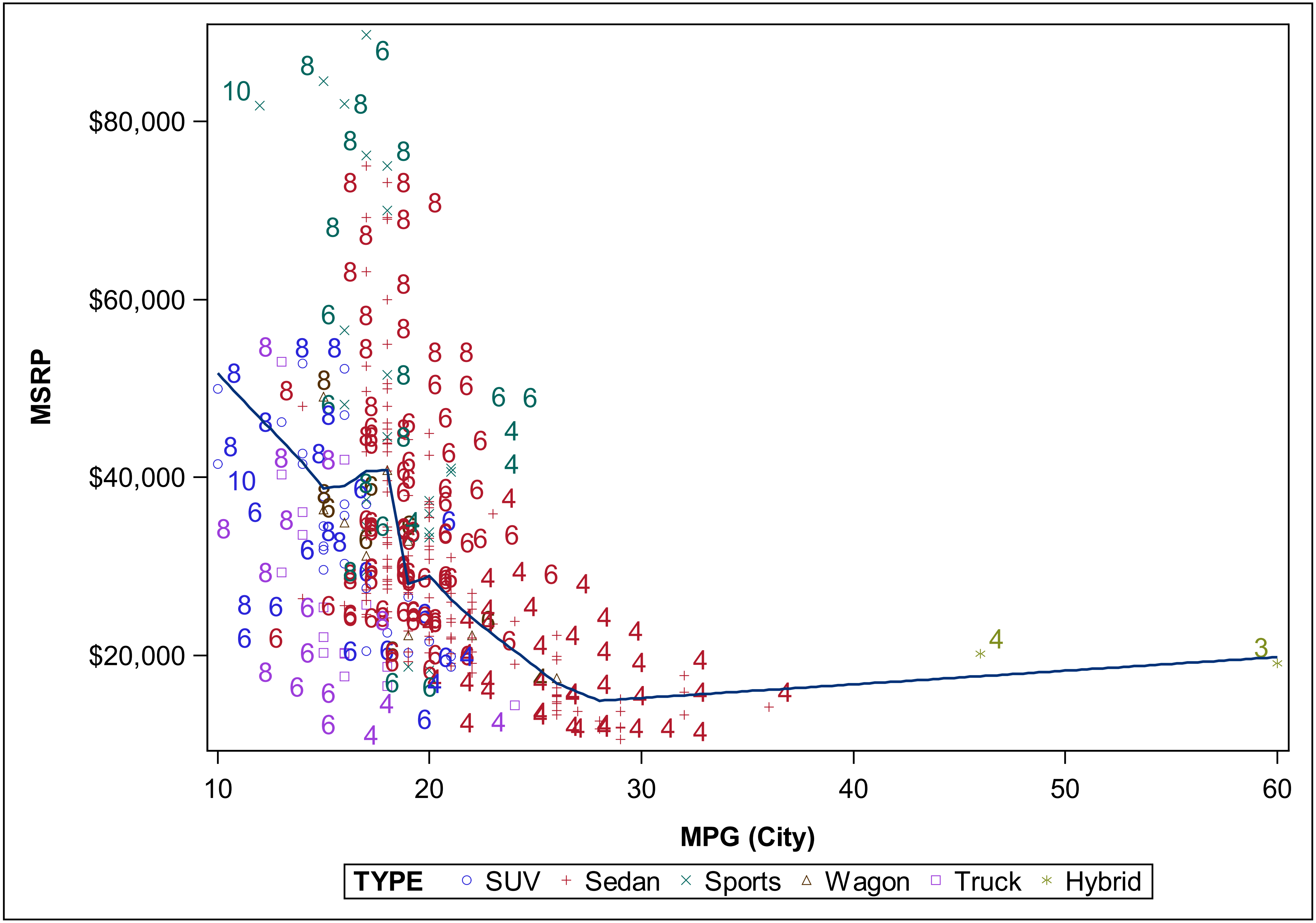

SEX = F
SEX = M
300
200
100
0
WEIGHT
50.5
161.5
182
192.5
224.5
85
310.5
84
215
245
150
11
12
13
14
15
16
11
12
13
14
15
16
AGE

```
proc sgplot data=sashelp.class;
yaxis grid;
refline 110 / label;
vline age / response=weight
stat=mean;
run;
```



WEIGHT (Mean)
140
120
100
80
110
11
12
13
14
15
16
AGE

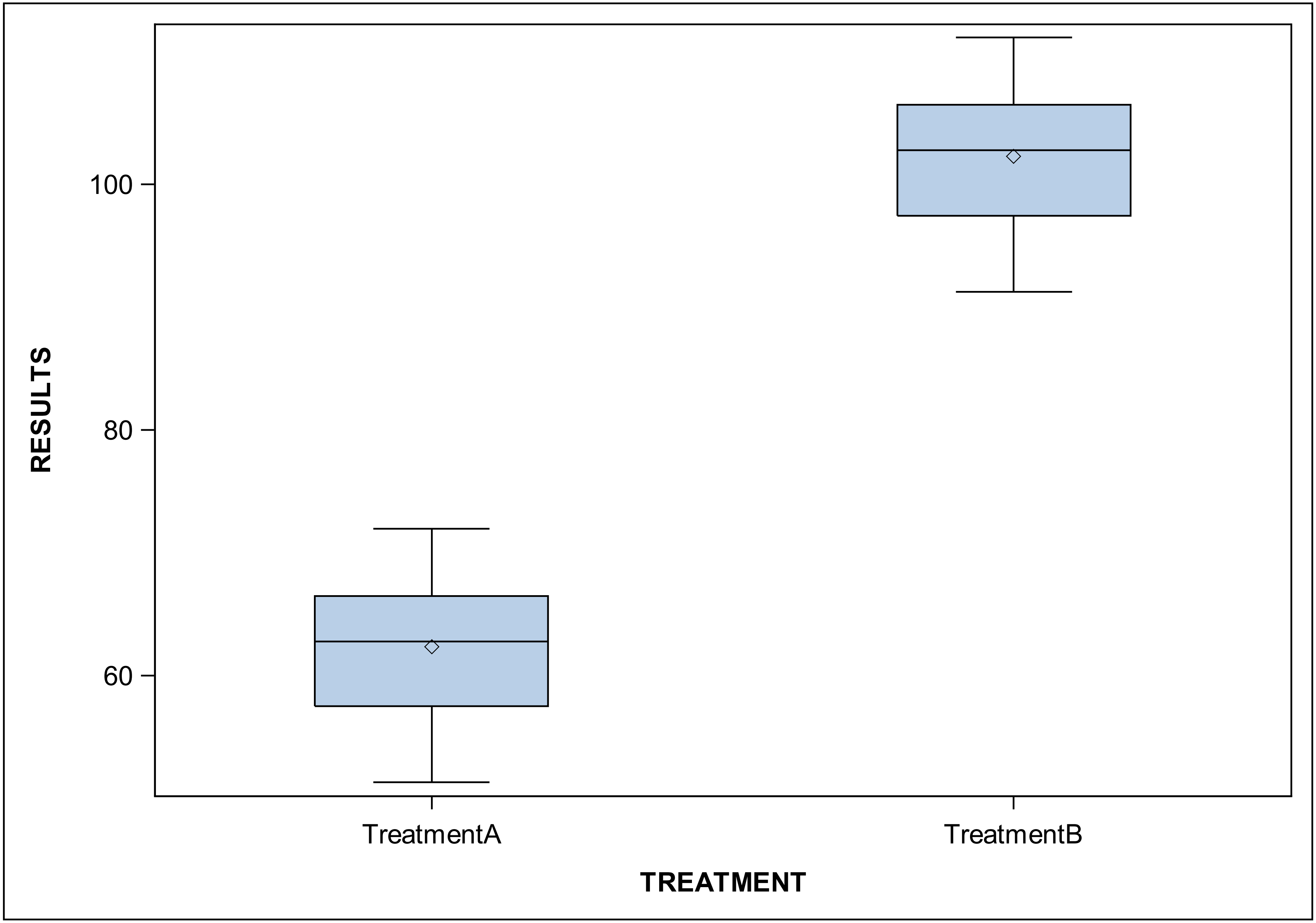
```
proc sgplot data=sashelp.cars;
scatter x=mpg_city y=msrp /
group=type datalabel=model;
loess x=mpg_city y=msrp / nomarkers;
run;
```


MSRP
$80,000
$60,000
$40,000
$20,000
10
20
30
40
50
60
MPG (City)
TYPE
SUV
Sedan
Sports
Wagon
Truck
Hybrid

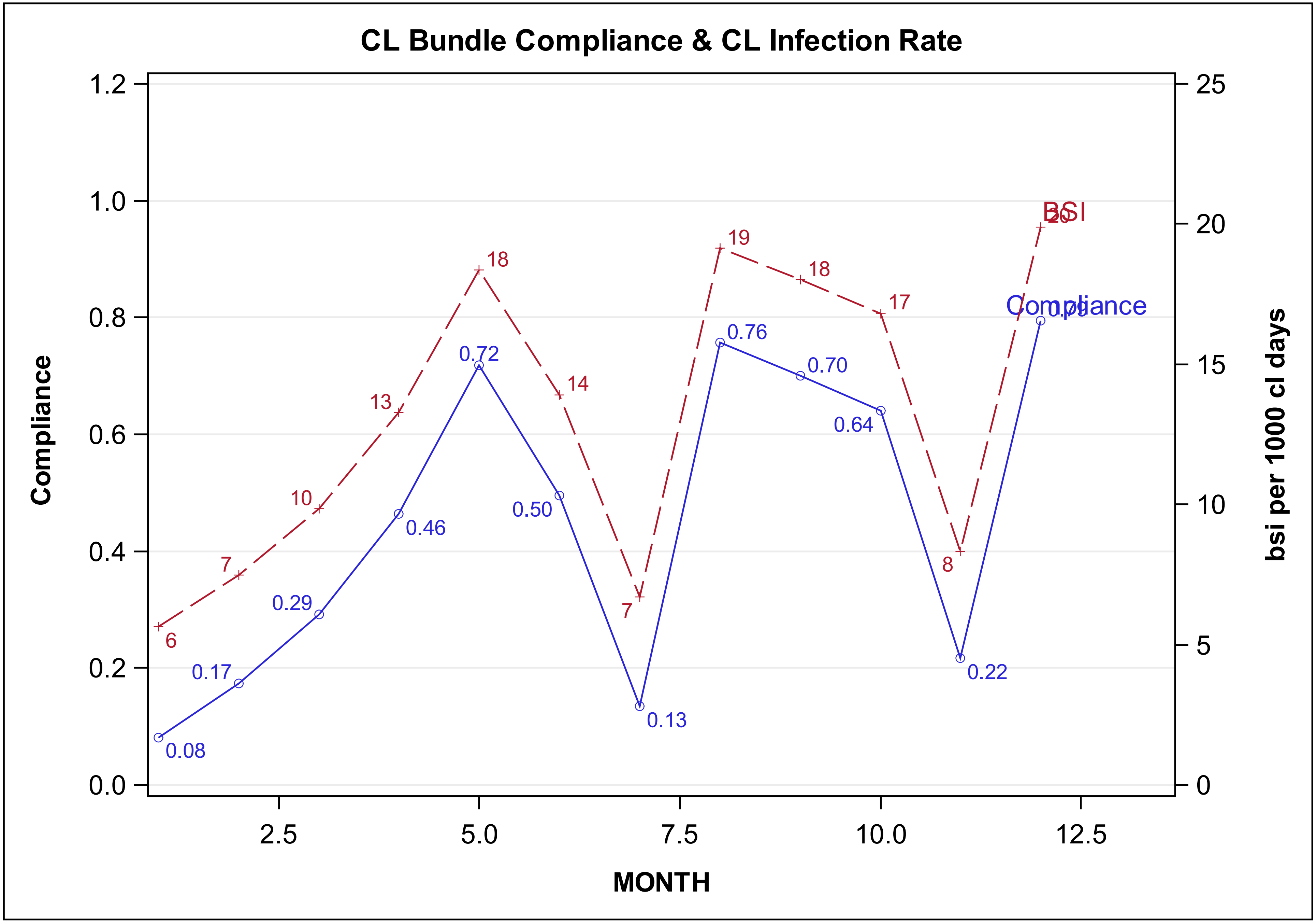
```
example-> 100
```

Advanced 3

```
proc sgplot data=boxplots;
vbox results / category=treatment;
run;quit;
```

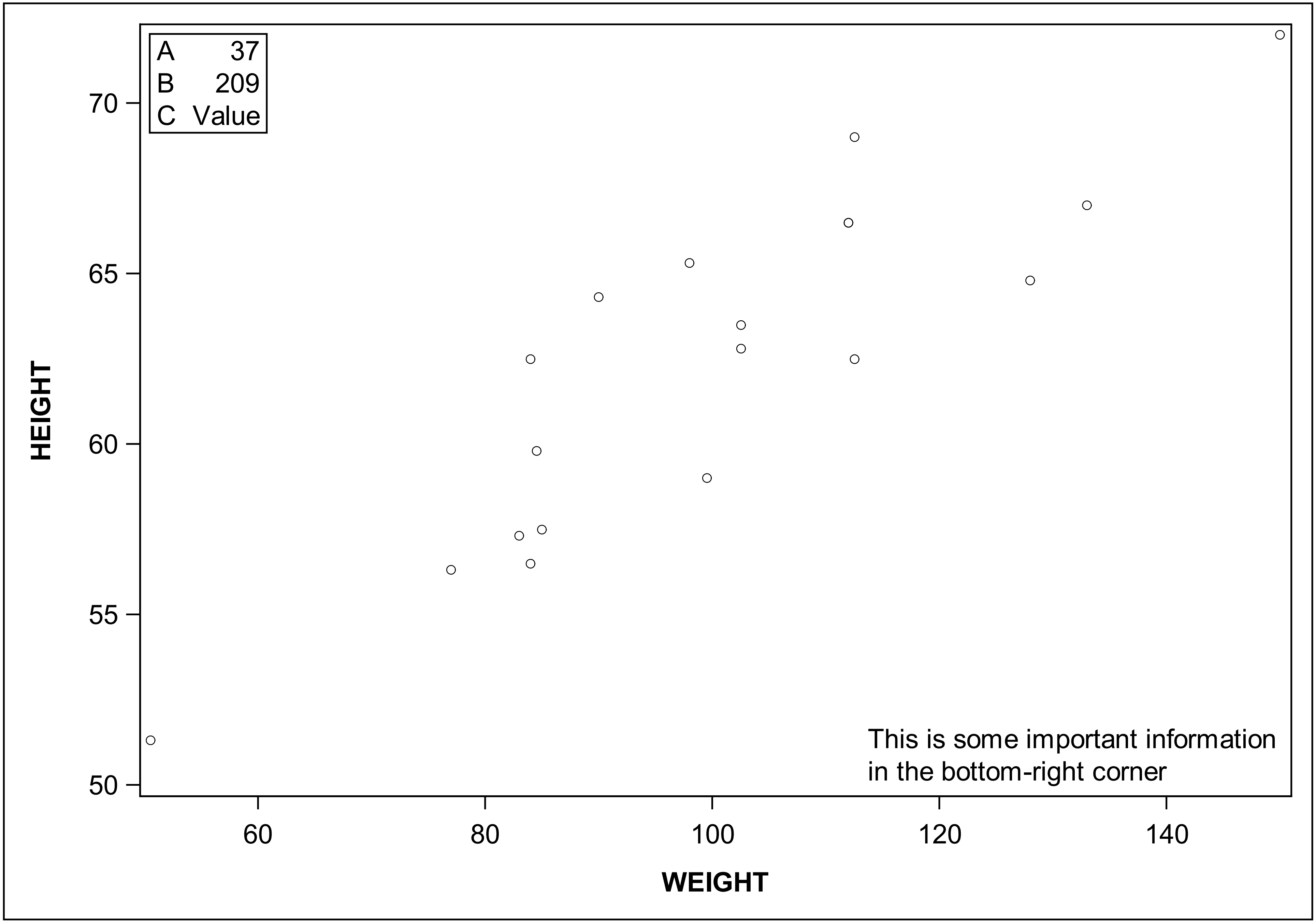

RESULTS
100
80
60
TreatmentA
TreatmentB
TREATMENT

```
title1 "CL Bundle Compliance & CL Infection Rate";
proc sgplot data=compliance;
format bsi 3. compliance 5.2;
series y=Compliance x=month / markers
curvelabel="      Compliance" curvelabelloc=inside datalabel ;
series y=BSI x=month / y2axis markers
curvelabel="      BSI"  curvelabelloc=inside datalabel;
yaxis label=" Compliance" values=(0 to 1.2 by .2) grid;
y2axis label="bsi per 1000 cl days" values=(0 to 25 by 5);
run;
```



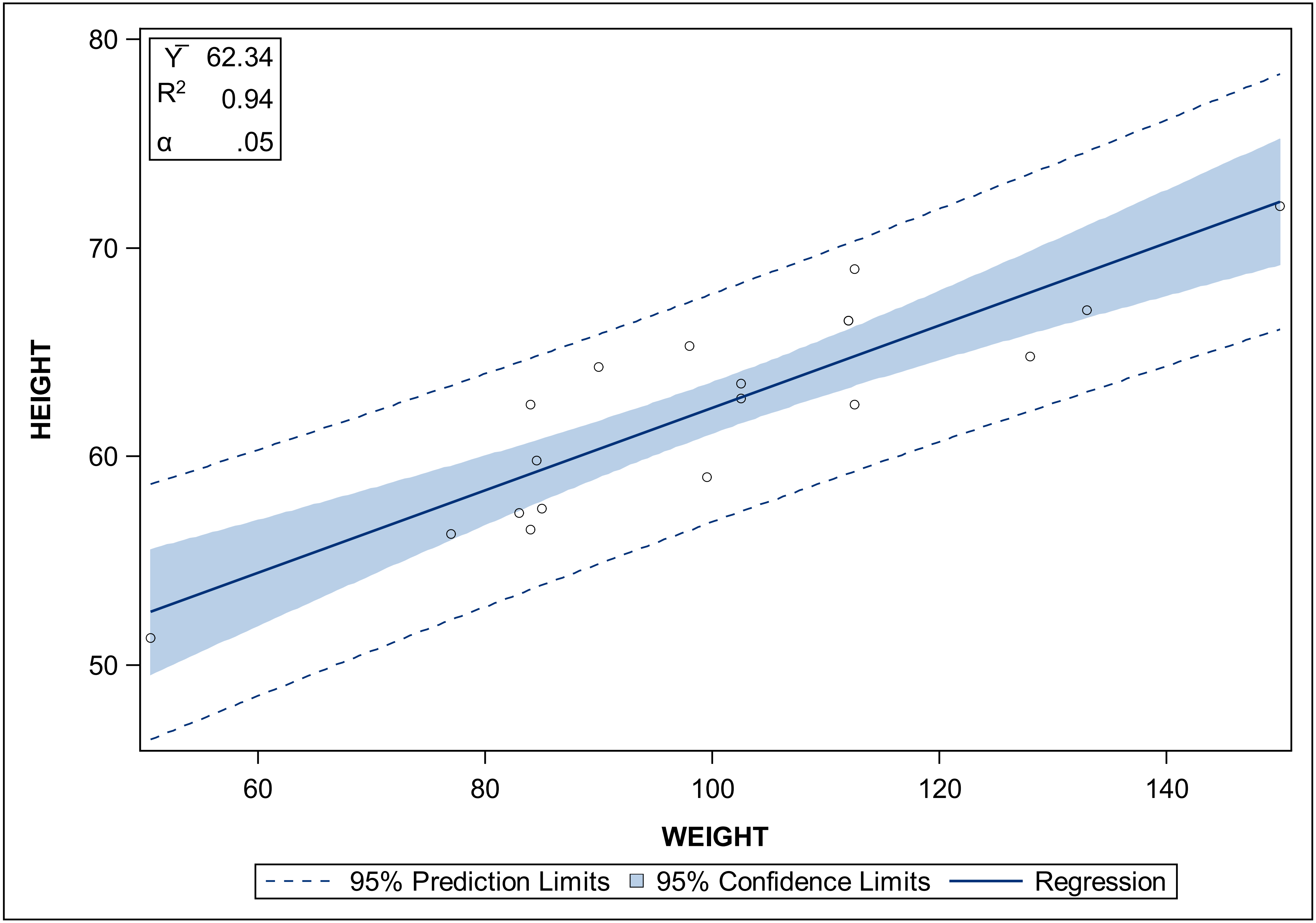
CL Bundle Compliance & CL Infection Rate
Compliance
bsi per 1000 cl days
MONTH
1.2
1.0
0.8
0.6
0.4
0.2
0.0
25
20
15
10
5
0
2.5
5.0
7.5
10.0
12.5
BSI
Compliance
6
7
10
13
18
14
7
19
18
17
8
20
0.08
0.17
0.29
0.46
0.72
0.50
0.13
0.76
0.70
0.64
0.22
0.79

```
proc sgplot data=sashelp.class;
scatter x=weight y=height;
inset "This is some important information"
"in the bottom-right corner" /
position=BottomRight;
inset ("A"="37" "B"="209" "C"="Value") /
position=TopLeft border;
run;
```



A 37
B 209
C Value
70
65
60
55
50
HEIGHT
60
80
100
120
140
WEIGHT
This is some important information
in the bottom-right corner

```
*ods escapechar="*";
proc sgplot data=sashelp.class;
reg x=weight y=height / clm cli;
inset ( "Y*{unicode bar}"="62.34" "R*{sup '2'}"="0.94"
"*{unicode alpha}"=".05" ) / position=TopLeft
border;
run;
```



$\bar{Y}$ 62.34
R^2 0.94
α .05
80
70
60
50
HEIGHT
60
80
100
120
140
WEIGHT
95% Prediction Limits
95% Confidence Limits
Regression

```
ods output lsmeans= lsmeans;
proc mixed data = addtrt;
class treatment age;
model results = treatment age;
lsmeans treatment / cl;
run;
proc sgplot data = lsmeans;
scatter x = treatment y = estimate
/ YERRORLOWER= lower YERRORUPPER= upper;
series x = treatment y = estimate;
run;
```

Model Information	
Data Set	WORK.ADDTRT
Dependent Variable	RESULTS
Covariance Structure	Diagonal
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Residual

Class Level Information		
Class	**Levels**	**Values**
TREATMENT	4	TreatmentAF TreatmentAM TreatmentBF TreatmentBM
AGE	6	11 12 13 14 15 16

Dimensions	
Covariance Parameters	1
Columns in X	11
Columns in Z	0
Subjects	1
Max Obs Per Subject	38

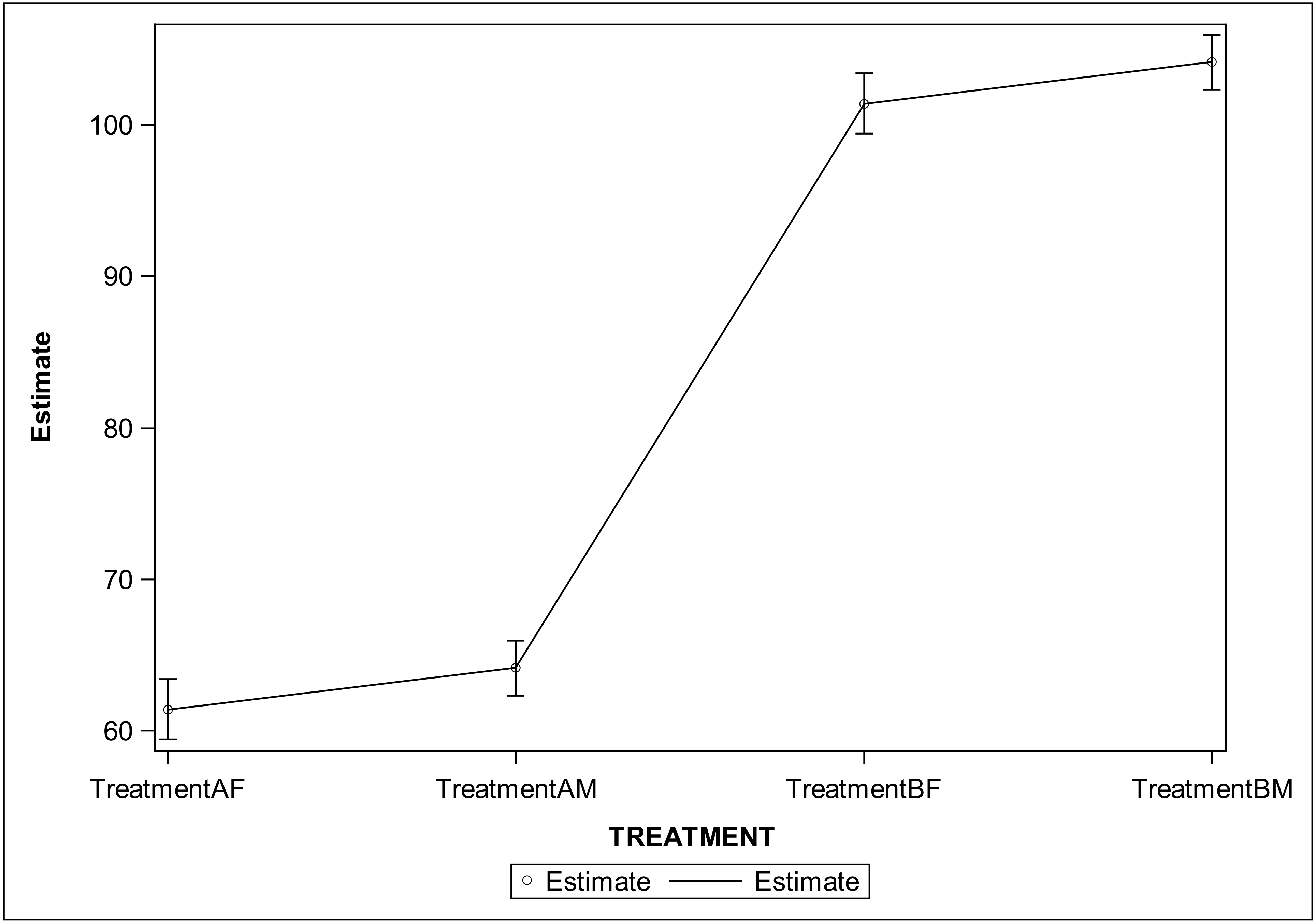
Number of Observations	
Number of Observations Read	38
Number of Observations Used	38
Number of Observations Not Used	0

Covariance Parameter Estimates	
Cov Parm	**Estimate**
Residual	7.4107

Fit Statistics	
-2 Res Log Likelihood	156.0
AIC (smaller is better)	158.0
AICC (smaller is better)	158.1
BIC (smaller is better)	159.4

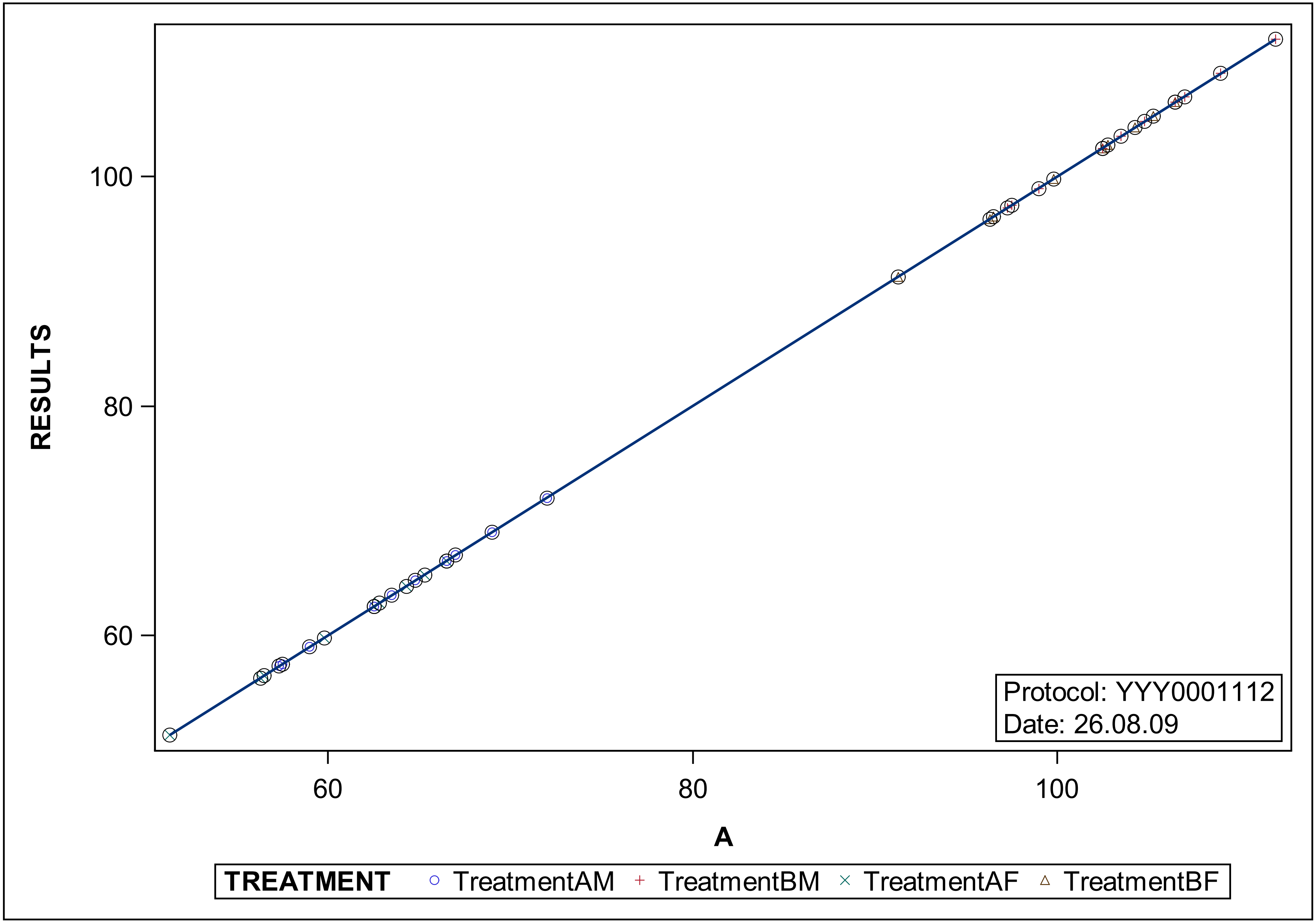
Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
TREATMENT	3	29	686.62	<.0001
AGE	5	29	16.92	<.0001

Least Squares Means									
Effect	**TREATMENT**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
TREATMENT	TreatmentAF	61.4074	0.9748	29	62.99	<.0001	0.05	59.4137	63.4012
TREATMENT	TreatmentAM	64.1318	0.8869	29	72.31	<.0001	0.05	62.3180	65.9457
TREATMENT	TreatmentBF	101.41	0.9748	29	104.03	<.0001	0.05	99.4137	103.40
TREATMENT	TreatmentBM	104.13	0.8869	29	117.41	<.0001	0.05	102.32	105.95

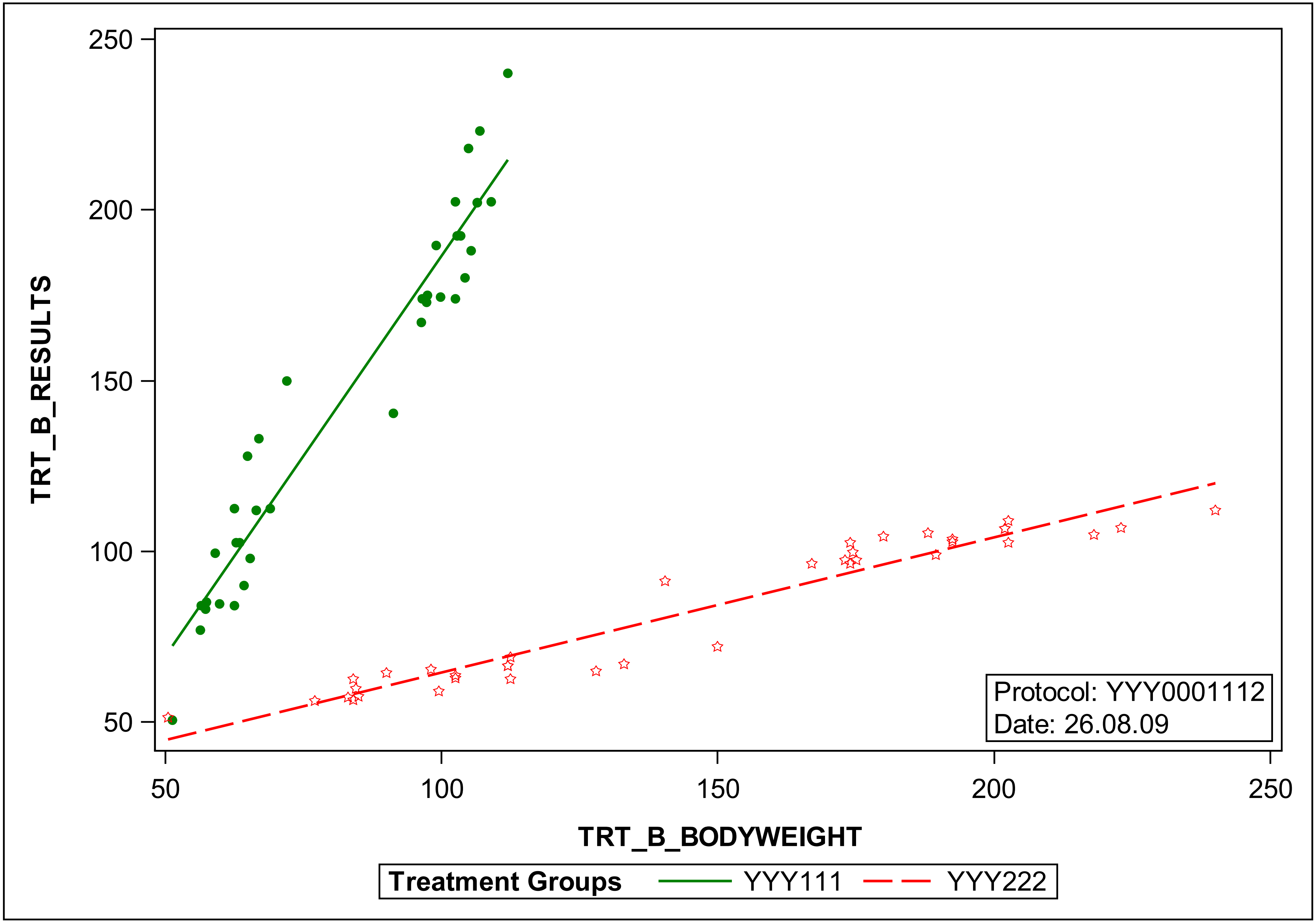


Estimate
100
90
80
70
60
TreatmentAF
TreatmentAM
TreatmentBF
TreatmentBM
TREATMENT
Estimate
Estimate

```
proc sgplot data = addtrt;
scatter x = a y = results / group= treatment;
reg x = a y = Results / markerattrs= (size= 10);
inset"Protocol: YYY0001112" "Date: 26.08.09"
/ position= bottomright BORDER;
run;
```


RESULTS
100
80
60
Protocol: YYY0001112
Date: 26.08.09
60
80
100
A
TREATMENT
TreatmentAM
TreatmentBM
TreatmentAF
TreatmentBF

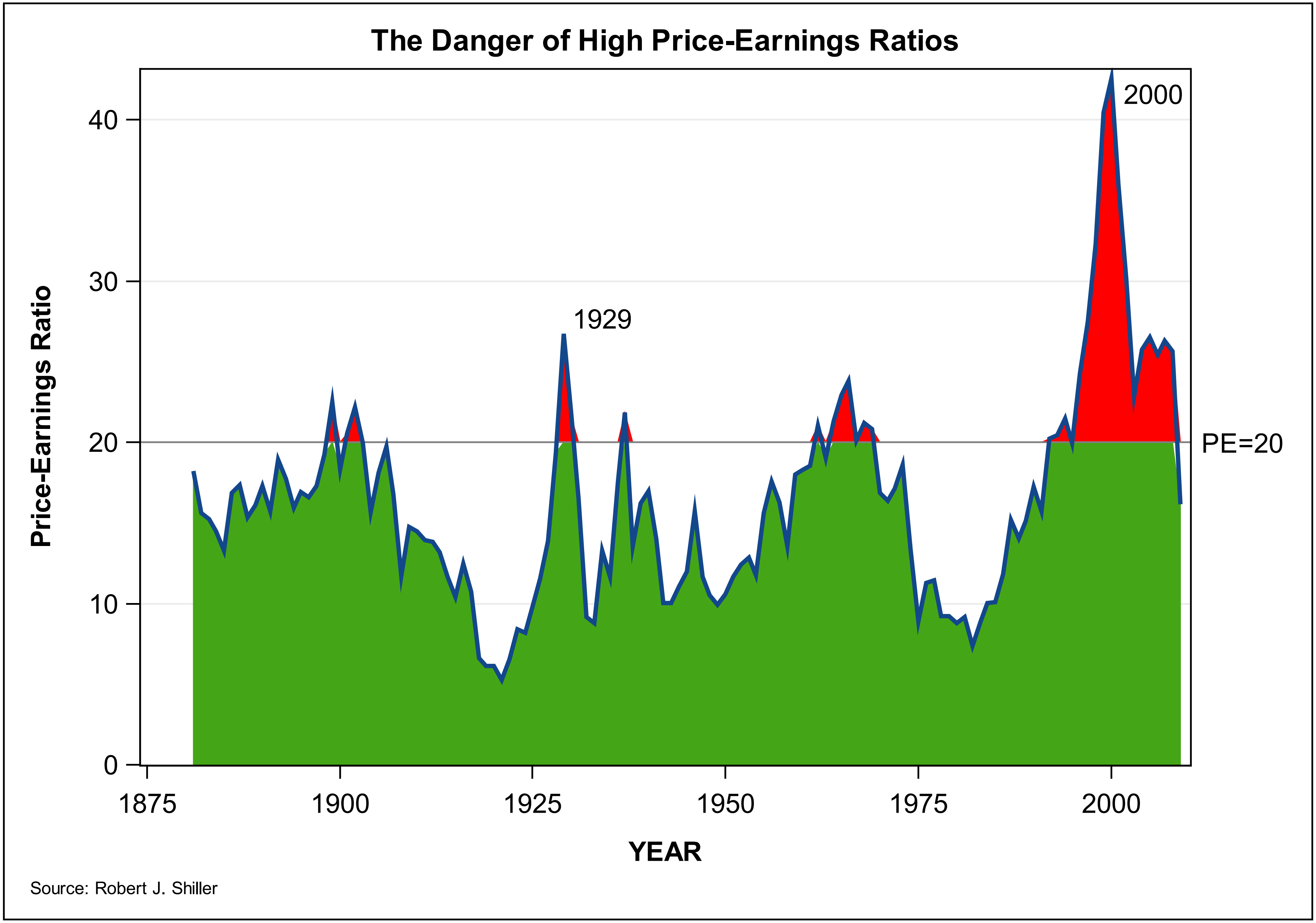
```
proc sgplot data = addtrt;
reg x = trt_A_bodyweight y = trt_A_results
/ LEGENDLABEL= "YYY111" name = "lineA" MARKERATTRS=
(symbol= circlefilled color= green) LINEATTRS= (color= green) ;
reg x = trt_B_bodyweight y = trt_B_results
/ LEGENDLABEL= "YYY222" name = "lineB"
MARKERATTRS= (symbol= star color= red) LINEATTRS = (color= red);
keylegend "lineA" "lineB" / title= "Treatment Groups";
inset "Protocol: YYY0001112" "Date: 26.08.09"
/ position= bottomright BORDER;
run;
```



250
200
150
100
50
TRT_B_RESULTS
Protocol: YYY0001112
Date: 26.08.09
50
100
150
200
250
TRT_B_BODYWEIGHT
Treatment Groups
YYY111
YYY222

```
example-> 120
```

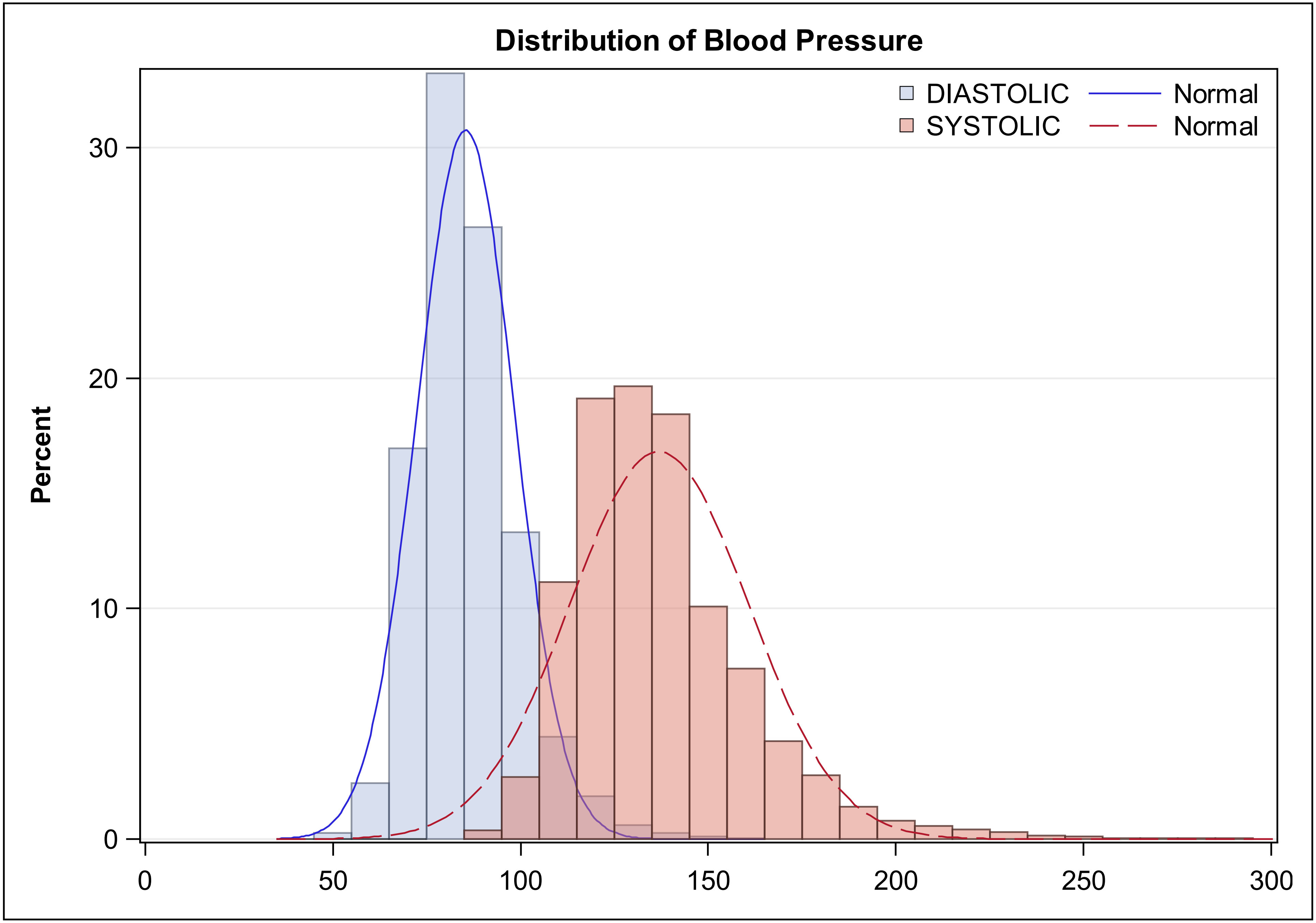
```
title "The Danger of High Price-Earnings Ratios";
footnote j=l "Source: Robert J. Shiller";
proc sgplot data=pe_data noautolegend;
yaxis offsetmin=0;
refline 10 20 30 40 / lineattrs=GraphGridLines;
band x=year upper=lPE lower=0 / fillattrs=(color=vilg);
band x=year lower=&thresholdPE upper=uPE /
fillattrs=(color=red);
refline &thresholdPE / label="PE=&thresholdPE";
series x=year y=pe10 / lineattrs=GraphData1
(thickness=3 color=cx13478c) datalabel=label;
run;
```



The Danger of High Price-Earnings Ratios
Price-Earnings Ratio
40
30
20
10
0
1929
2000
PE=20
1875
1900
1925
1950
1975
2000
YEAR
Source: Robert J. Shiller

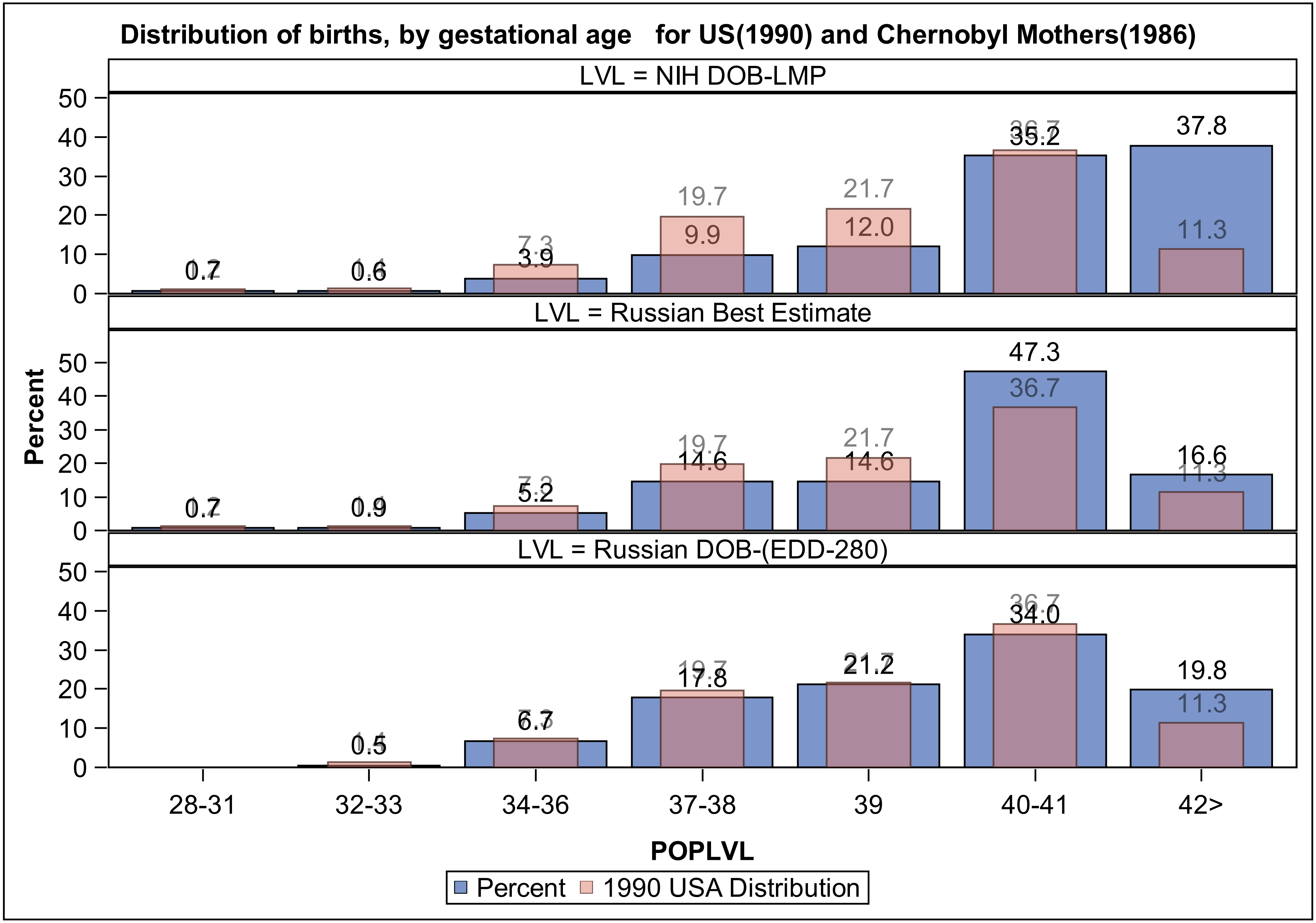
```
example-> 130
```

```
title "Distribution of Blood Pressure";
proc sgplot data=sashelp.heart;
histogram diastolic / fillattrs=graphdata1
transparency=0.7 binstart=40 binwidth=10;
density diastolic / lineattrs=graphdata1;
histogram systolic / fillattrs=graphdata2
transparency=0.5 binstart=40 binwidth=10;
density systolic / lineattrs=graphdata2;
keylegend / location=inside
position=topright noborder across=2;
yaxis grid;
xaxis display=(nolabel) values=(0 to 300 by 50);
run;
```


Distribution of Blood Pressure
DIASTOLIC
SYSTOLIC
Normal
Normal
Percent
30
20
10
0
0
50
100
150
200
250
300

```
example-> 140
```

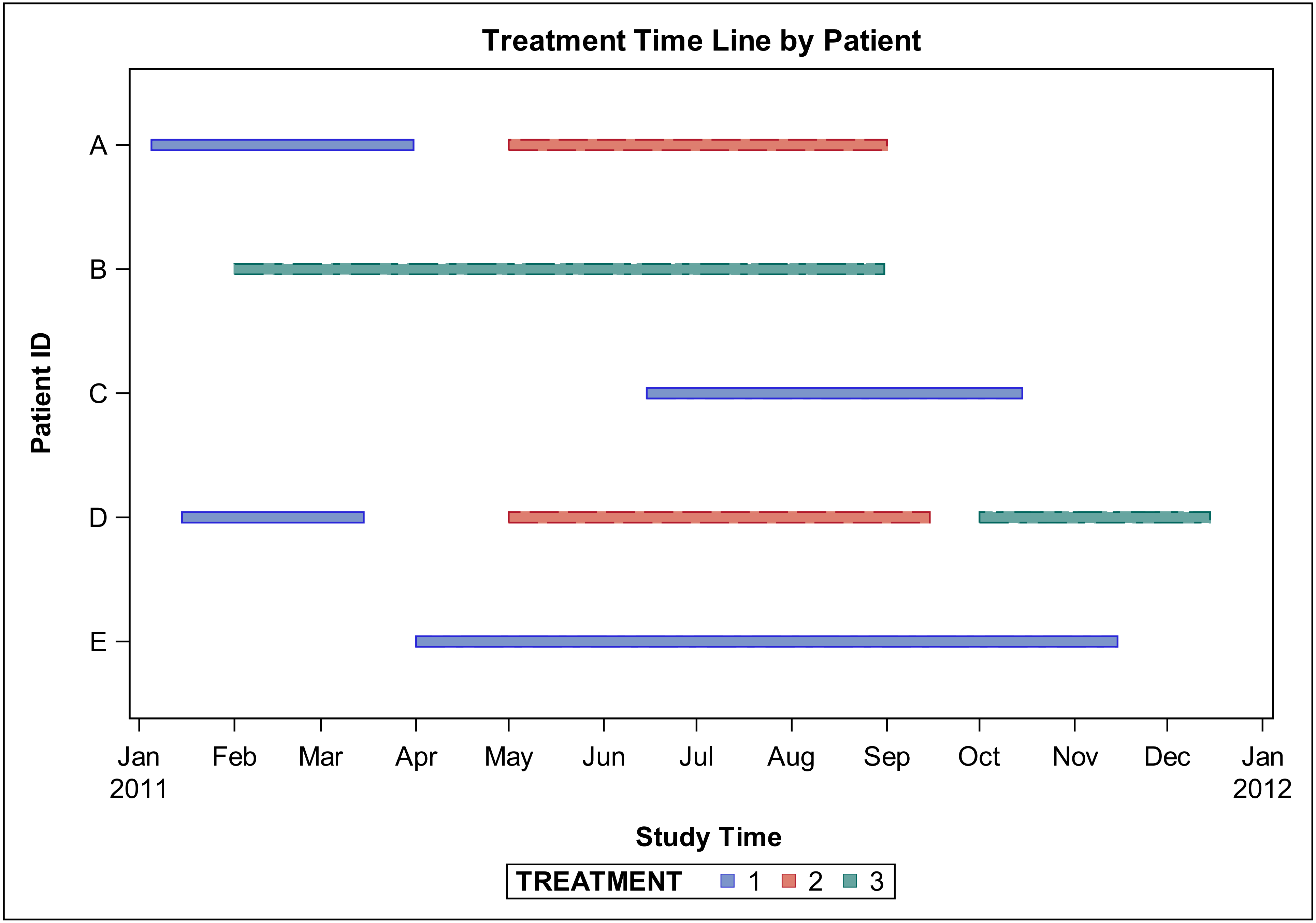
```
proc sgpanel data=grptre32;
title "Distribution of births, by gestational age
for US(1990) and Chernobyl Mothers(1986)";
label poppct="1990 USA Distribution";
format poppct ruspct 5.1;
panelby lvl / rows=3;
vbar poplvl / response=ruspct datalabel;
vbar poplvl / response=poppct datalabel
barwidth=0.5
transparency=0.5;
run;quit;
```



Distribution of births, by gestational age for US(1990) and Chernobyl Mothers(1986)
LVL = NIH DOB-LMP
37.8
35.2
19.7
21.7
9.9
12.0
11.3
3.9
0.7
0.6
LVL = Russian Best Estimate
47.3
36.7
19.7
21.7
14.6
14.6
16.6
5.2
0.7
0.9
LVL = Russian DOB-(EDD-280)
34.0
21.2
17.8
19.8
11.3
6.7
0.5
Percent
0
10
20
30
40
50
28-31
32-33
34-36
37-38
39
40-41
42>
POPLVL
Percent
1990 USA Distribution

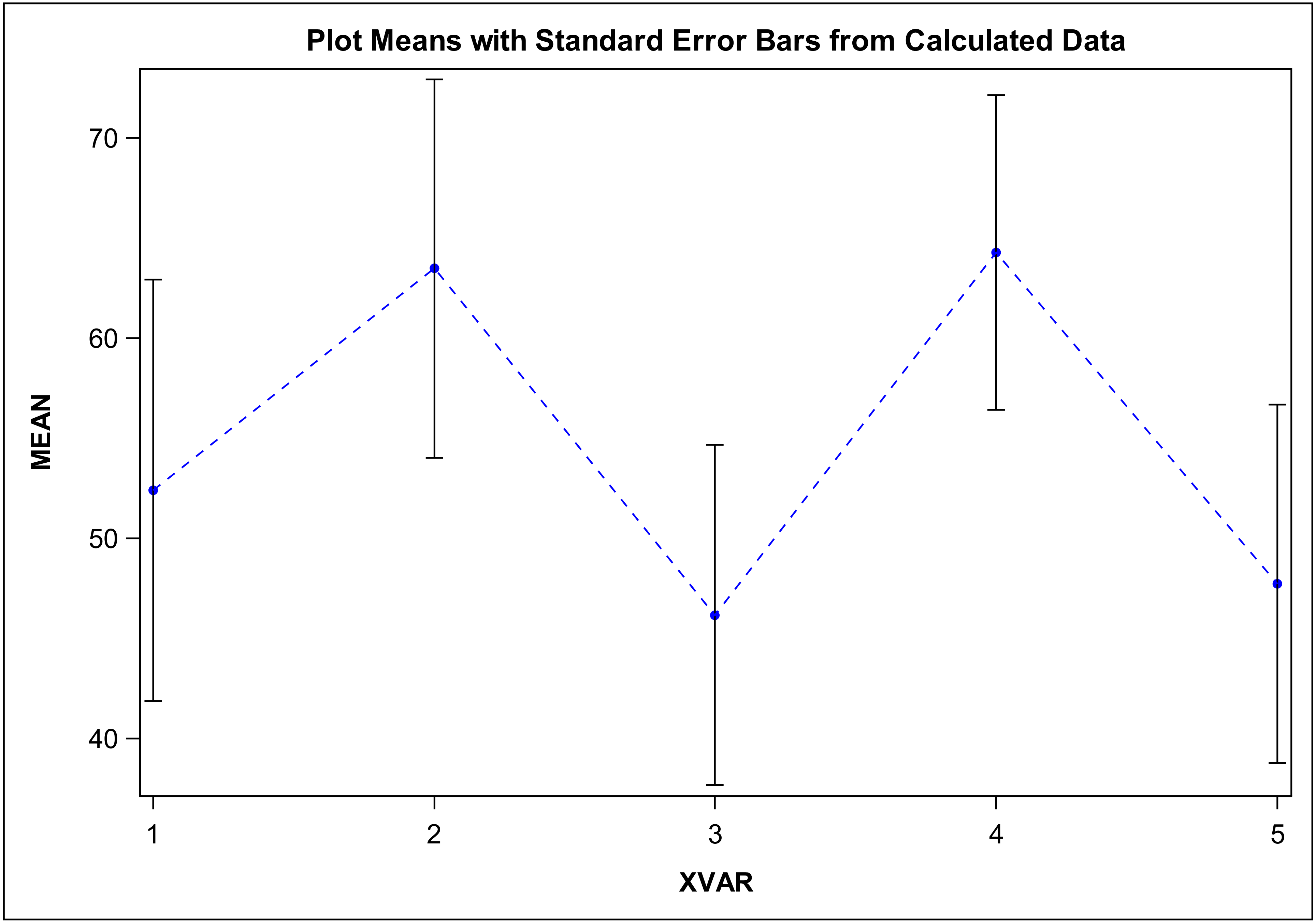
```
example-> 150
```

```
title1 "Treatment Time Line by Patient";
proc sgplot data=trttrt;
highlow y=PatientID low=start_date high=end_date /
group=Treatment
type=bar
barwidth=0.1;
yaxis label="Patient ID" reverse;
xaxis label="Study Time";
run;
```

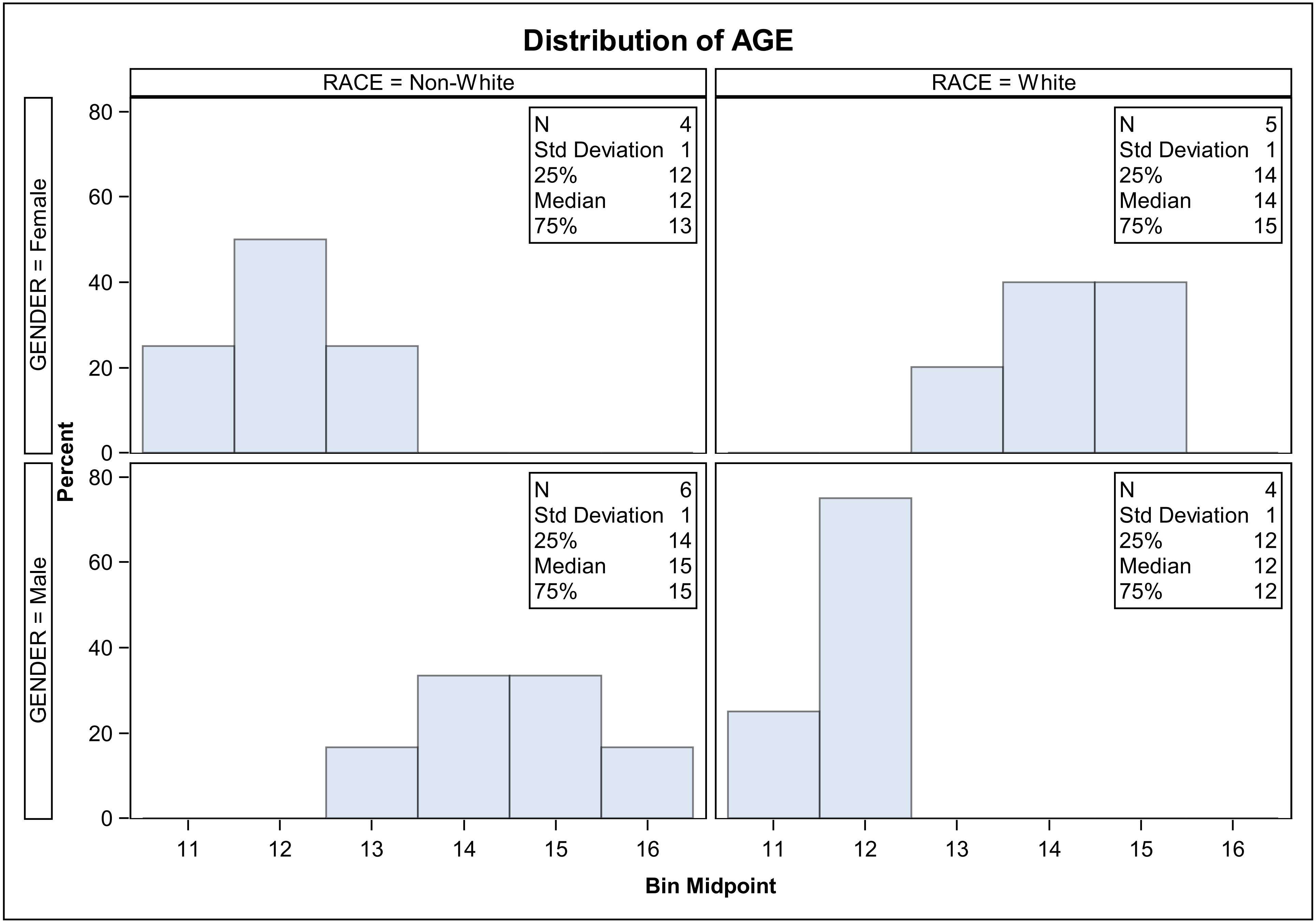

Treatment Time Line by Patient
Patient ID
A
B
C
D
E
Jan 2011
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan 2012
Study Time
TREATMENT 1 2 3

```
example-> 170
```

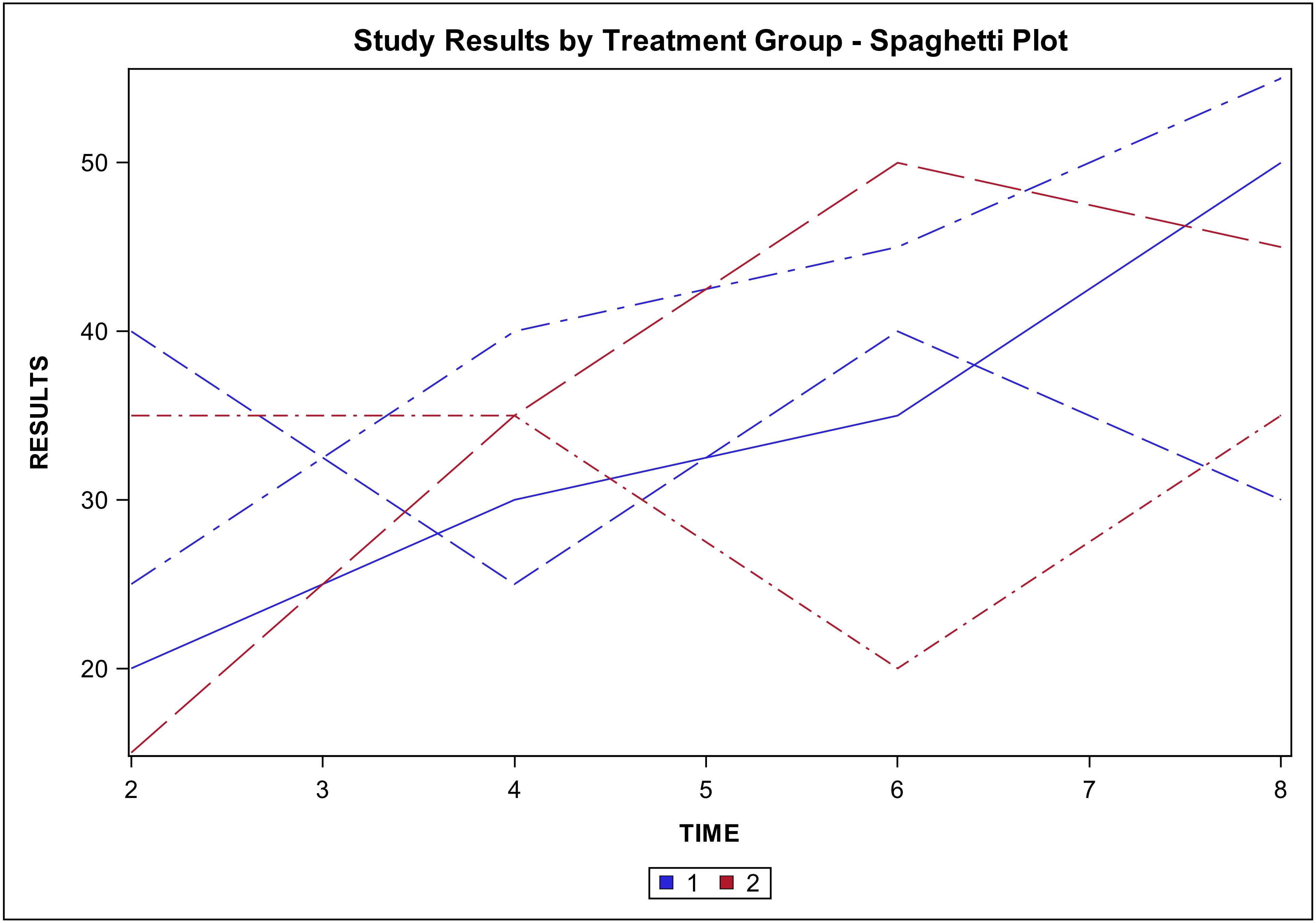
```
proc sgplot data=reshape noautolegend;
scatter x=xvar y=mean / yerrorlower=lower
yerrorupper=upper
markerattrs=(color=blue symbol=CircleFilled);
series x=xvar y=mean / lineattrs=(color=blue pattern=2);
title1 "Plot Means with Standard Error Bars from Calculated Data";
run;
```


Plot Means with Standard Error Bars from Calculated Data
MEAN
70
60
50
40
1
2
3
4
5
XVAR

```
data fixage(keep=Gender Age Race);
length Gender $12;
set sashelp.class;
if sex="M" then Gender="Male";
else Gender="Female";
if mod(_n_,2)=0 then Race="White       ";
else race="Non-White";
run;
proc univariate data=fixage noprint;
axis1 order=10 to 18 by 2;
label Age=""; *"Age Histogram";
class Gender Race;
var Age;
histogram Age   / ncols=2  nrows=2
haxis      = axis1
inheight   = 3
intertile  = 1
cfill      = ligb
cframe     = ligr
cframeside = ligr;
inset  N  Std  q1="25%" median q3="75%"
/ pos    = ne
format = comma12.
cfill  = ywh
height = 3;
run;quit;
```

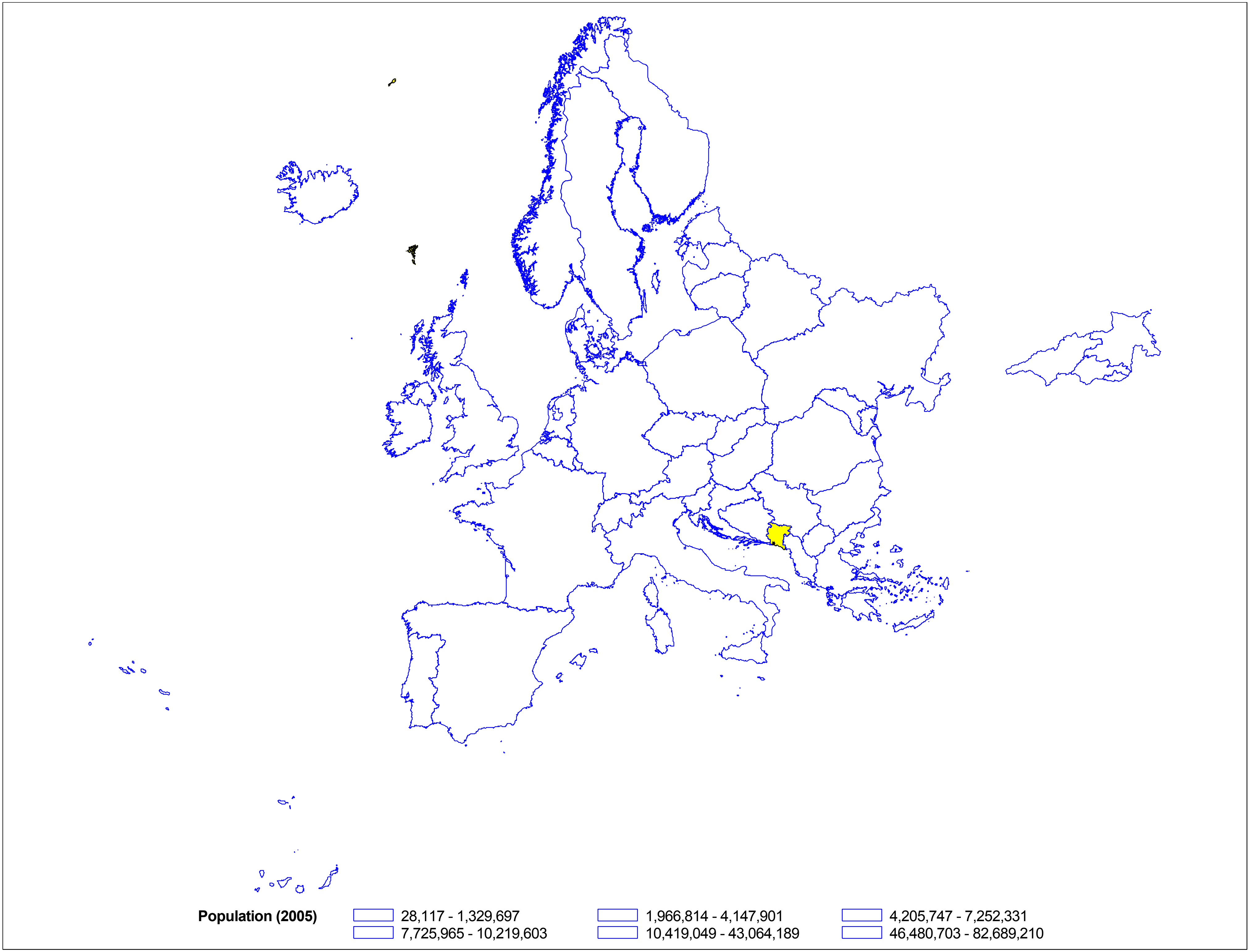

Distribution of AGE
RACE = Non-White
RACE = White
GENDER = Female
GENDER = Male
Percent
N 4
Std Deviation 1
25% 12
Median 12
75% 13
N 5
Std Deviation 1
25% 14
Median 14
75% 15
N 6
Std Deviation 1
25% 14
Median 15
75% 15
N 4
Std Deviation 1
25% 12
Median 12
75% 12
0 20 40 60 80
11 12 13 14 15 16
Bin Midpoint

```
data one;
input trt_group time subject results;
datalines;
1 2 100 20
1 4 100 30
1 6 100 35
1 8 100 50
1 2 200 40
1 4 200 25
1 6 200 40
1 8 200 30
1 2 300 25
1 4 300 40
1 6 300 45
1 8 300 55
2 2 400 15
2 4 400 35
2 6 400 50
2 8 400 45
2 2 500 35
2 4 500 35
2 6 500 20
2 8 500 35
;
run;quit;
proc sgplot data=one;
title "Study Results by Treatment Group";
series x=time y=results / group=subject
grouplc=trt_group name="grouping";
keylegend "grouping" / type=linecolor;run;quit;
```


Study Results by Treatment Group - Spaghetti Plot
RESULTS
50
40
30
20
2
3
4
5
6
7
8
TIME
1
2

MAPS

```
proc gmap map=maps.europe(where=(id ne 405 and id ne 845))
data=sashelp.demographics(where=(cont=93)) all;
id id;
choro pop / cdefault=yellow;
run;
quit;
```



Population (2005)
28,117 - 1,329,697
1,966,814 - 4,147,901
4,205,747 - 7,252,331
7,725,965 - 10,219,603
10,419,049 - 43,064,189
46,480,703 - 82,689,210

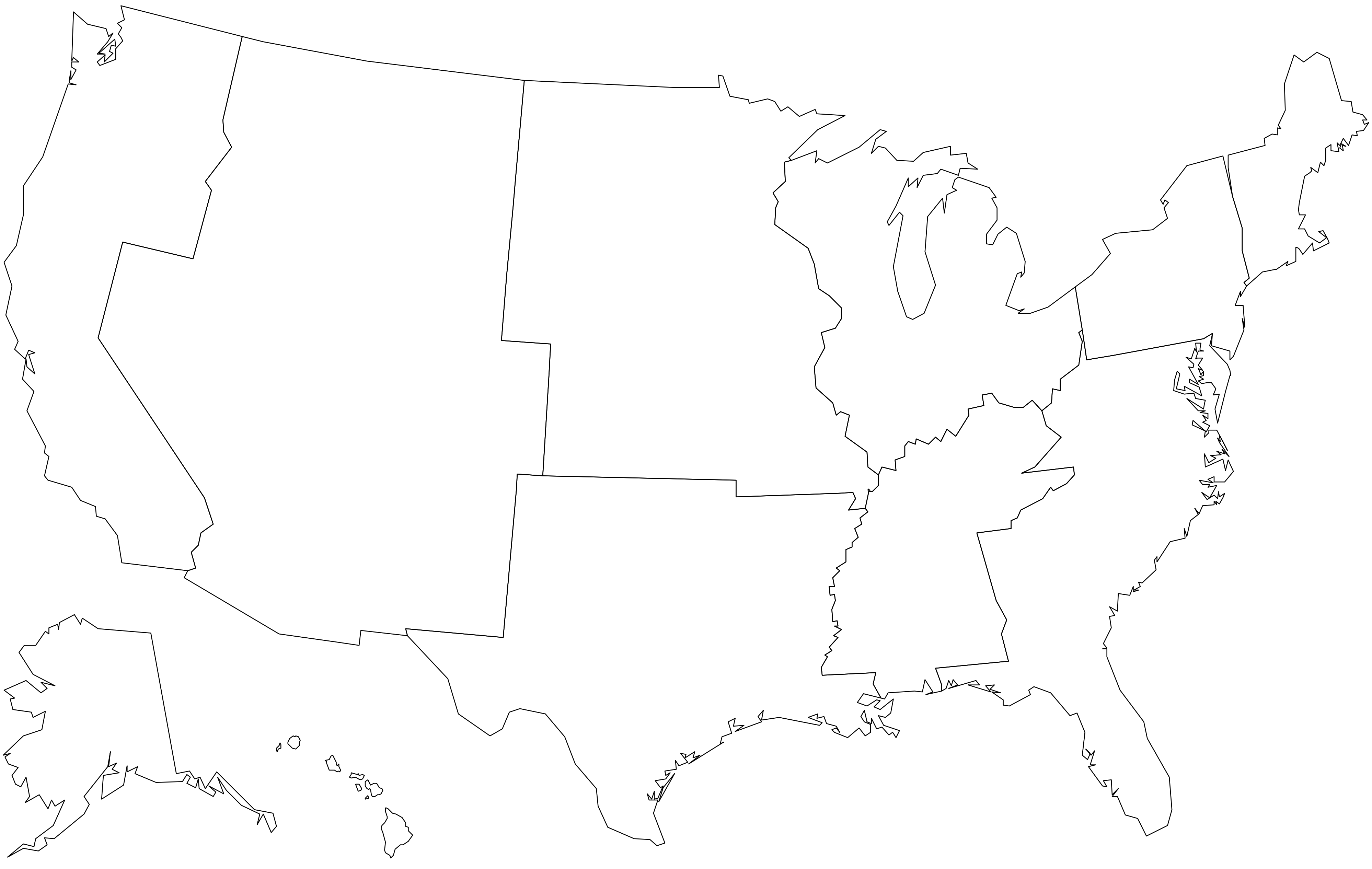
```
proc gproject data=maps.counties(where=(state=50)) out=vermont;
id state county;
run;quit;
data vtnames;
set maps.cntyname(where=(state=50));
run;quit;
%annomac;
/* Use the MAPLABEL annotate macro to create an annotate data set */
/* The macro parameters are:                                      */
/*     Attribute data set that contains variable for the label.   */
/*     Resulting output data set for use in ANNO= in GMAP.        */
/*     Variable for label on.  Can be text or numeric.            */
/*     Space-separated list of IDs that the map and attribute     */
/*         data sets are sorted on.                               */
/*     FONT=      Font for the label.                             */
/*     COLOR=     Color of the label.  Default is BLACK.          */
/*     SIZE=      Size of the label.  Default is 1.               */
/*     HSYS=      UNIT system for SIZE=.  Default is 3 (PERCENT). */
%maplabel(vermont,vtnames,anno,countynm,state county,
font="Albany AMT/bold", color=black,size=2.1);
title1 "County Map of Vermont";
pattern1 v=me c=black r=15;
proc gmap data=vermont map=vermont;
id state county;
choro county / anno=anno nolegend coutline=grayaa;
run; quit;
```

County Map of Vermont

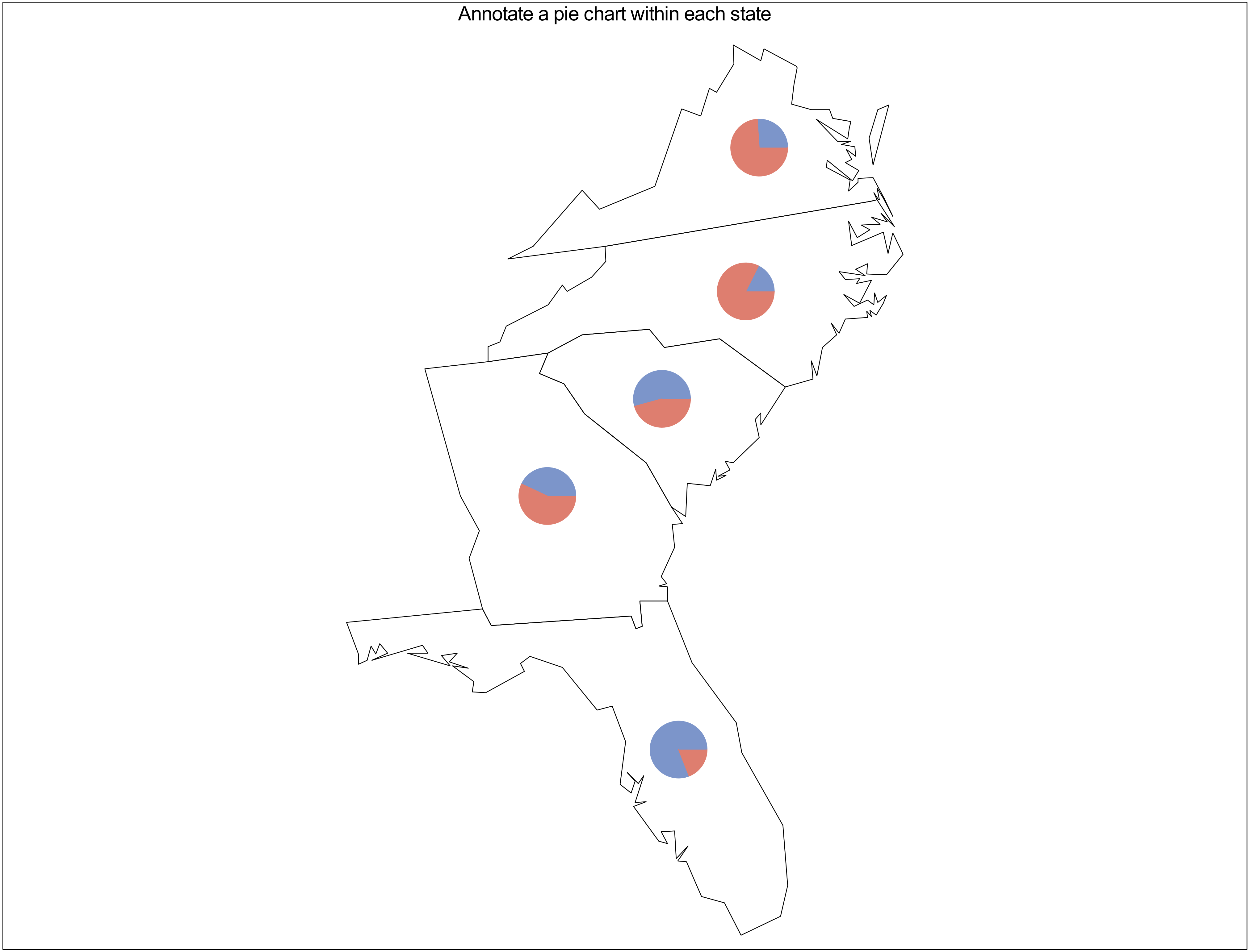
```
goptions reset=all cback=white border htitle=12pt htext=10pt;
data cbstates(drop=stcode);
length State 8 Stcode $ 2 Division 4;
input Stcode $ Division @@;
State=stfips(stcode);
cards4;
CT 1 MA 1 ME 1 NH 1 RI 1 VT 1 PA 2 NJ 2 NY 2
IL 3 IN 3 MI 3 OH 3 WI 3 IA 4 KS 4 MN 4 MO 4
ND 4 NE 4 SD 4 DC 5 DE 5 FL 5 GA 5 MD 5 NC 5
SC 5 VA 5 WV 5 AL 6 KY 6 MS 6 TN 6 AR 7 LA 7
OK 7 TX 7 AZ 8 CO 8 ID 8 MT 8 NM 8 NV 8 UT 8
WY 8 AK 9 CA 9 HI 9 OR 9 WA 9
;;;;
run;quit;
proc sort data=cbstates out=cbsort;by state;run;
data uscb;merge cbsort maps.us;by state;run;
proc sort data=uscb out=divstate;by division;run;
/* Remove interior boundaries within divisions */
proc gremove data=divstate out=remstate;by division;
id state;run;
title1 "U.S. State Map (before GREMOVE)";
pattern value=mempty repeat=48 color=black;
proc gmap map=maps.us data=maps.us all;id state;
choro state / nolegend;run;quit;
title1 "U.S. Census Division Map (after GREMOVE)";
proc gmap map=remstate data=remstate all;id division;
choro division / nolegend;run;quit;
```

U.S. State Map (before GREMOVE)

U.S. Census Division Map (after GREMOVE)

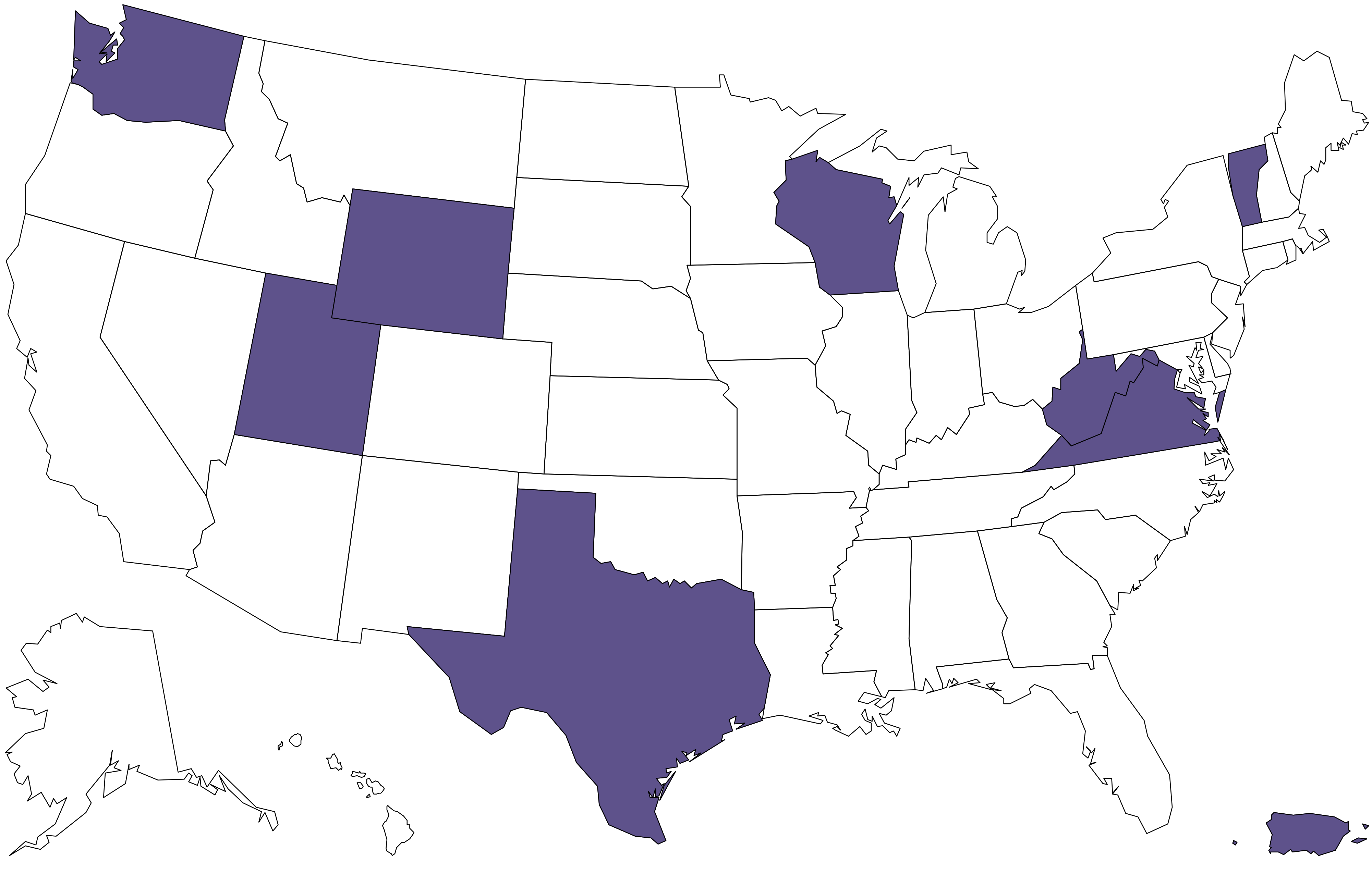


```
goptions reset=all cback=white border htitle=12pt htext=10
proc freq data=shares noprint;weight num;
tables state*vendor / outpct out=freq;run;
data anno;
merge freq(in=a) maps.uscenter;
by state;if a;
xsys="2"; /* X and Y coordinate system */
ysys="2";
when="a"; /* Apply the annotation after */
function="pie";   /* Draw a pie */
if vendor=1 then color="CX7C95CA";
else color="CXDE7E6F";
rotate=360*pct_row/100;/* Draw the portion pie */
size=2;
style="solid";
line=0;
run;
pattern1 v=me c=black r=5;
title "Annotate a pie chart within each state";
proc gmap data=maps.us(where=(state in(12 13 37 45 51)))
map=maps.us(where=(state in(12 13 37 45 51)));
id state;
choro state / nolegend annotate=anno coutline=black;
run;quit;
```


Annotate a pie chart within each state

```
proc template;
define style styles.colorramp;
parent=styles.default;
/* Define a lighter and darker shade of blue for
the starting and ending colors. */
style twocolorramp / startcolor=cxF3F7FE endcolor=cx6497EB;
/* When there are fewer than 3 response levels,
GraphData1 and GraphData2
are used for the colors */
style graphdata1 from graphdata1 / color=cxF3F7FE;
style graphdata2 from graphdata2 / color=cx6497EB;
end;
run;
ods listing style=styles.colorramp;
title "Map with colors defined from a color ramp";
proc gmap data=maps.us map=maps.us;
id state;
choro state;
run;
quit;
```

Map with colors defined from a color ramp

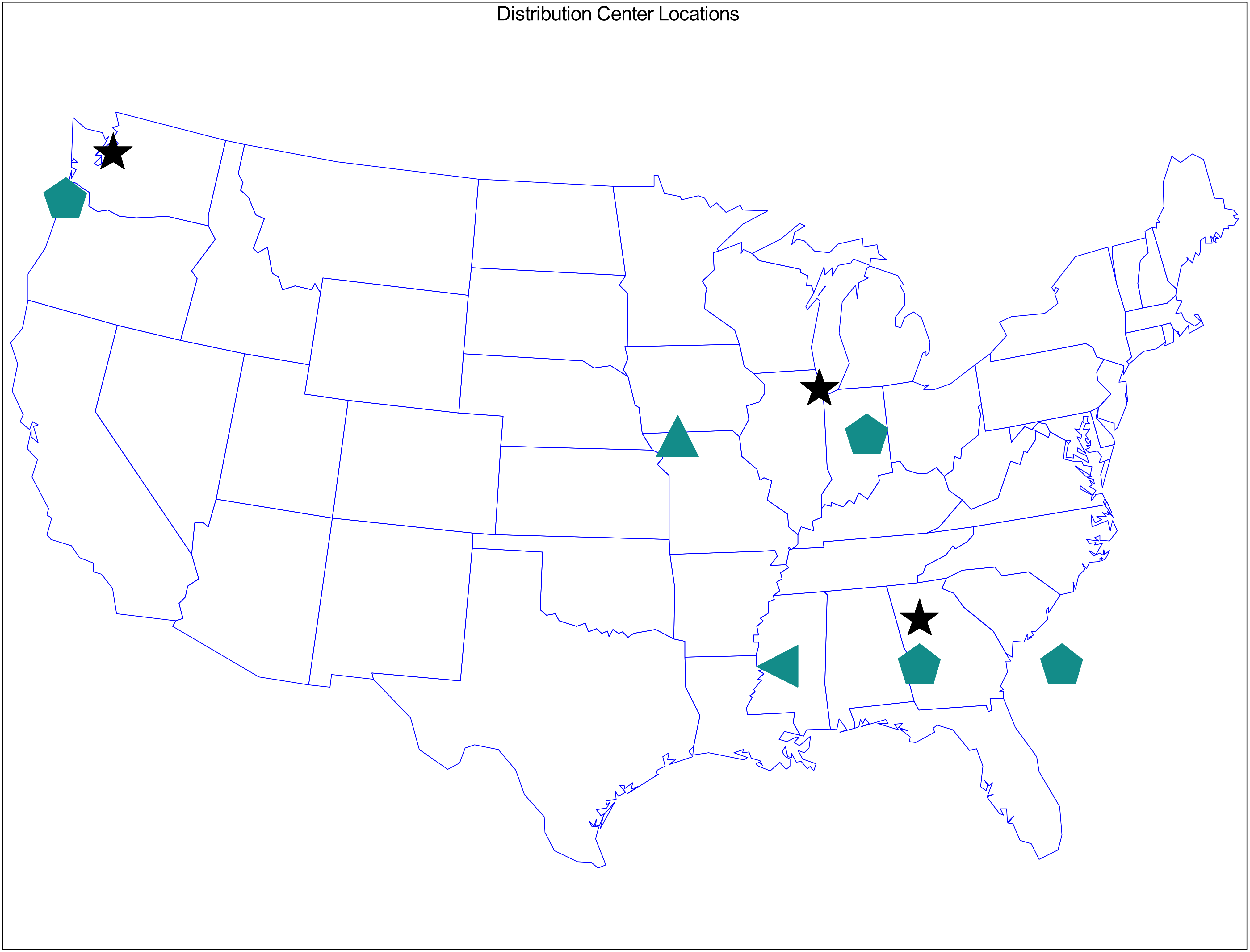


```
goptions reset=all cback=white border htitle=12pt htext=10pt;
data newaf;
set maps.africa;
region=1;
run;
/* Remove the unit areas from the AFRICA data set */
proc gremove data=newaf out=africa;
by region;
id id;
run;
title1 "Africa before PROC GREMOVE";
pattern value=mempty r=50 color=black;
proc gmap map=maps.africa data=maps.africa all;
id id;
choro id / nolegend;
run;quit;
title1 "Africa after PROC GREMOVE";
proc gmap data=africa map=africa;
id region;
choro region / nolegend;
run;
quit;
```

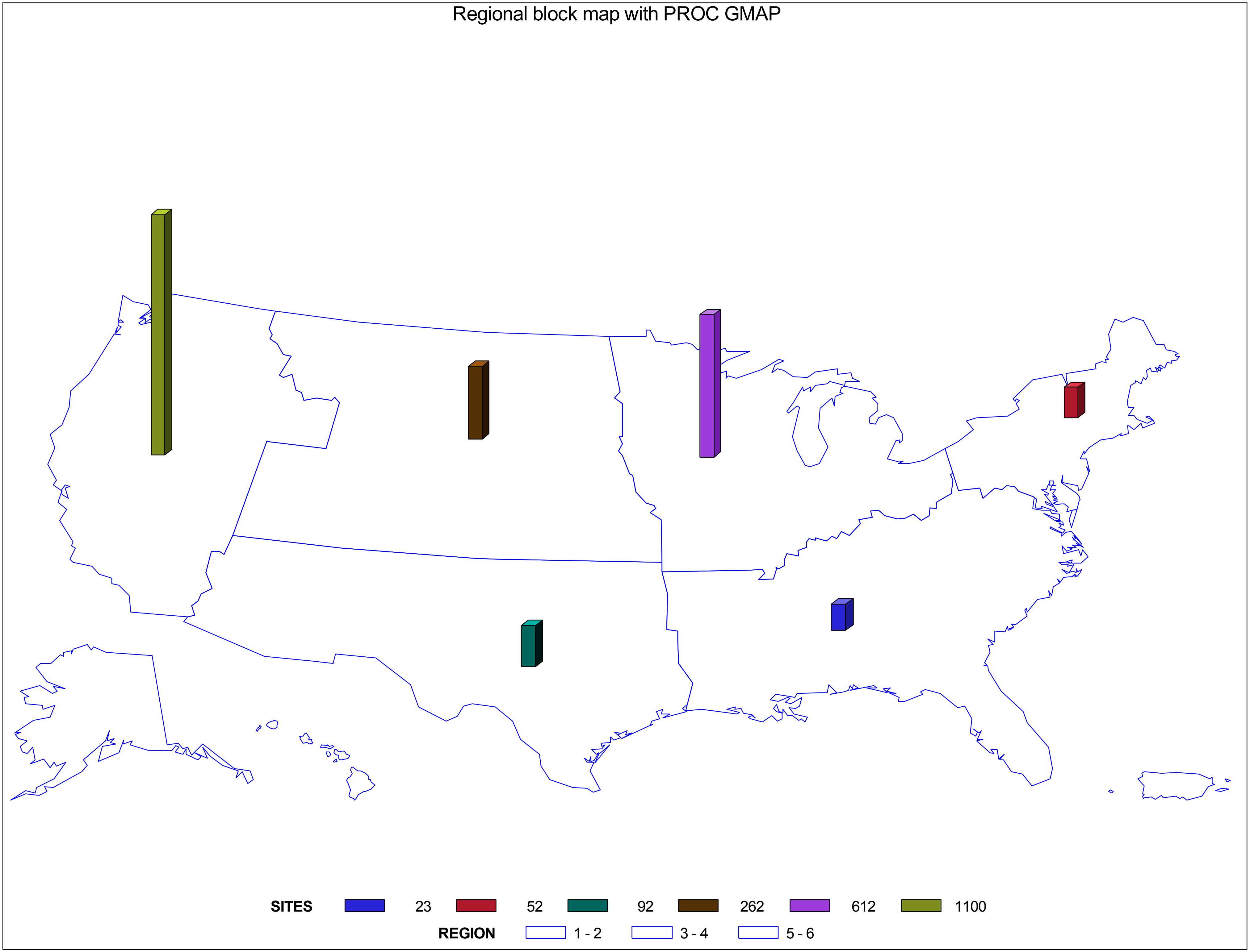
Africa before PROC GREMOVE

Africa after PROC GREMOVE

```
data lower48;
set maps.us;
if state ne stfips("AK");
if state ne stfips("HI");
if state ne stfips("PR");
run;
data citystar;/* Create the Annotate data set*/
length function color $ 8 position $ 1
text $ 20 style $ 30;
retain xsys ysys "2" hsys "3" when "a";
set maps.uscity(keep=x y city state);
if (city="Atlanta" and state=13)
or city="Chicago" or
city="Seattle";
/* Create the observation for a star */
function="symbol"; style="marker"; text="V";
color="black"; size=5; output;
/* Create the observation for a city */
function="label";  text=city;
color="vibg"; size=5; position="8"; output;
run;
title "Distribution Center Locations";
pattern value=mempty color=blue repeat=49;
proc gmap data=lower48 map=lower48;
id state;
choro state / annotate=citystar discrete nolegend;
run;quit;
```


Distribution Center Locations

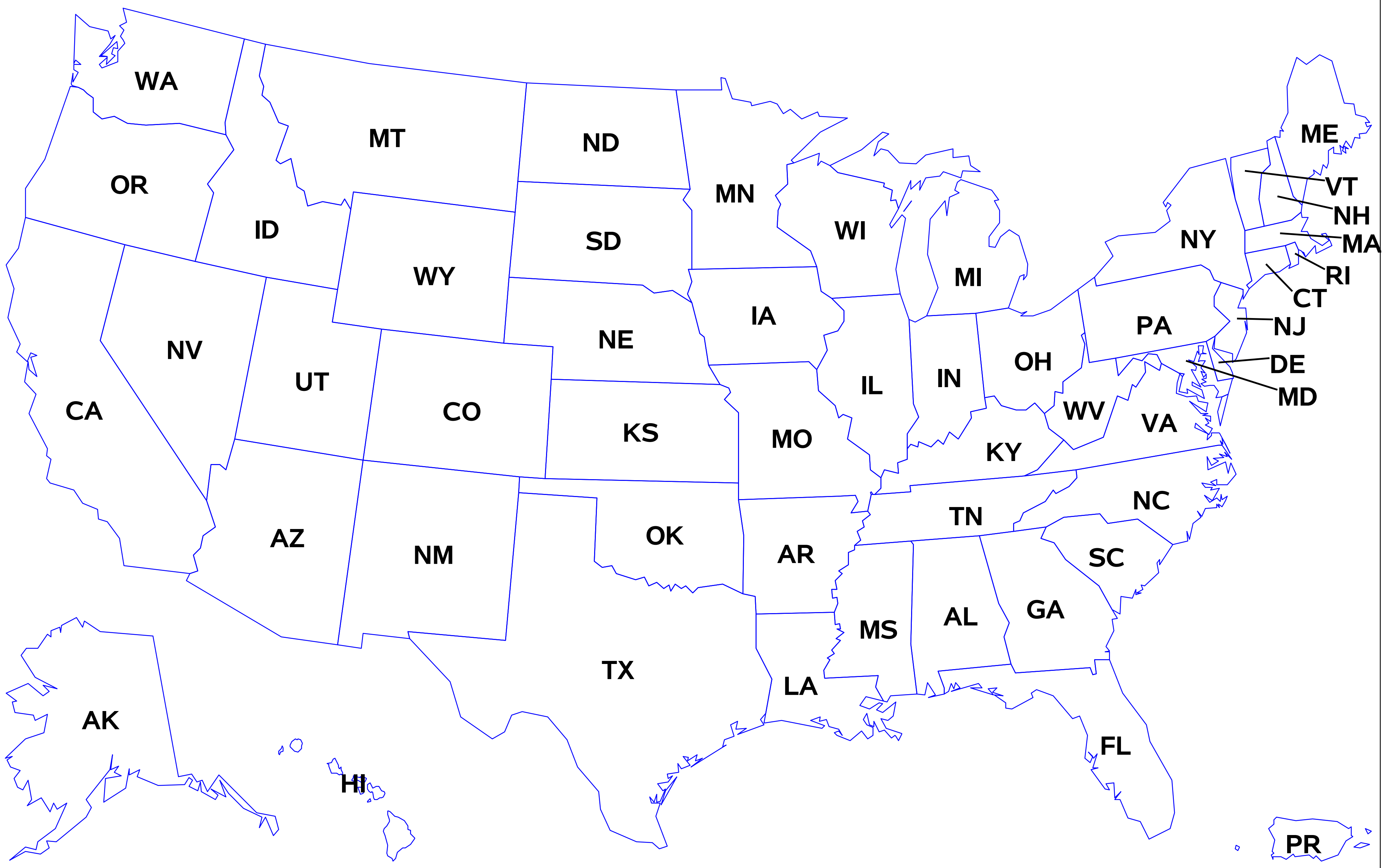
```
data sites;input Region  Sites @@;
cards4;
1 1100 2 262 3 92 4 612 5 23 6 52
;;;;
run;
data states1; /* Create map data set STATES1 by adding   */
set maps.us; /* REGION to the US map data set */
select;
when (state=53 or state=41 or state=16 or state=32 or state=06
or state=02 or state=15) region=1; /* west */
when (state=30 or state=46 or state=38 or state=31
or state=20 or state=56 or state=49
or state=08) region=2;  /* north central */
when (state=04 or state=35 or state=48
or state=40) region=3;  /* midwest */
when (state=27 or state=19 or state=29 or state=55
or state=17 or state=26 or state=18
or state=39) region=4;  /* southwest */
when (state=05 or state=22 or state=01 or state=21 or state=47
or state=28 or state=13 or state=12 or state=45 or state=37
or state=51 or state=54) region=5;  /* south */
otherwise region=6; /* new england */
end;run;
proc sort data=states1;by region state;run;
proc gremove data=states1 out=map;by region;
id state; /* Remove the state boundaries */run;
title1 "Regional block map with PROC GMAP";
proc gmap data=sites map=map all;id region;
block sites / area=1 discrete;run;quit;
```



Regional block map with PROC GMAP
SITES
23
52
92
262
612
1100
REGION
1 - 2
3 - 4
5 - 6

```
data center;
length function $ 8;
retain flag 0 xsys ysys "2" hsys "3" when "a";
set maps.uscenter
(where=(fipstate(state) ne "DC")
drop=long lat);
*style = "Albany AMT/bold";
function="label";
text=fipstate(state);
size=2.5;
position="5";
if ocean="Y" then
do;
position="6";
output;
function="move";
flag=1;
end;
else if flag=1 then
do;
function="draw";
size=.25;
flag=0;
end;
output;
run;
title "Positioning State Labels with MAPS.USCENTER";
pattern1 value=mempty color=blue repeat=50;
proc gmap data=maps.us map=maps.us;
id state;
choro state / nolegend annotate=center;run;quit;
```

Positioning State Labels with MAPS.USCENTER



State, County, and Zipcode Maps Using SF1 Census Data.

Using simple question and answer queries to
locate the data and documentation for your the project.

Integrating documentation and meta data for
Census,Medicare, Medicaid, ,Encounter(MA),
Marketplace ,American Consumer Survey(ACS),
Cost Reports and Acxiom household.

Roger DeAngelis
11/21/2015

Agenda

Good meta data is more important than raw data.
PDF and word docs are difficult to incorporate with data.
Ambitious goal to provide a single meta database.

- 2010 Census SF1 Percent Single Households by State.
- 2010 Census Percent Single Person Households Texas Counties.
- 2010 Census Percent Single PersonHouseholds Starr County(TX).
- Meta data and code for State map.
- Major headings in the SF1 Census data.
- Simple query for subcategories.
- Texas household size data.
- US state map with the percent of single households.
- Texas percent single households by county.
- Querying for meta data on Zcta.
- How to get a list of USPS Zips in a given Zcta.
- Downloading and using the Census ZCTA shapefiles.
- Build annotation dataset and formats.
- ZCTA Map for Starr County(TX).

Ambitious goal to provide a single meta database.

Single meta database

Medicare

Medicaid

Encounter(MA)

Marketplace

American Consumer Survey(ACS)

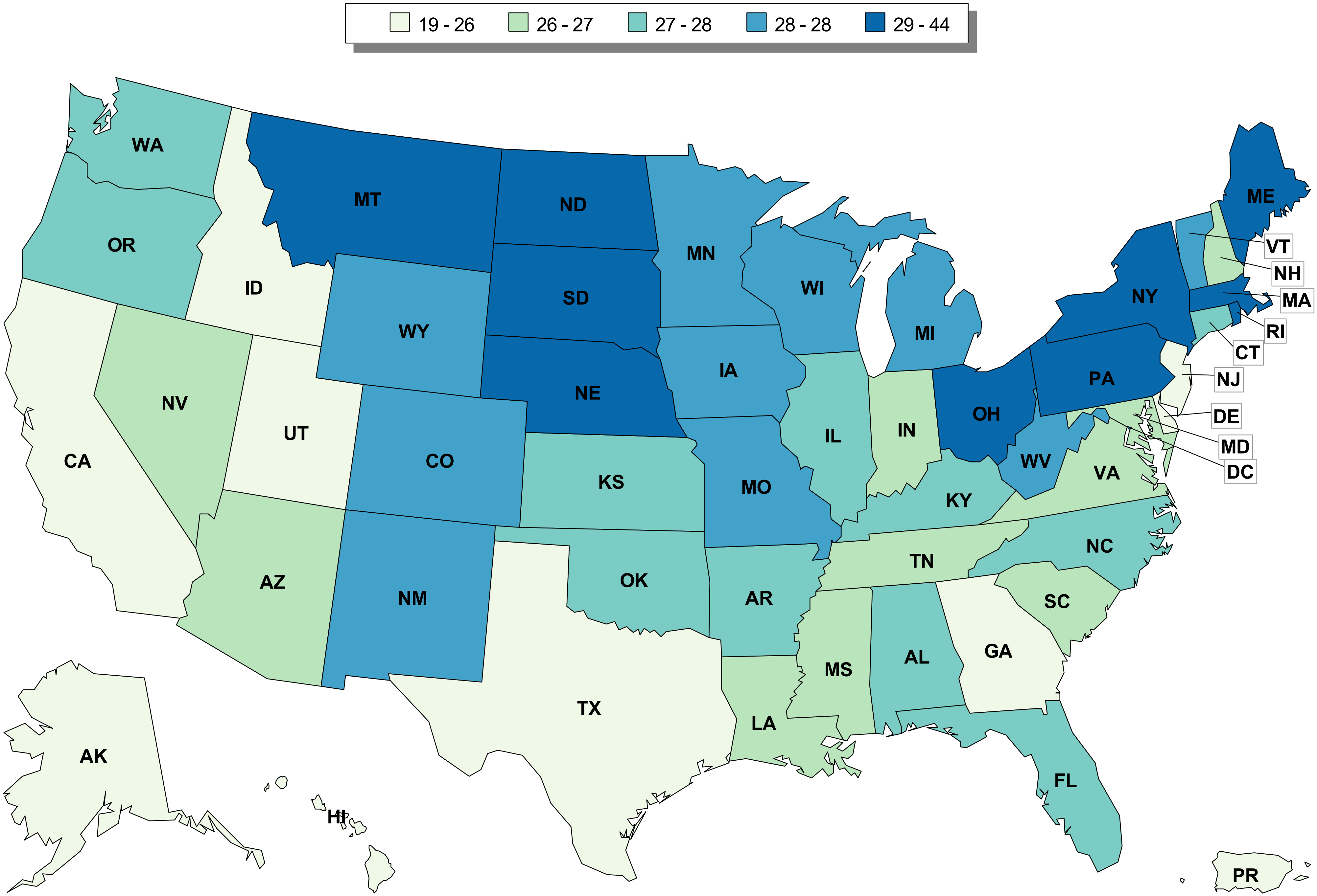
Cost Reports

Acxiom household

Census

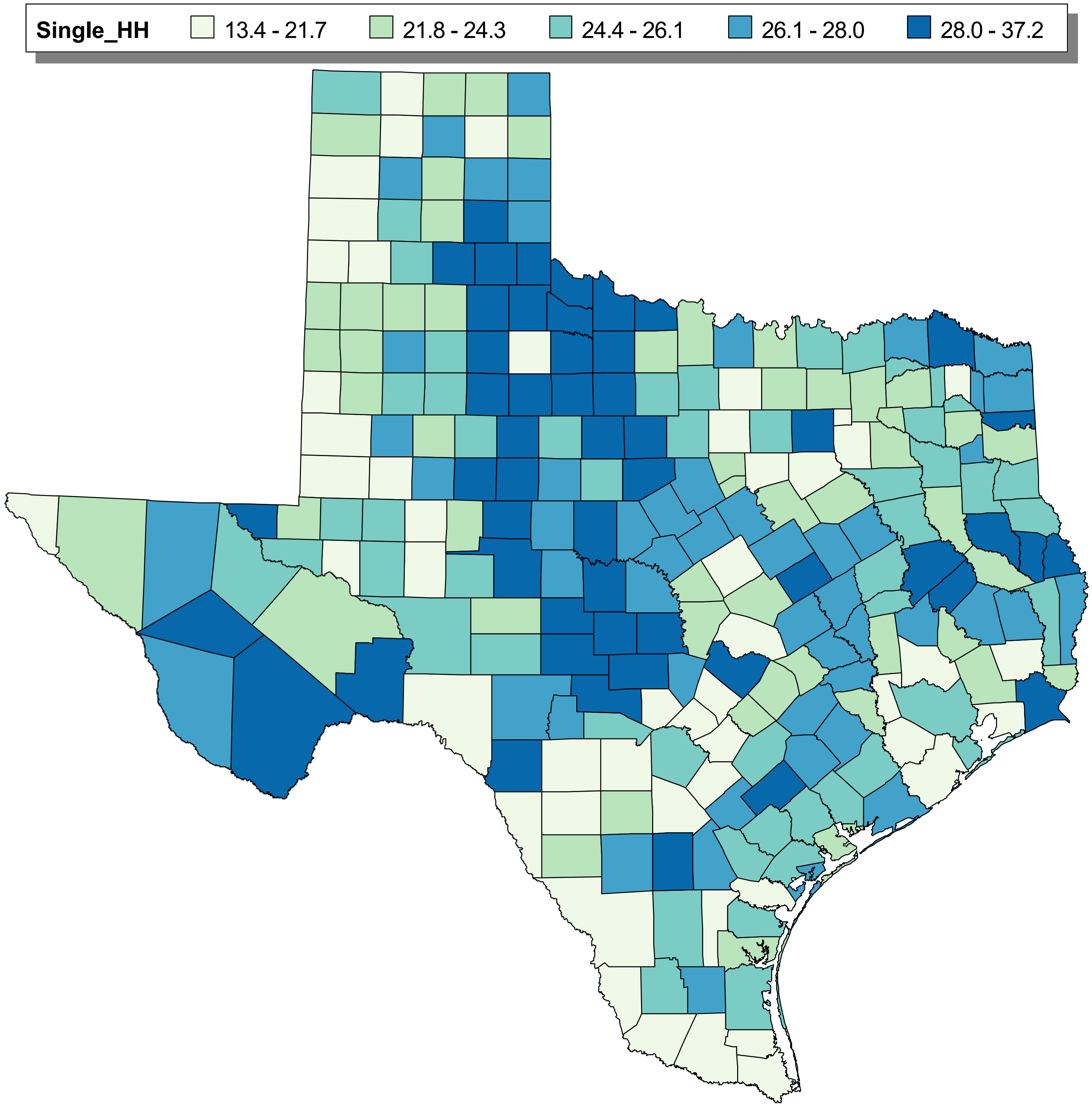
2010 Census SF1 Percent Single Households by State.

2010 Census SF1 Percent Single Households by State



2010 Census Percent Single Person Households Texas Counties

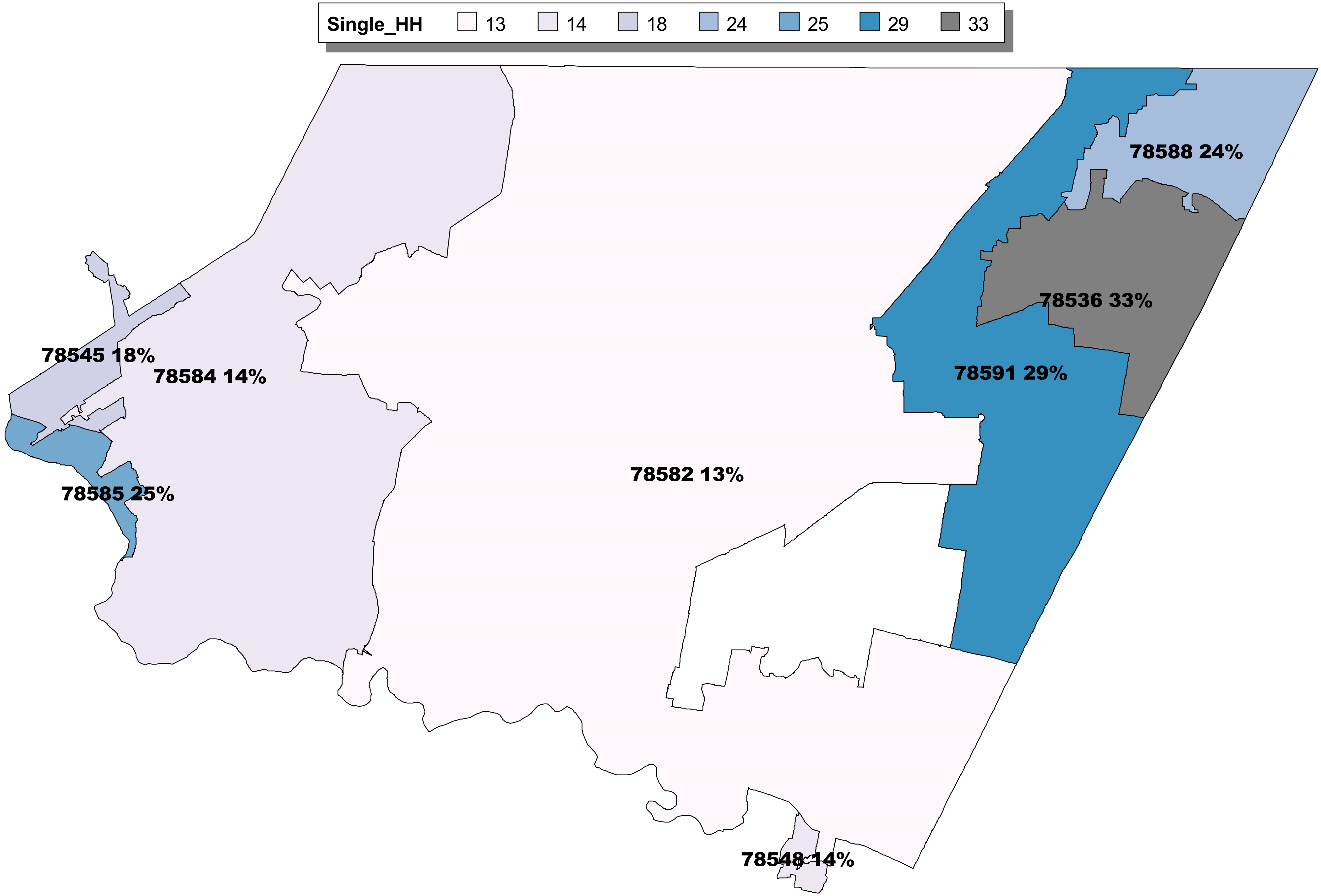
2010 Census SF1 Percent Single Households Texas Counties



2010 Census Percent Single PersonHouseholds Starr County(TX)
Proc gremove would excude Zcta areas ouside the county

Percent Single PersonHouseholds Starr County(TX) by Zcta

Percent Single Housholds



Meta data and code for State map

Major headings in the SF1 Census data.
ums_sf1zcta is the Zcta table and 1st 3 bytes of label are level

```
proc sql;
  create
    table mjrcat as
  select
    answer
  from
    mta.mta_mtacen
  where
    table="UMS_SF1ZCTA"
    and question = "LABEL"
    and answer eqt "001"
  ;quit;
```

NOTE: The variable names and hierarchy are the same for
all SF1 geographies, ie state, county and Zcta

The query above pulls 184 major categories.
Here is a sample of major headings, SF1 is hierachical

001@V=H3I1@Occupancy Status [3]@Total:
001@V=H4I1@Tenure [4]@Total:
001@V=H5I1@Vacancy Status [8]@Total:
001@V=H6I1@Race Of Householder [8]@Total:
001@V=H13I1@Household Size [8]@Total:
001@V=P18I1@Household Type [9]@Total:

001 means it is a major category
H3I1 variable name - Household major category 3 line 1
Household Size is major category name
[3] has three subcategories
Total - usually total of subcategories

NOTE: The variable names and hierarchy are the same for
all SF1 geographies, ie state, county and Zcta

Lets examine Household Size(H13I) and subcategories.

Simple query for subcategories

Lets examine subcategories of Household Size.
Note: variable eqt "H13I" give all sub cats

```
proc sql;
  create
    table mjrcat as
  select
    question
   ,answer
  from
    mta.mta_mtacen
  where
    table="UMS_SF1ZCTA"
    and question in ("LABEL","DESCRIPTION")
    and variable eqt "H13I"
;quit;
```

The query above lists the subcategorues, SF1 is hierarchical
Here is the result of the query

```
QUESTION       ANSWER

DESCRIPTION    001   Total:
DESCRIPTION    002     1-person household
DESCRIPTION    003     2-person household
DESCRIPTION    004     3-person household
DESCRIPTION    005     4-person household
DESCRIPTION    006     5-person household
DESCRIPTION    007     6-person household
DESCRIPTION    008     7-or-more-person household
LABEL          001@V=H13I1@Household Size [8]@Total:
LABEL          002@V=H13I2@Household Size [8]@Total:@1-person household
LABEL          003@V=H13I3@Household Size [8]@Total:@2-person household
LABEL          004@V=H13I4@Household Size [8]@Total:@3-person household
LABEL          005@V=H13I5@Household Size [8]@Total:@4-person household
LABEL          006@V=H13I6@Household Size [8]@Total:@5-person household
LABEL          007@V=H13I7@Household Size [8]@Total:@6-person household
LABEL          008@V=H13I8@Household Size [8]@Total:@7-or-more-person household
```

DESCRIPTION: Provides the last subcategory
LABEL: Provides the full hierarchy. Some cells have five levels

The data is not stored with the meta data.

We know the variables so lets get some data

Extracting household size data for state=TX

This is all the code for Texas household size data
We are not using meta data, this is actual data(wildcard :).

```
proc transpose
    data=mta.ums_sf1state(where=(stab="TX") keep=stab H13I:)
    out=sf1state_1;
by stab;
;run;quit;
```

```
STAB _LABEL_                                                    COL1

 TX  Var=H13I1:@Household Size@Total:                          8922933
 TX  Var=H13I2:@Household Size@Total:@1-person household       2163266
 TX  Var=H13I3:@Household Size@Total:@2-person household       2703417
 TX  Var=H13I4:@Household Size@Total:@3-person household       1482329
 TX  Var=H13I5:@Household Size@Total:@4-person household       1312995
 TX  Var=H13I6:@Household Size@Total:@5-person household        716376
 TX  Var=H13I7:@Household Size@Total:@6-person household        310605
 TX  Var=H13I8:@Household Size@Total:@7-or-more-person household  233945
```

Lets prepare the data for a US map of all states

I selected state level data and Texas to limit output.

Lets prepare the data for a US map of all states
100*H13I2/H13I1 is percent single households

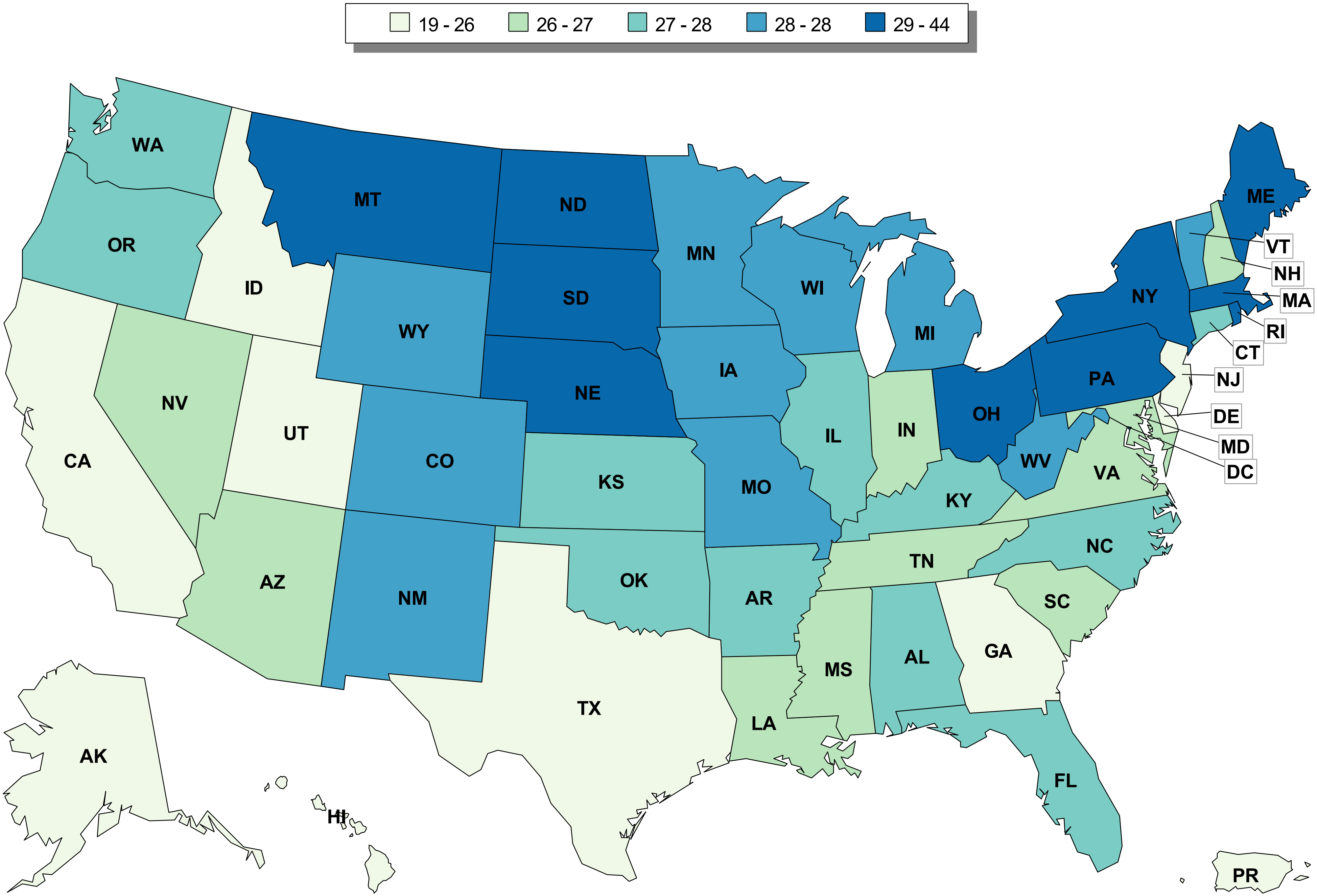
```
data sf1statemap;
  set mta.ums_sf1state(
      rename=stab=state
      keep=stab H13I1 H13I2);
  Single_HH=100*H13I2/H13I1;
;run;quit;
```

Lets create a US state map with the percent of single households.

See cen_sf1.zip for state map macro
Lets prepare the data

```
title;footnote;
let utl_pdf=c:\temp\utl_100usmap.pdf;
ods listing close;
options orientation=landscape;
ods pdf file="c:\temp\utl_100usmap.pdf" style=pearl notoc;
ods graphics on;
utl_100usmap(
     var=Single_HH
    ,inp=sf1statemap
    ,tyt=2010 Census SF1 Percent Single Households by State
    );
ods pdf close;
ods graphics off;
ods listing;
run;quit;
```

2010 Census SF1 Percent Single Households by State



County Map

Prepare the data for a county map of Texas

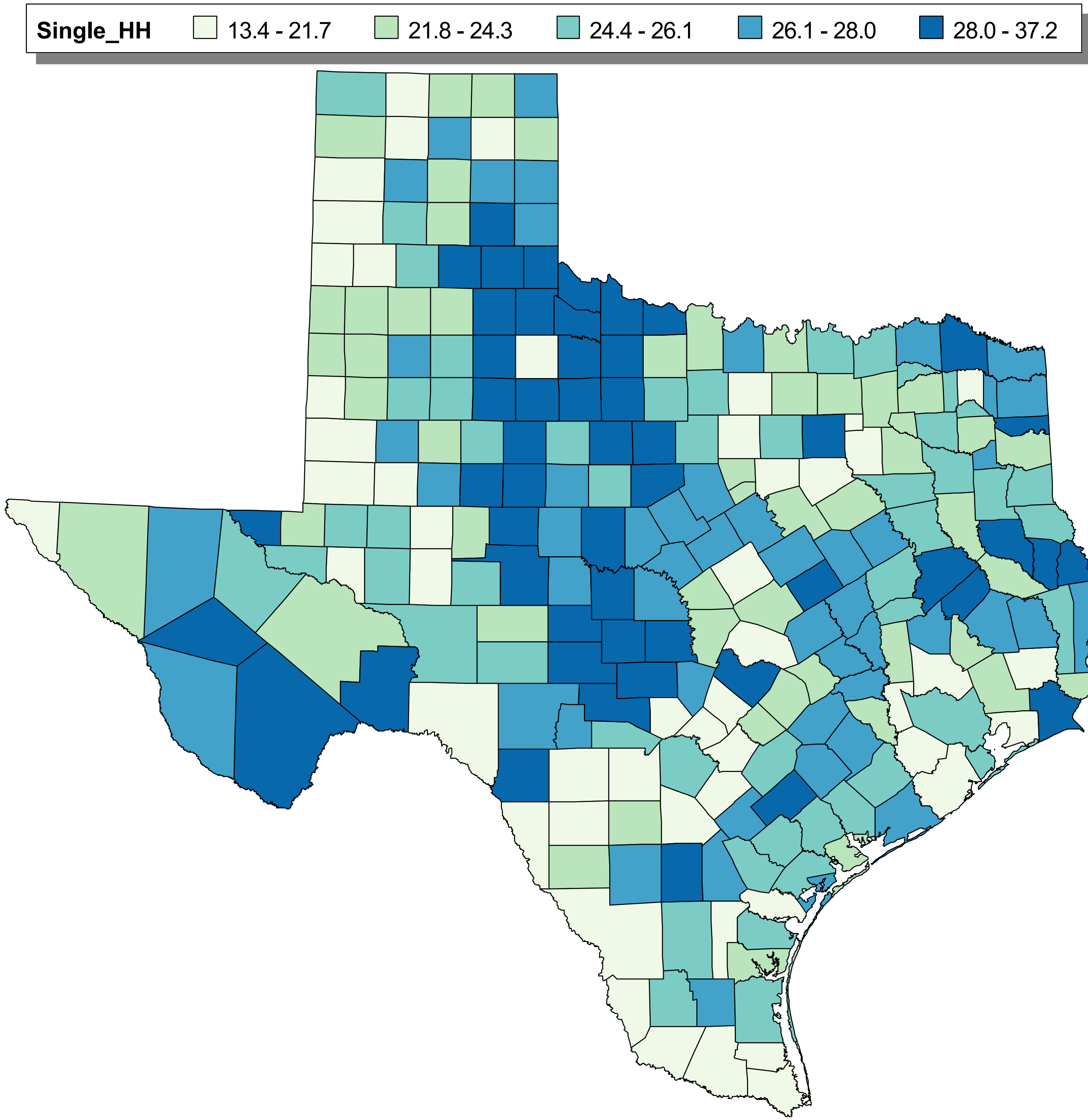
```
data sf1countymap;
  set mta.ums_sf1county(
      rename=(state=statec county=countyc)
      keep=state county H13I1 H13I2
      where=(statec eq "48"));
  Single_HH=100*H13I2/H13I1;
  state=input(statec,5.);
  county = input(substr(countyc,3),5.);
  drop H13I2 H13I1 statec countyc;
;run;quit;
```

Lets create Texas county map with percent single households

Create Texas county map with percent single households

```
title1 "2010 Census SF1 Percent Single Households by County";
pattern1 value=solid color="CXF0F9E8";
pattern2 value=solid color="CXBAE4BC";
pattern3 value=solid color="CX7BCCC4";
pattern4 value=solid color="CX43A2CA";
pattern5 value=solid color="CX0868AC";
legend1 shape=bar(.15in,.15in) frame cshadow=gray position=(top)
label=(position=left height=2pct font="arial/bold")
value=(height=2pct font="arial");
proc gmap data=sf1countymap map=texas;
id state county;
format single_hh 5.1;
choro single_hh /
 levels=5 legend=legend1 cempty=white cdefault=white coutline=black;
run; quit;
```

2010 Census SF1 Percent Single Households for Starr County(TX)



Zip Tabulation Area Map

Zcta Map for Starr County(TX) Zip Boundaries
You can get a list of USPS zips in Starr County from the web

What meta data do we have related to ZCTA

Querying for meta data on Zcta

```
proc transpose data=mta.mta_mtacen (where=(
      table="UMS_SF1ZCTA" and
      question in  ("LABEL","NOTES") and
      variable in ("ZCTA5","NUMZIP","ZCTA2ZIP")));
by variable question;
var answer;
;run;quit;
```

Result of query

```
VARIABLE QUESTION  ANSWER
NUMZIP    LABEL    Number of USPS Zips in ZCTA
ZCTA5     LABEL    ZIP Census Tabulation Area
ZCTA2ZIP  LABEL    Format for lookup for the list of USPS Zips in
                   the ZCTA ie put("20906",zcta2zip_v1f.)
                   gives N004@20897@20906@20908@20916 most are 1:1
ZCTA5     NOTES    ZIP Code Tabulation Areas (ZCTAs) are approximate area
                   representations of U.S. Postal Service (USPS) five-digit
                   ZIP Code service areas. The Census Bureau defines ZCTAs by
                   allocating each block that contains addresses to a single
                   ZCTA, usually to the ZCTA that reflects the most frequently
                   occurring ZIP Code for the addresses within that tabu
                   lation block. Blocks that do not contain addresses but are
                   completely surrounded by a single ZCTA (enclaves) are
                   assigned to the surrounding ZCTA; those surrounded by mult
                   iple ZCTAs will be added to a single ZCTA based on limited
                   buffering performed between multiple ZCTAs. The Census Bureau
                   identifies five-digit ZCTAs using a five-character
                    numeric code that represents the most frequently occurring
                   USPS ZIP Code within that ZCTA, and this code may contain
                   leading zeros. Data users should not use ZCTAs to ide
                   ntify the official USPS ZIP Code for mail delivery. The
                   ZCTAs process used primarily residential addresses and was
                   biased towards Zip Codes used for city-style mail delive
                   ry, thus there may be Zip Codes that are primarily
                   nonresidential or boxes only that may not have a corresponding ZCTA.
```

How to get a list of USPS Zips in a given Zcta
The vast majority of Zctas have just one USPS zipcode

The code below provides:

- Number of USPS zips in a given Zcta(20906)
- List of the four zips in Zcta 20906

```
options fmtsearch=(mta.mta_formats_v1f work.formats);
data  subzipdat;
  set mta.ums_sf1zcta(keep=zcta5 numzip
     where=(zcta5 ="20906") );
  usps_zips=put(zcta5,$ZCTA2ZIP_V1F.);
  put
     zcta5  = /
     numzip = /
     usps_zips= /
;run;quit;
```

RESULT

```
ZCTA5      =  20906
NUMZIP     =  4
usps_zips  =  N004@20897@20906@20908@20916
```

Downloading and using the Census ZCTA shapefiles

Unzip Yammer cen_sf1.zip file and skip import or go to Census site
Go to http://www.census.gov/cgi-bin/geo/shapefiles2010/main

Select Geography ie Zip Tabulation Area = see Ymmer file
Select State
Download and unzip

Run the code below for subset boundary for Starr County Zips(TX)

```
proc mapimport datafile="c:\mta\shp\tl_2010_26_zcta510.shp" out=kntzip;
;run;quit;

data subzipmap;
  set
    ums.ums_zcta_tx(where=(zcta in (
"78536" ,"78545" ,"78548" ,"78582",
"78584" ,"78585" ,"78588" ,"78591")));
;run;quit;

proc sort data=subzip out=subzipsrt;
by zcta;
;run;quit;
```

I have the shape files for all Zcta geographies.
No need to do over 50 downloads from the Census site.
Just email me.

Prepare Zcta data and compute percent single households

Prepare the SF1 Zcta data and compute percent single households

```
data  subzipdat(drop=H13I2 H13I1);
  set mta.ums_sf1zcta(keep=H13I2 H13I1 zcta5
    rename=zcta5=zcta  where=(zcta in (
"78536" ,"78545" ,"78548" ,"78582",
"78584" ,"78585" ,"78588" ,"78591")));
 Single_HH=100*H13I2/H13I1;
 txt=catx(" ",zcta,cats(put(Single_HH,3.),"@"));
;run;quit;
```

TXT	ZCTA	Single_HH
78536 33	78536	33.1
78545 18	78545	18.1
78548 14	78548	14.0
78582 13	78582	12.7
78584 14	78584	13.8
78585 25	78585	25.1
78588 24	78588	23.7
78591 29	78591	28.8

Build annotation dataset and formats

Build annotation dataset and formats @ is percent sign

Run these macros see Yammer cen_sf1.zip
Add ZCTA and percent Single households to the ZCTA map

ANNOMAC;
MAPLABEL (subzipsrt, subzipdat, anno, zcta,
zcta5,font=Arial Black,color=black, size=2, hsys=3);

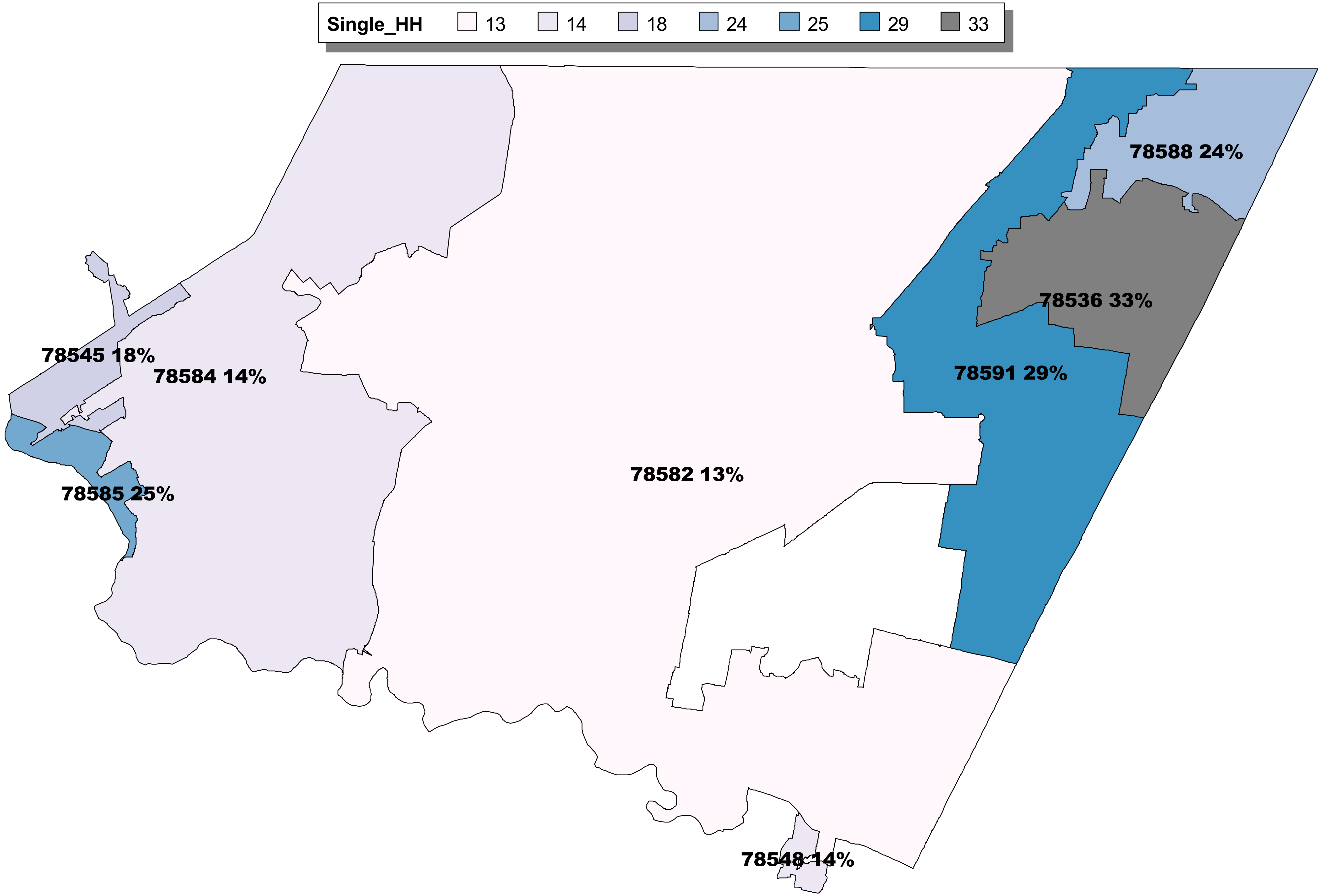
Produce the final zipciode map
With progressive shading and percent annotation

Produce the final zipciode map

```
options orientation=landscape;
goptions reset=all rotate=landscape;
ods graphics on / reset  height=640px width=800px;
ODS pdf file="c:/mta/pdf/mta_cen_kvtmap.pdf";
PATTERN1 C = cxfff7fb;
PATTERN2 C = cxece7f2;
PATTERN3 C = cxd0d1e6;
PATTERN4 C = cxa6bddb;
PATTERN5 C = cx74a9cf;
PATTERN6 C = cx3690c0;
PATTERN7 C = cx570b0 ;
PATTERN8 C = cx34e7b ;
PROC GMAP DATA = subzipdat map= subzipsrt all;
TITLE1 height=2.5pct "ZCTA Map  for Starr County(TX)";
TITLE2 height=2.5pct "Percent Single Housholds";
format Single_HH 2.;
legend1 shape=bar(.15in,.15in) frame cshadow=gray position=(top)
label=(position=left height=2pct font="arial/bold")
value=(height=2pct font="arial");
ID ZCTA;
FORMAT Percent PercentGroup.;
CHORO Single_HH /levels=4 discrete annotate=anno legend=legend1;
RUN;quit;
ods pdf close;
ods graphics off;
```

ZCTA Map for Starr County(TX) Zip

Percent Single Housholds



For complete code see Yammer zip file cen_sf1.zip

Zipcodes with Under Performing Marketplace Enrollment(fake data).

Using simple question and answer queries to
locate the data and documentation for your the project.
Integrating documentation and meta data for
MIDAS, IDR, CCW, Financial Management,
CENSUS, Acxiom, Experian and Consumer Surveys(DOL)

Roger DeAngelis
11/18/2015

Agenda

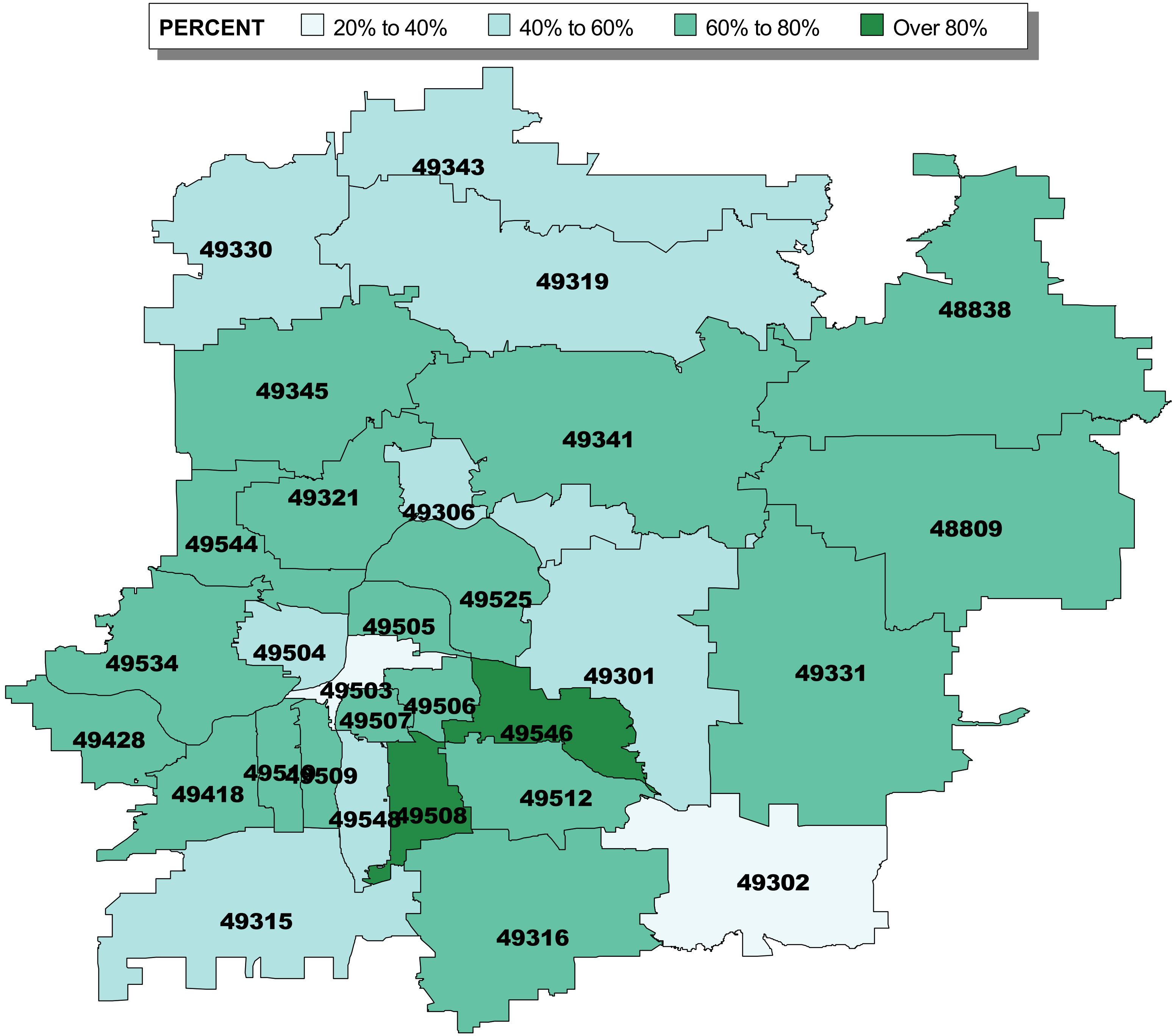
- Final map of Under Performing Zipcodes.
- Querying the meta data for percent enrolled from SF1 Census.
- ZCTA boundary files downloaded from Census site.
- Kent County Michigan zips pulled from either SAS or Internet.
- Boundary and percent enrolled subsetted for Kent County.
- An annotation dataset created with ZCTA labels
- A projection map is not needed since the earths curvature not an issue.
- Proc GMAP is used to graph the final data.

Although SAS can map state and county, there is more
data elements at the zip level than other geographies. There are
many Zip crosswalks for elements: such as HRR, Poverty, Income...

Final map of Under Performing Zipcodes.

Marketplace Enrollment Kent County Michigan by Zipcode(fake data)

Percent of Eligible Enrollees



Querying the meta data for fake Percent Enrollment

Lets pull all the major headings in the SF1 Census data.
The query below lists the major headings, SF1 is hierachical

```
proc sql;
  create
     table answer as
  select
    distinct
     scan(answer,2,"@") as major
  from
     mta.mta_cenfact
  where
     context = "SF1CENSUS"
     and question = "LABEL"
     and table eqt "UMS_SF1ZCTA"
;quit;
```

The Query pulled 124 Major Headings
Here is a sample

Median Age By Sex
Race (Total Races Tallied)
Race For The Population 18 Years And Over
Race Of Householder
Sex By Age

Hierarchy for "Sex By Age"

Lets pull the full hierarchy in the SF1 Census data.
The query below lists the full hierarchy

```
proc sql;
  create
    table answer as
  select
    answer
  from
    mta.mta_cenfact
  where
    context = "SF1CENSUS"
    and question = "LABEL"
    and table eqt "UMS_SF1ZCTA"
    and scan(answer,2,"@") eqt "Sex By Age"
;quit;
```

We decide on the answers below

Var=P12I26:@Sex By Age@Total:@Female:
Var=P12I2:@Sex By Age@Total:@Male:

We are not interested in the Age breakdowns.

Lets pull data for Zip 20906

Lets pull data for Zip 20906
The query below lists the full hierarchy

```
proc transpose
    data=mta.ums_sf1zcta(
        keep=zcta5 P12I26 P12I2
        where=(zcta5="20906")
    ) out=umsxpo;
by zcta5;
;run;quit;
```

Here is what we get

ZCTA5	NAME	LABEL	SEXCOUNT
20906	P12I2	Var=P12I2:@Sex By Age@Total:@Male:	29891
20906	P12I26	Var=P12I26:@Sex By Age@Total:@Female:	34805

Downloading and Importing Census Zip Boundaries

Go to http://www.census.gov/cgi-bin/geo/shapefiles2010/layers.cgi

Select Geography ie Zip Tabulation Area
Select State
Download and unzip

Run the code below to create and subset boundary for Kent County Zips

```
proc mapimport datafile="c:\mta\shp\tl_2010_26_zcta510.shp" out=kntzip;
;run;quit;

data subzip;
  set
    kntzip( rename=ZCTA5CE10=zcta5 where=(zcta5 in (
"48809", "48838", "49301", "49302", "49306",
"49315", "49316", "49319", "49321", "49330", "49331",
"49341", "49343", "49345", "49418", "49428", "49501",
"49502", "49503", "49504", "49505", "49506", "49507",
"49508", "49509", "49512", "49514", "49519", "49525",
"49534", "49544", "49546", "49548")));
;run;quit;

proc sort data=subzip out=subzipsrt;
by zcta5;
;run;quit;
```

Prepare the SF1 data and compute Percent Enrolled

Prepare the SF1 data and compute Percent Enrolled

```
data  subzipnro;
  set mta.ums_sf1zcta(keep=P12I26 P12I2 zcta5
     where=(zcta5 in (
"48809", "48838", "49301", "49302", "49306",
"49315", "49316", "49319", "49321", "49330", "49331",
"49341", "49343", "49345", "49418", "49428", "49501",
"49502", "49503", "49504", "49505", "49506", "49507",
"49508", "49509", "49512", "49514", "49519", "49525",
"49534", "49544", "49546", "49548")));
 percent = round(100*P12I26/(P12I2+P12I26));
 by zcta5;
 zcta=zcta5;
;run;quit;
```

Build annotation dataset and formats

Build annotation dataset and formats @ is percent sign

```
PROC FORMAT;
VALUE PercentGroup
 48 <- 49 = "20% to 40% "
 49 <- 50 = "40% to 60% "
 50 <- 52 = "60% to 80% "
 52 <- HIGH = "Over 80% ";
RUN;

@ANNOMAC;
@MAPLABEL ( subzipsrt, subzipnro, anno, zcta5,
zcta5,font=Arial Black,color=black, size=2, hsys=3);
```

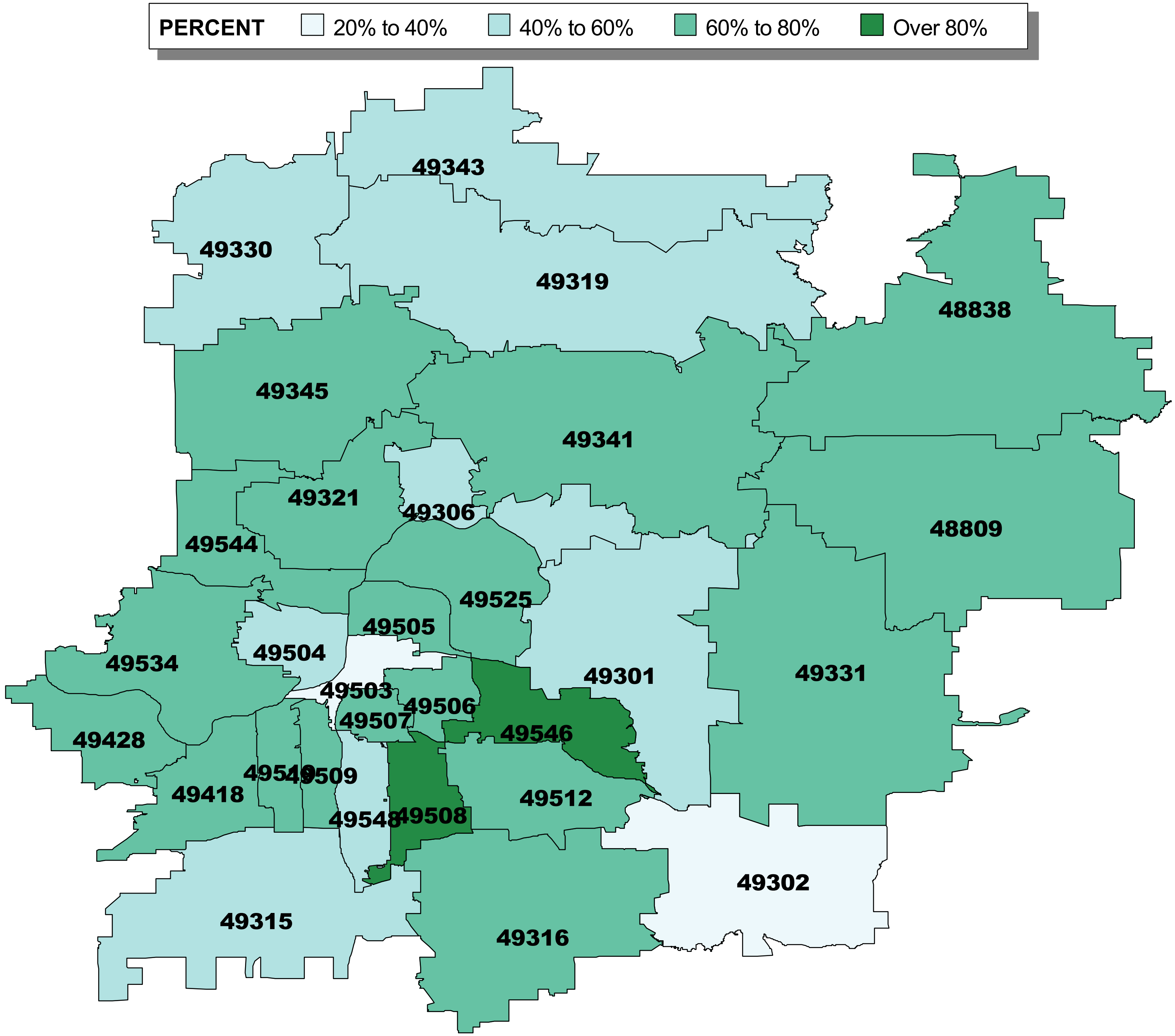
Produce the final zipciode map

Produce the final zipciode map

```
options orientation=landscape;
goptions reset=all rotate=landscape;
ods graphics on / reset  height=640px width=800px;
ODS pdf file="c:/mta/pdf/mta_lntzip_kvtmap.pdf";
PROC GMAP DATA = subzipnro map= subzipsrt all;
TITLE1 height=2.5pct  "Marketplace Enrollment Kent County Michigan by Zipcode(fake
data)";
TITLE2 height=2.5pct  "Percent of Eligible Enrollees";
legend1 shape=bar(.15in,.15in) frame cshadow=gray position=(top)
label=(position=left height=2pct font="arial/bold")
value=(height=2pct font="arial");
PATTERN1 C = cxedf8fb;
PATTERN2 C = cxb2e2e2;
PATTERN3 C = cx66c2a4;
PATTERN5 C = cx238b45;
ID ZCTA5;
FORMAT Percent PercentGroup.;
CHORO Percent /levels=4 discrete annotate=anno legend=legend1;
RUN;quit;
ods pdf close;
ods graphics off;
```

Marketplace Enrollment Kent County Michigan by Zipcode(fake data)

Percent of Eligible Enrollees



HANDOUTS

Hands-On with an Excel-Based Code Playground for Creating and Sharing SAS® ODS Graphics

SESUG Paper 168-2017

CHARTS

CHART TYPE	SLIDE #
SCATTER	3
LINE	14
STEP	25
BAR	32
COMBO	43
TABLE	52
DOT	55
BUBBLE	62
BOX	71
HIGHLOW	82
WATERFALL	89
SERIES	96
HISTOGRAM	107
VECTOR	114

CHART TYPE	SLIDE #
TEXT	123
NEEDLE	128
HEATMAP	135
BAND	144
BLOCK	151
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GTL	194
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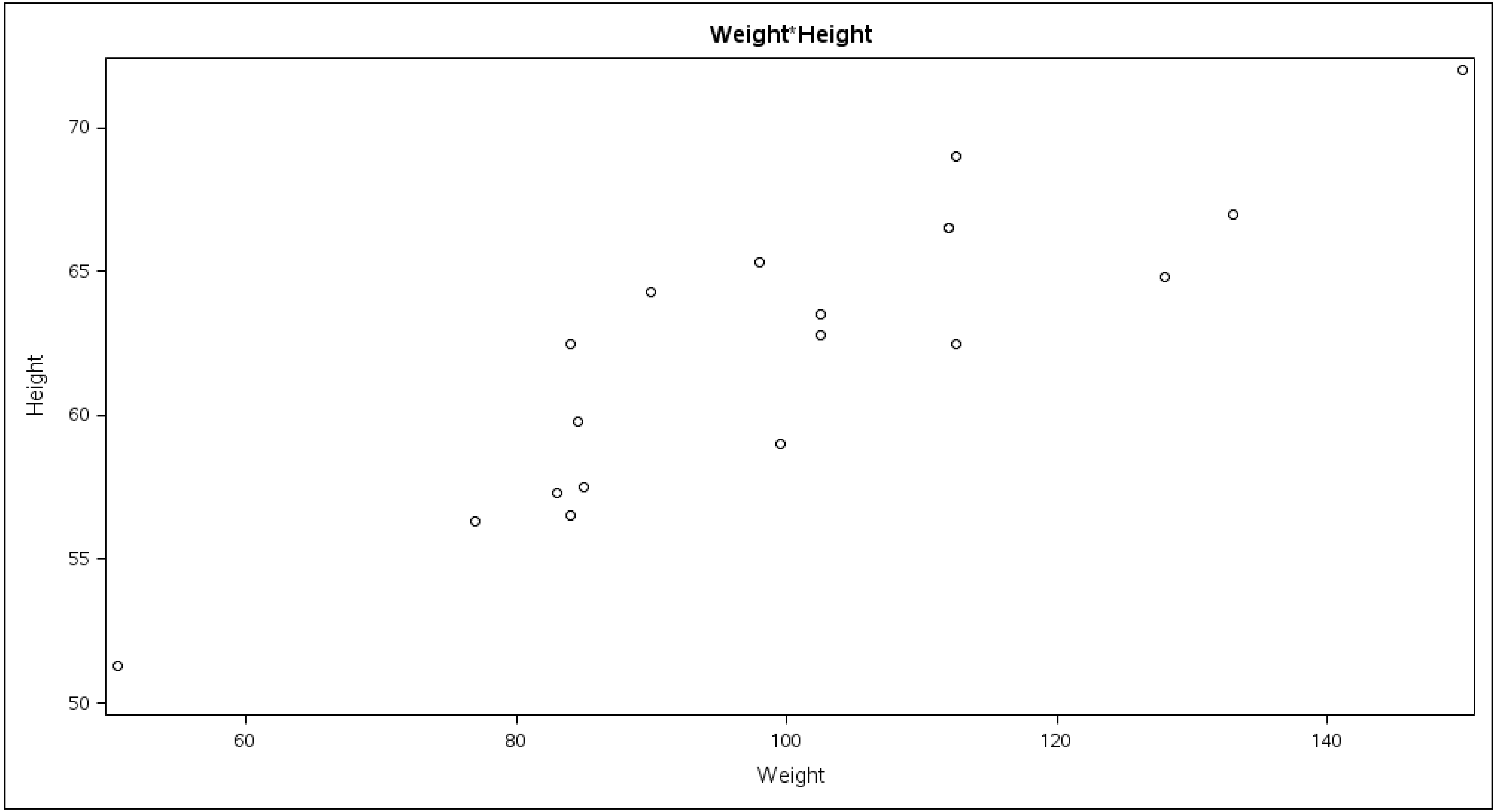
SCATTER CHARTS

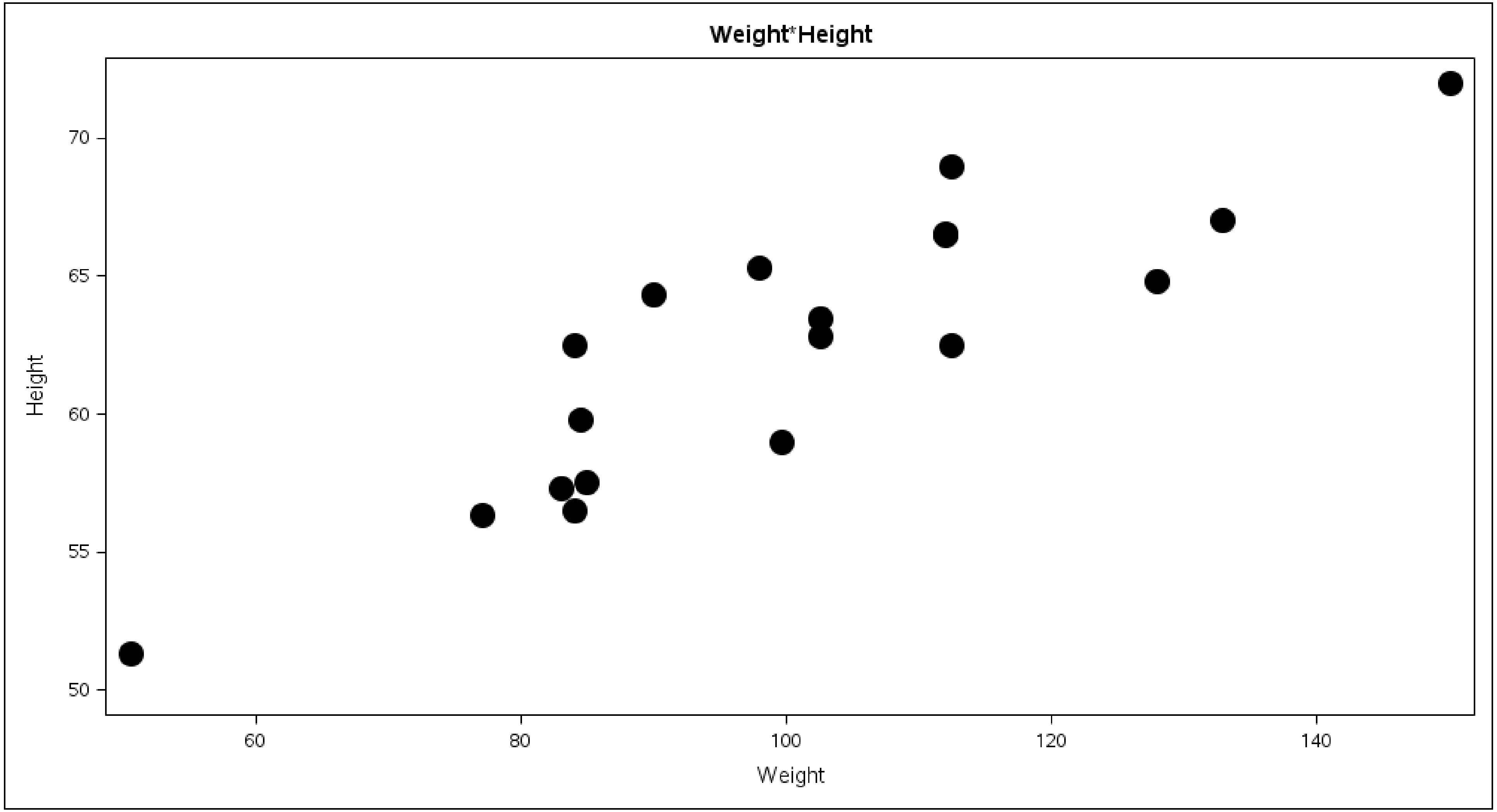
SCATTER CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Weight*Height";
scatter x=weight y=height;
```


Weight*Height
Height
70
65
60
55
50
60
80
100
120
140
Weight

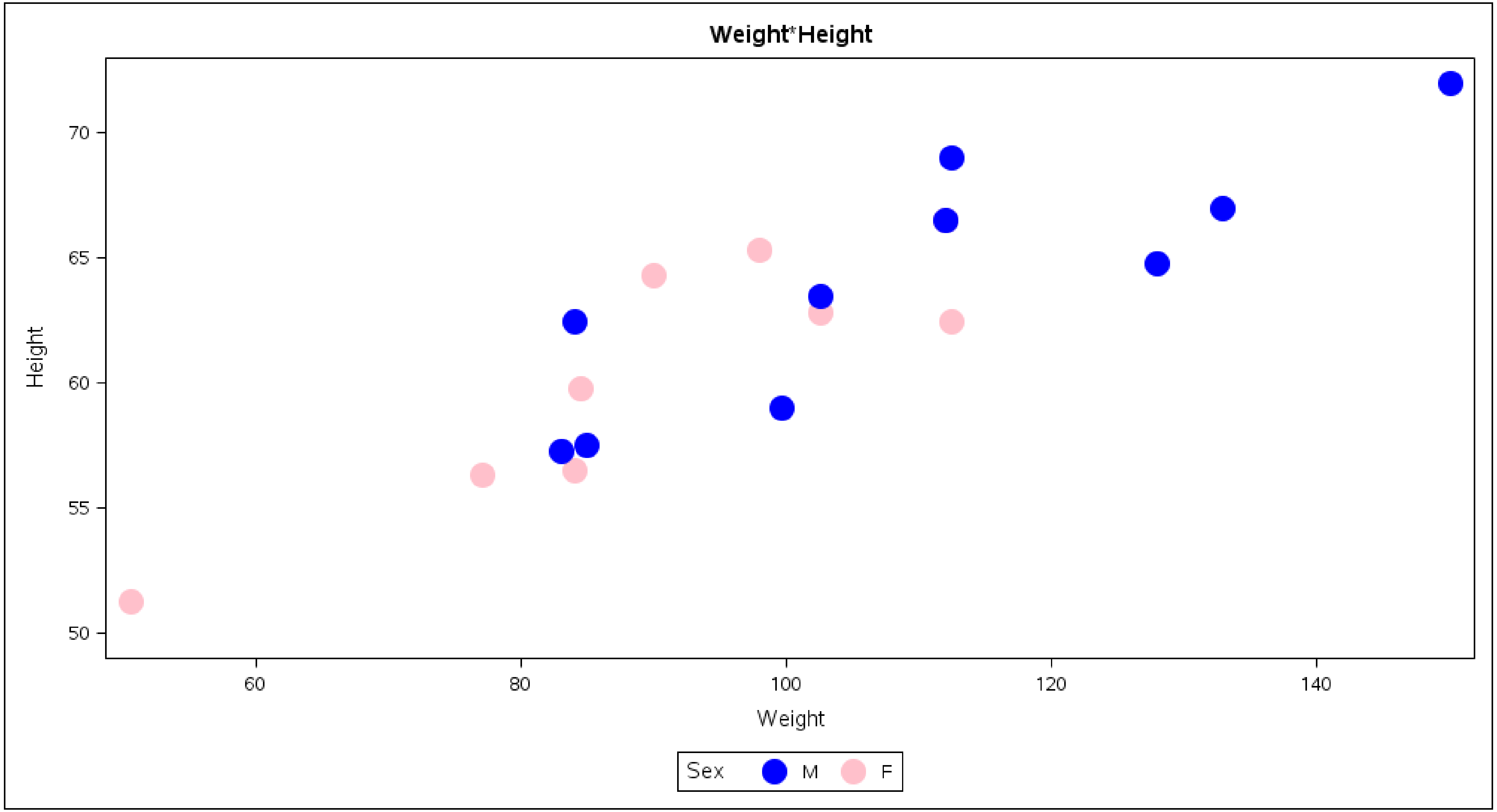
SCATTER CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.class;
title "Weight*Height";
scatter x=weight y=height /
	markerattrs=(size=12pt symbol=circlefilled)
	jitter;
```


Weight*Height
Height
70
65
60
55
50
60
80
100
120
140
Weight

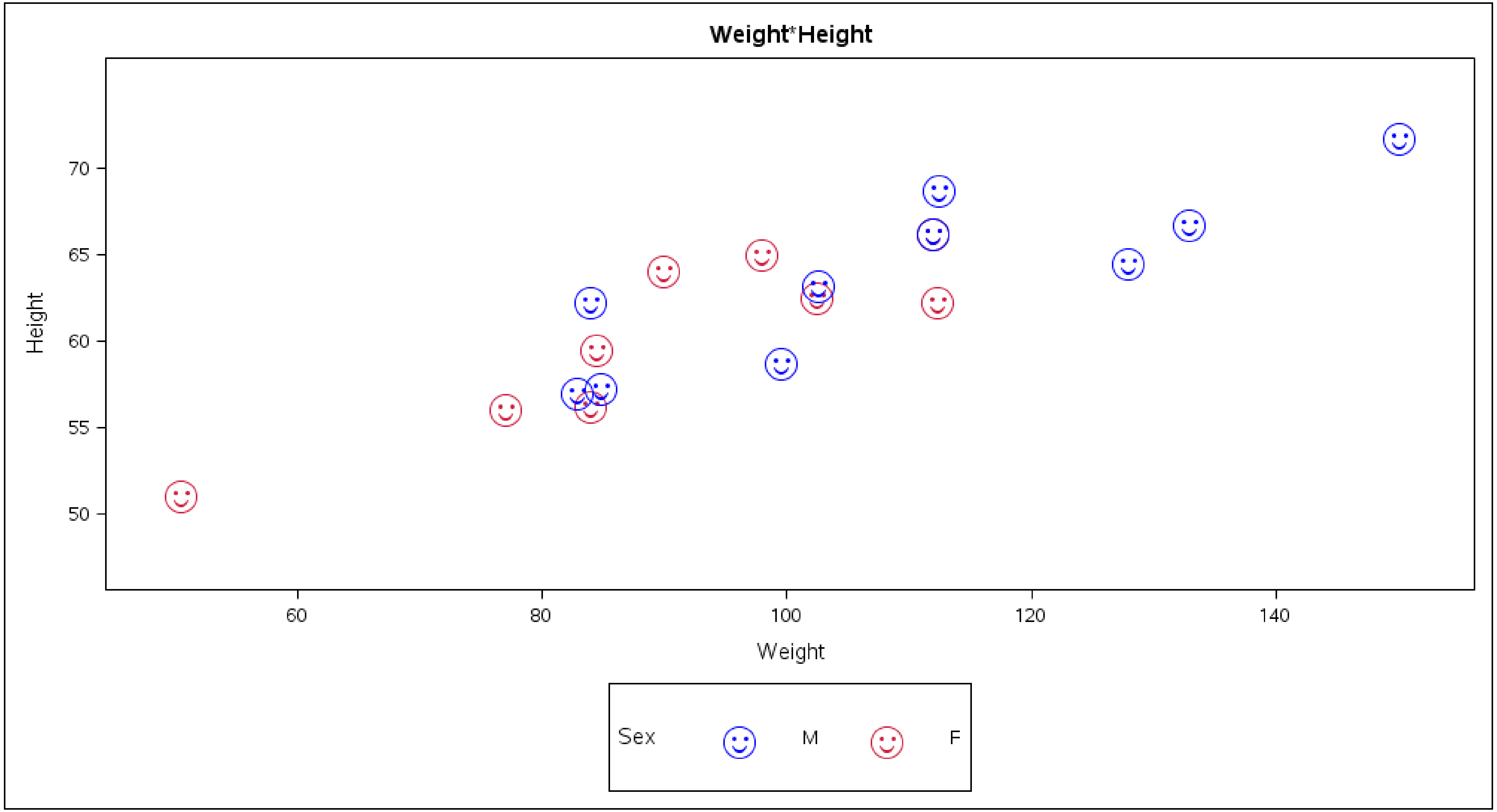
SCATTER CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.class;
title "Weight*Height";
styleattrs datacontrastcolors=(blue pink);
scatter x=weight y=height /
	markerattrs=(size=12pt symbol=circlefilled)
	jitter
	group=sex;
```


Weight*Height
Height
70
65
60
55
50
60
80
100
120
140
Weight
Sex
M
F

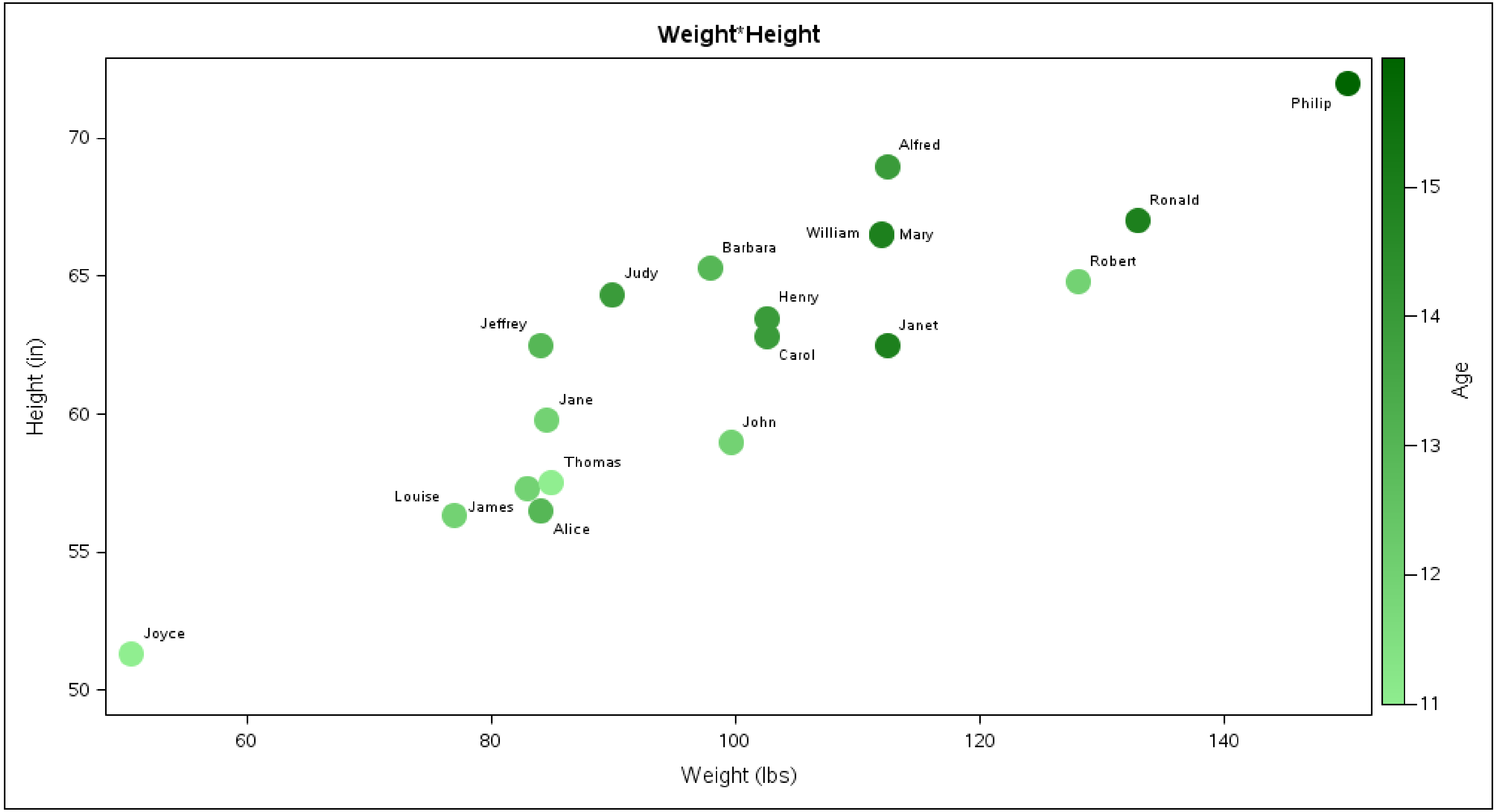
SCATTER CHARTS: EXERCISE 4

```
proc sgplot data=sashelp.class;
title "Weight*Height";
styleattrs datacontrastcolors=(blue vipk);  * VIPK=Vivid Pink;
symbolchar name=Smiley char='263A'x;  * Unicode smiley face;
scatter x=weight y=height /
        markerattrs=(size=36pt symbol=Smiley)
        jitter
        group=sex;
```


Weight*Height
Height
70
65
60
55
50
60
80
100
120
140
Weight
Sex
M
F

SCATTER CHARTS: EXERCISE 5

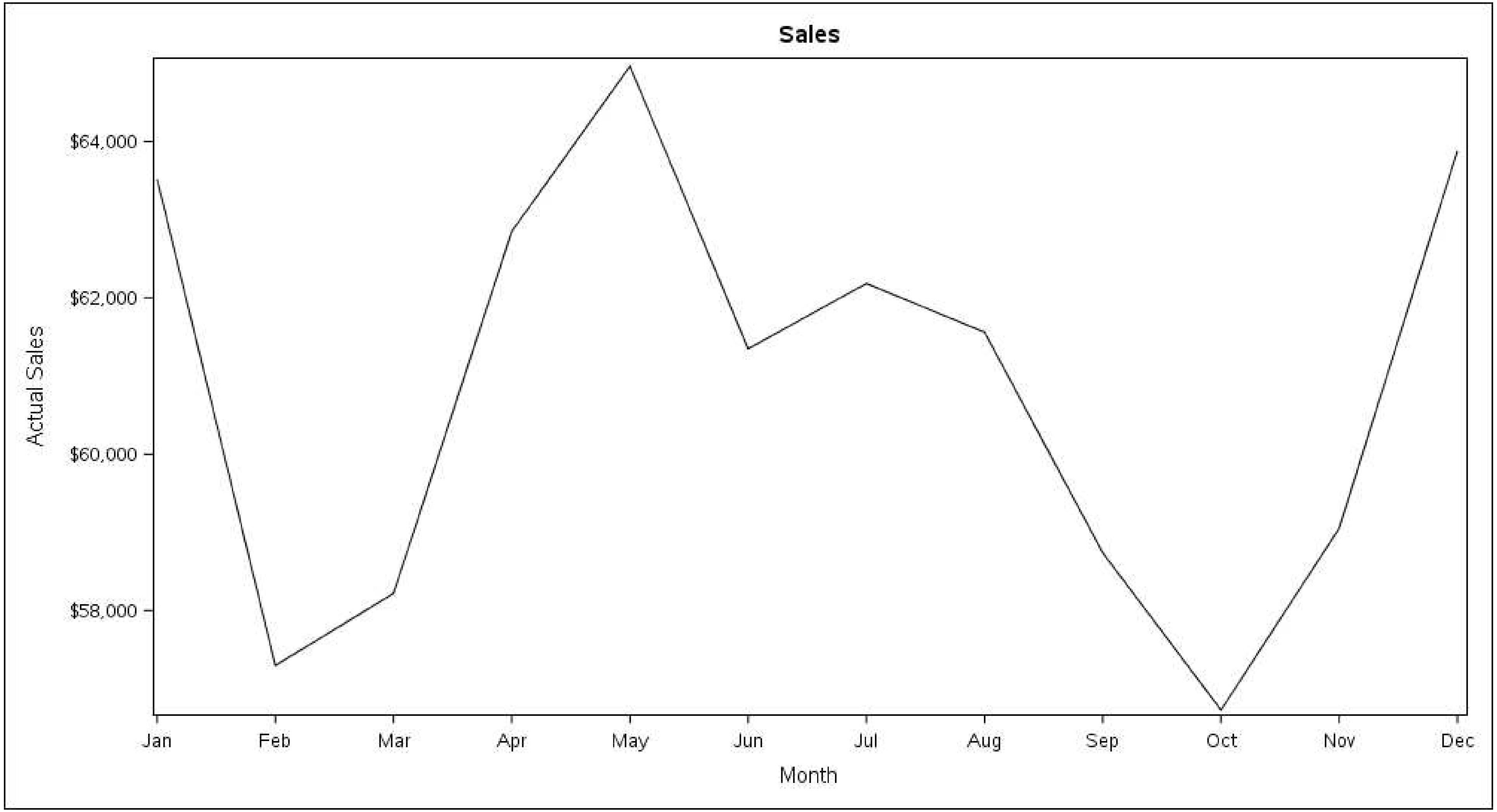
```
proc sgplot data=sashelp.class;
title "Weight*Height";
scatter x=weight y=height /
	markerattrs=(size=12pt symbol=circlefilled)
	jitter
	colorresponse=age
	colormodel=(lightgreen darkgreen)
	datalabel=name datalabelattrs=(color=black);
xaxis label="Weight (lbs)";
yaxis label="Height (in)";
```


Weight*Height
Philip
Alfred
Ronald
William
Mary
Barbara
Robert
Judy
Henry
Janet
Jeffrey
Carol
Jane
John
Thomas
Louise
James
Alice
Joyce
70
65
60
55
50
Height (in)
60
80
100
120
140
Weight (lbs)
15
14
13
12
11
Age

LINE CHARTS

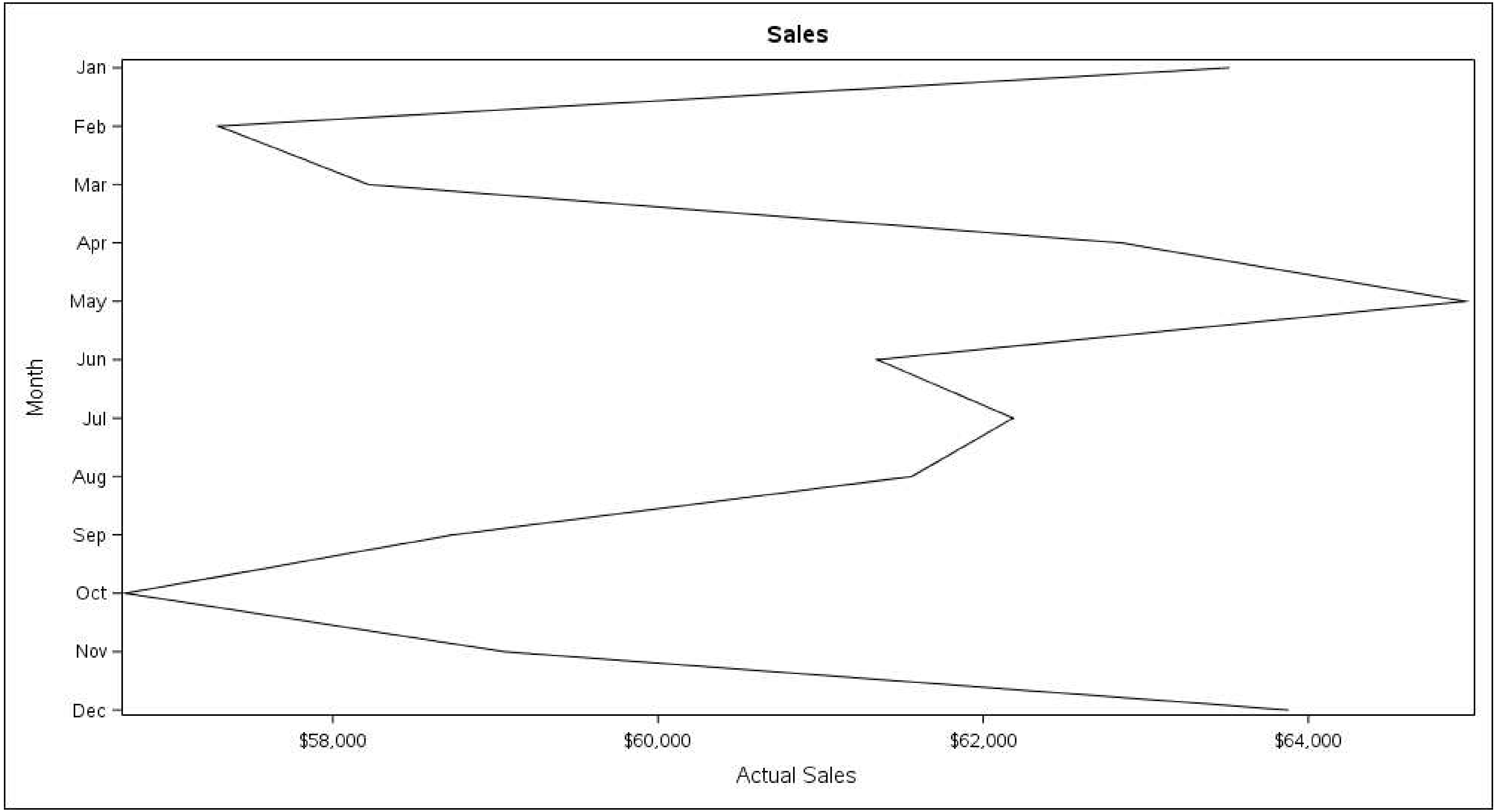
LINE CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.prdsale;
title "Sales";
vline month / response=actual;
```


Sales
Actual Sales
$64,000
$62,000
$60,000
$58,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

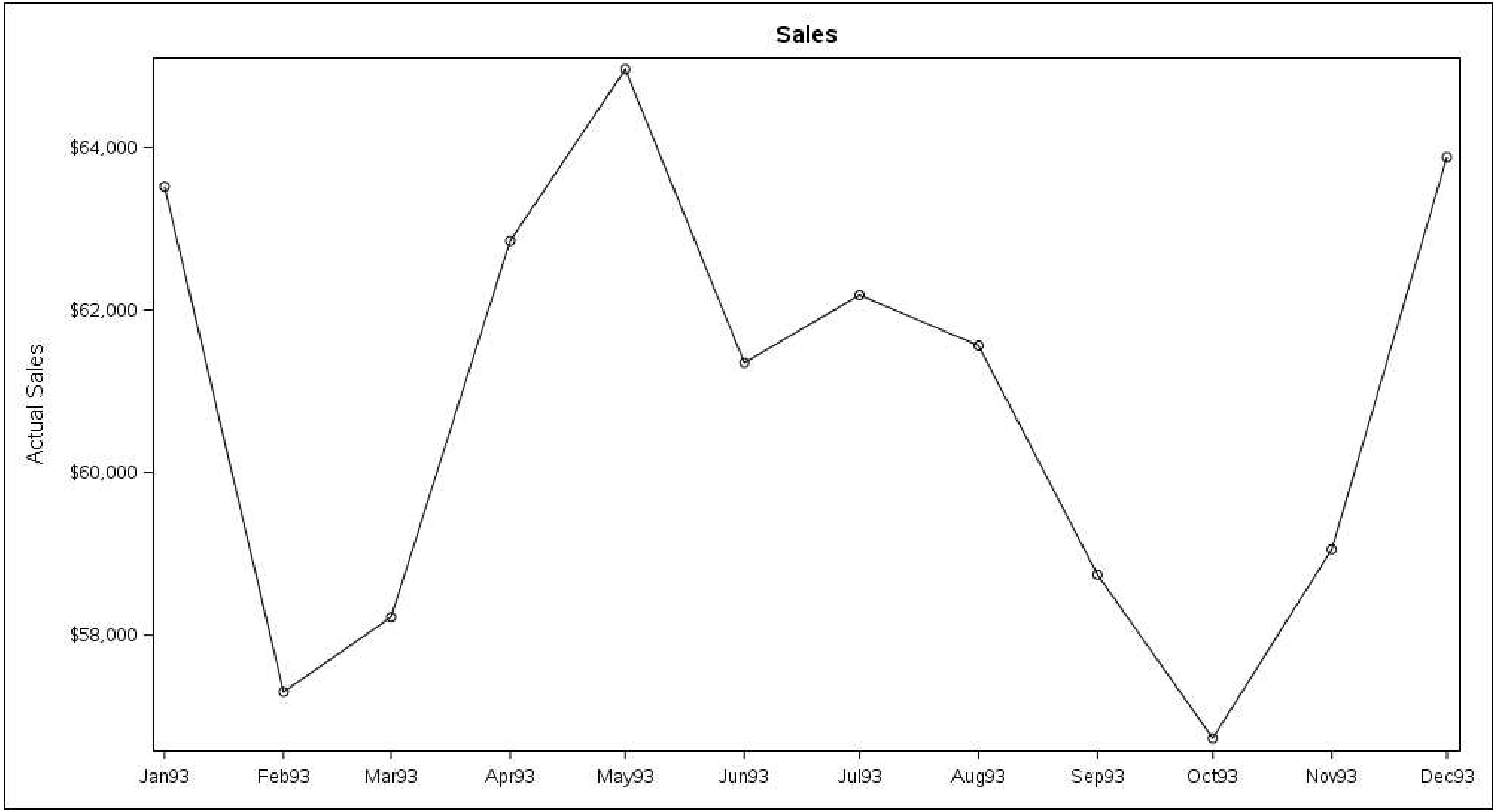
LINE CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.prdsale;
title "Sales";
hline month / response=actual;
```


Sales
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
$58,000
$60,000
$62,000
$64,000
Actual Sales

LINE CHARTS: EXERCISE 3

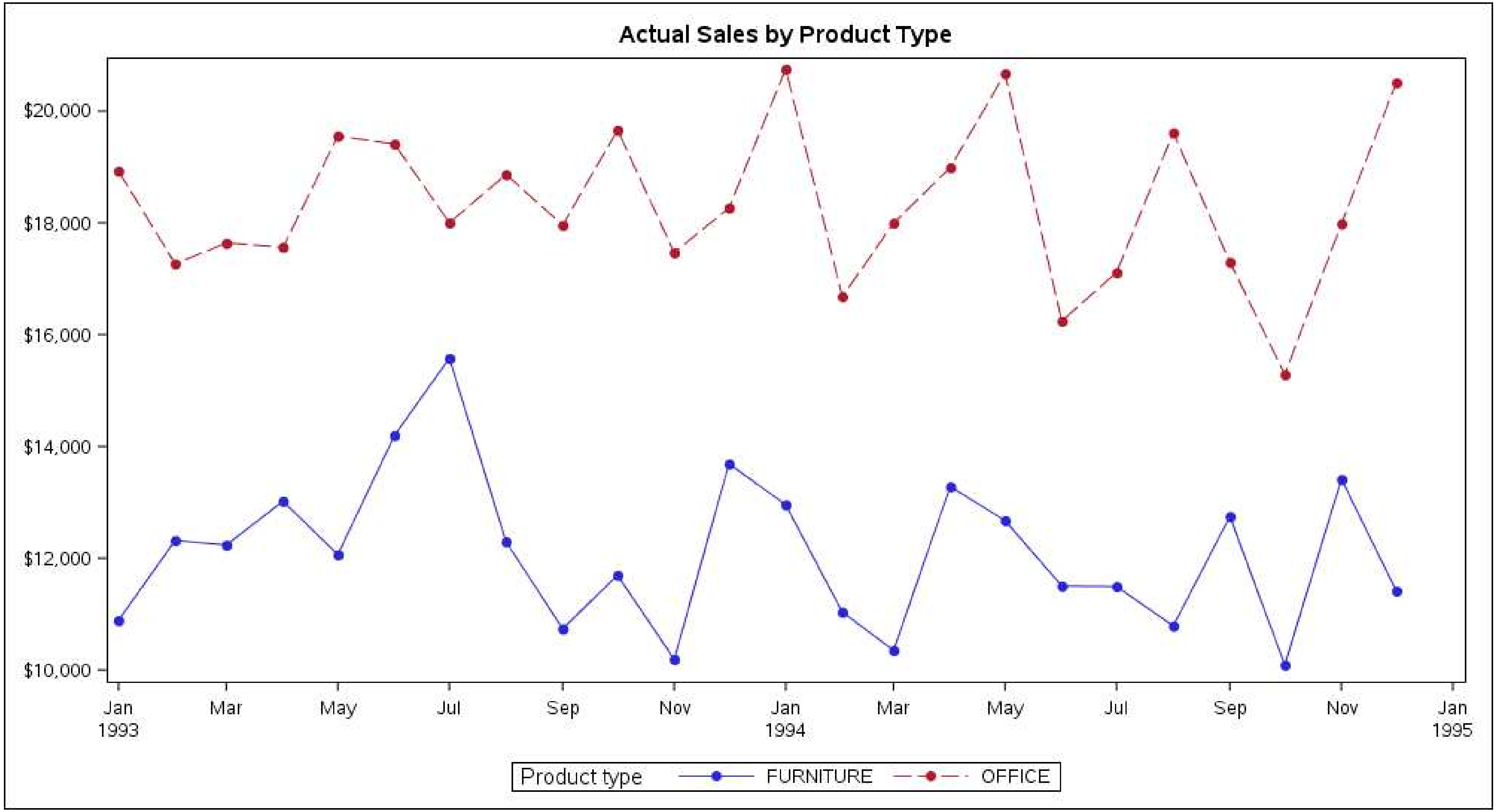
```
proc sgplot data=sashelp.prdsale;
title "Sales";
vline month / response=actual
          markers;
xaxis display=(nolabel) valuesformat=monyy5. type=time;
```



Sales
Actual Sales
$64,000
$62,000
$60,000
$58,000
Jan93
Feb93
Mar93
Apr93
May93
Jun93
Jul93
Aug93
Sep93
Oct93
Nov93
Dec93

LINE CHARTS: EXERCISE 4

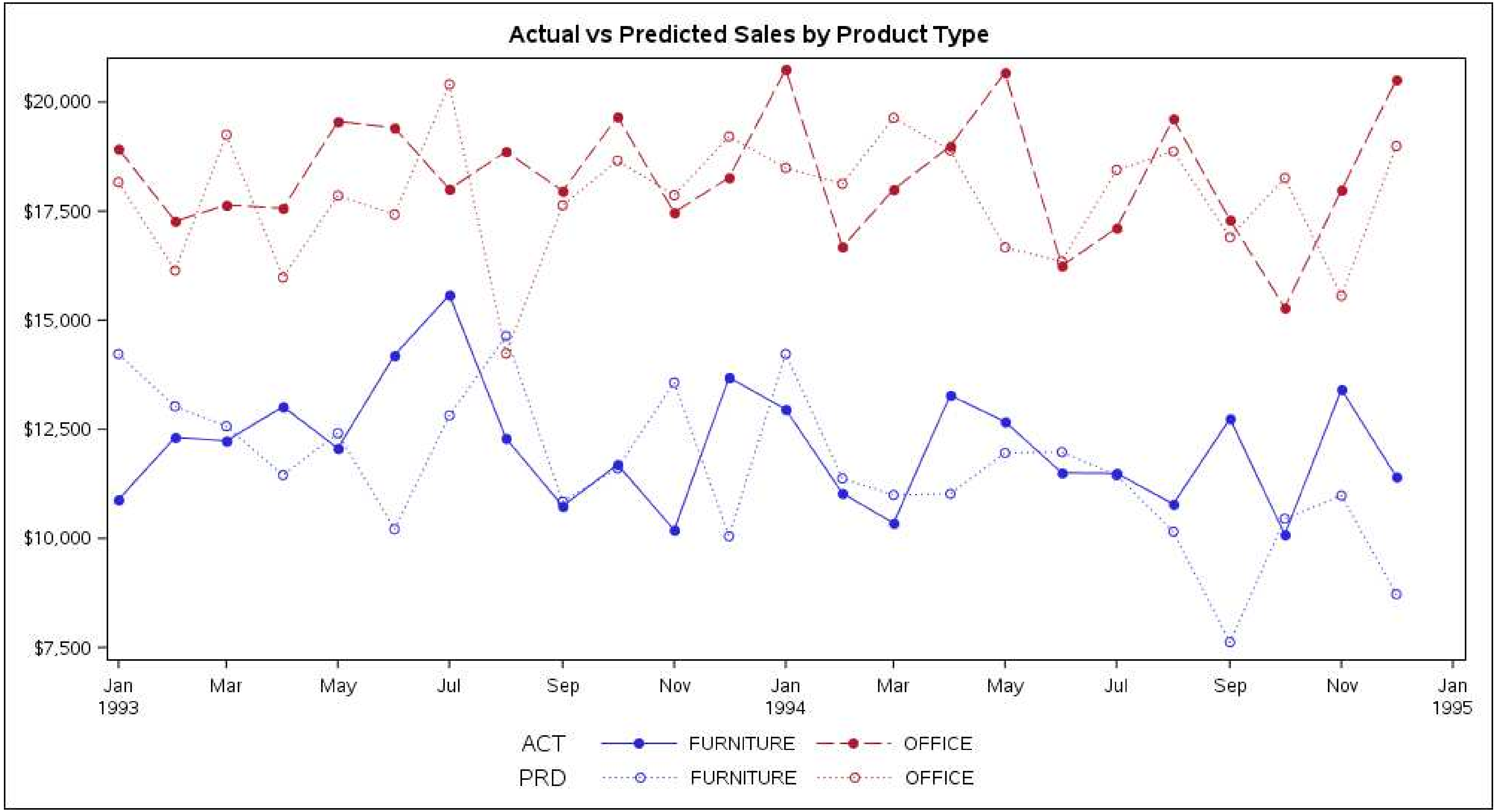
```
proc sgplot data=sashelp.prdsale;
title "Actual Sales by Product Type";
vline month / response=actual
        markers markerattrs=(symbol=circlefilled)
        group=prodtype;
xaxis display=(nolabel) type=time;
yaxis display=(nolabel);
format month yymmdd10.;
```



Actual Sales by Product Type
$20,000
$18,000
$16,000
$14,000
$12,000
$10,000
Jan 1993
Mar
May
Jul
Sep
Nov
Jan 1994
Mar
May
Jul
Sep
Nov
Jan 1995
Product type
FURNITURE
OFFICE

LINE CHARTS: EXERCISE 5

```
proc sgplot data=sashelp.prdsale;
title "Actual vs Predicted Sales by Product Type";
vline month / response=actual
		markers markerattrs=(symbol=circlefilled)
		group=prodtype name="actual";
vline month / response=predict
		markers markerattrs=(symbol=circle)
		group=prodtype lineattrs=(pattern=dot)
		name="predict";
xaxis display=(nolabel) type=time;
yaxis display=(nolabel);
format month yymmdd10.;
keylegend "actual" / title="ACT" position=bottom noborder;
keylegend "predict" / title="PRD" position=bottom noborder;
```

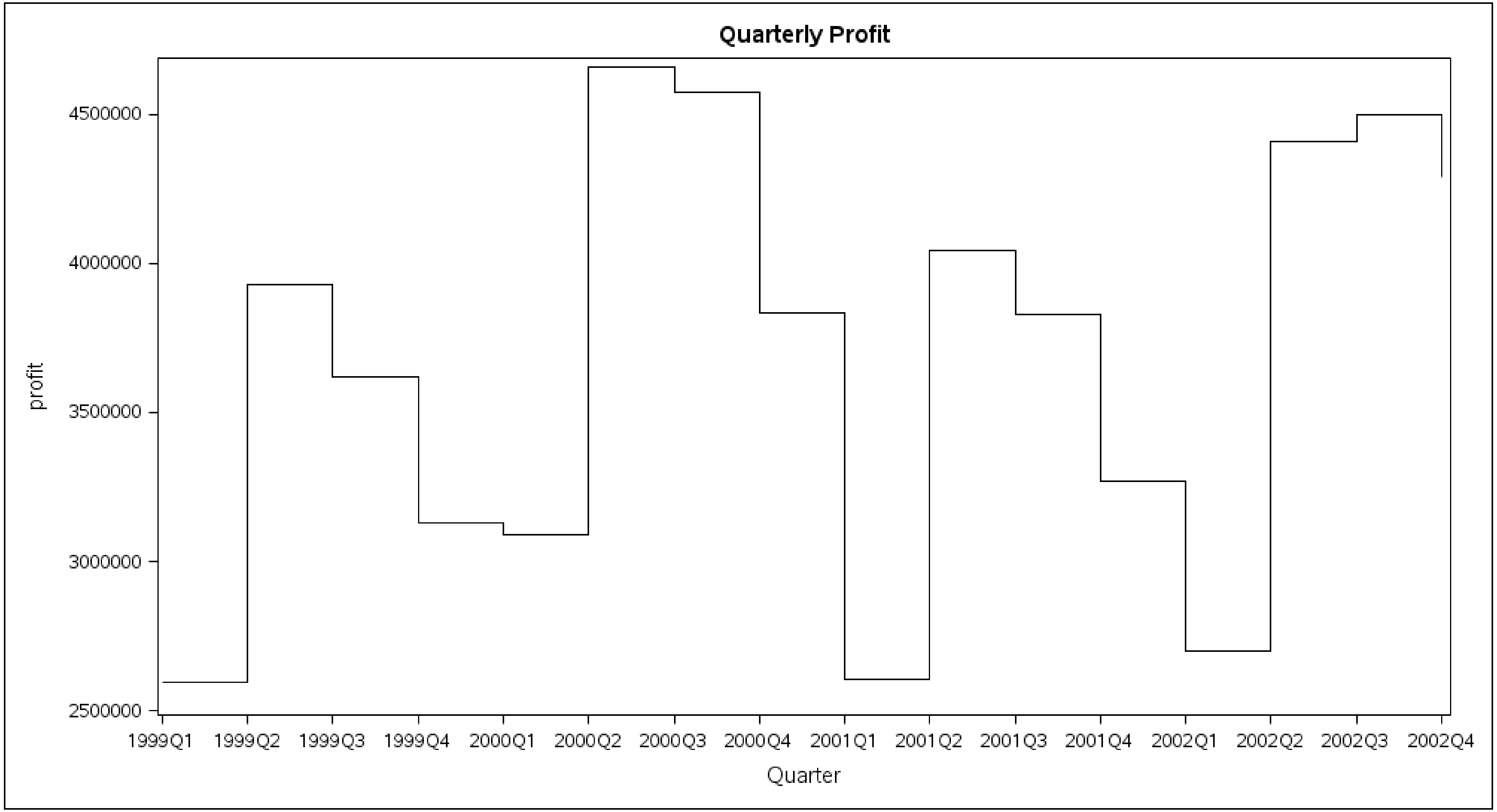


Actual vs Predicted Sales by Product Type
$20,000
$17,500
$15,000
$12,500
$10,000
$7,500
Jan 1993
Mar
May
Jul
Sep
Nov
Jan 1994
Mar
May
Jul
Sep
Nov
Jan 1995
ACT FURNITURE OFFICE
PRD FURNITURE OFFICE

STEP CHARTS

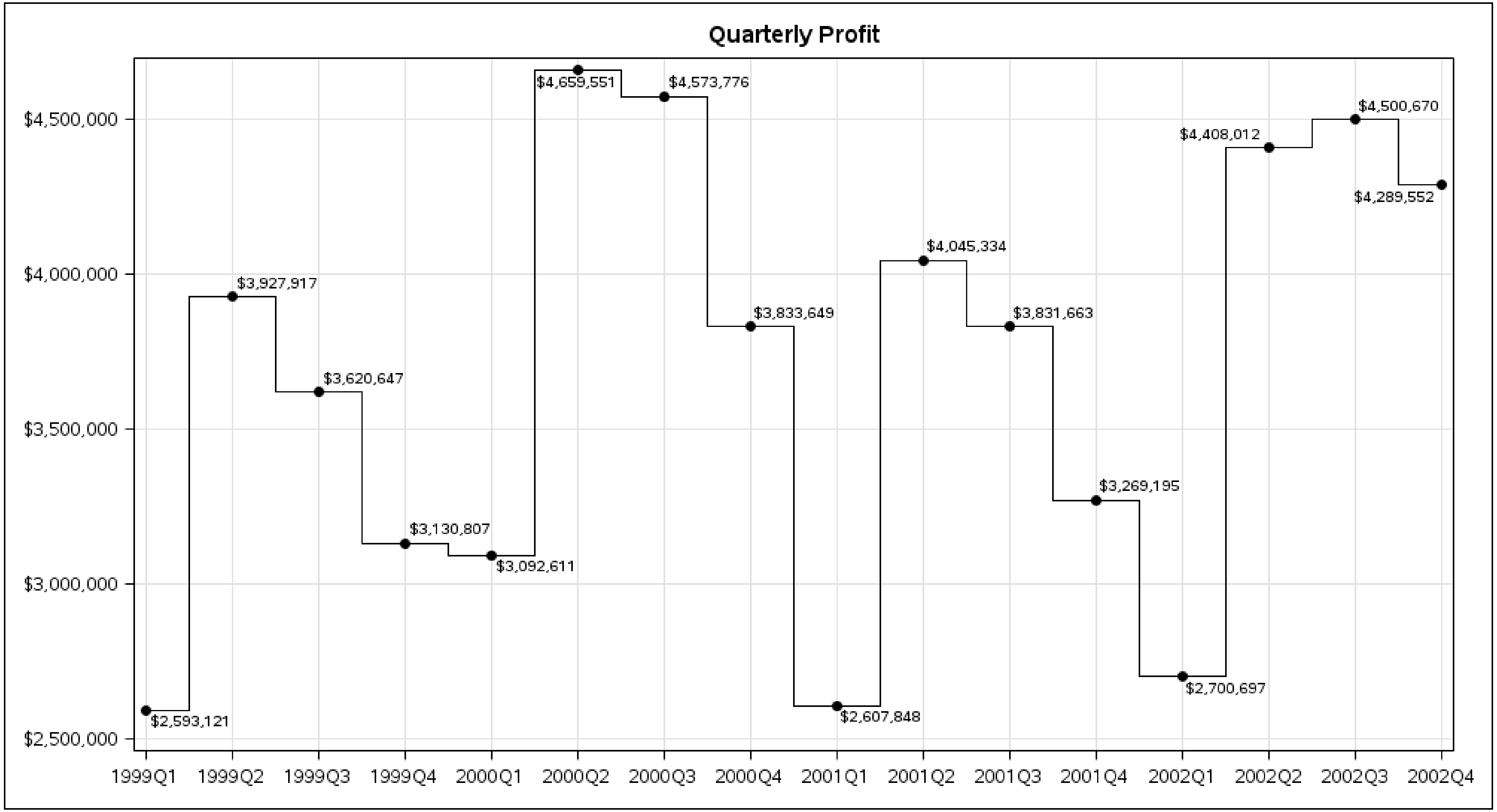
STEP CHARTS: EXERCISE 1

```
proc sql noprint;
create table orsalesum as
select quarter, sum(profit) as profit
from sashelp.orsales group by 1 order by 1;

proc sgplot data=orsalesum;
title "Quarterly Profit";
step x=quarter y=profit;
```


Quarterly Profit
profit
4500000
4000000
3500000
3000000
2500000
1999Q1
1999Q2
1999Q3
1999Q4
2000Q1
2000Q2
2000Q3
2000Q4
2001Q1
2001Q2
2001Q3
2001Q4
2002Q1
2002Q2
2002Q3
2002Q4
Quarter

STEP CHARTS: EXERCISE 2

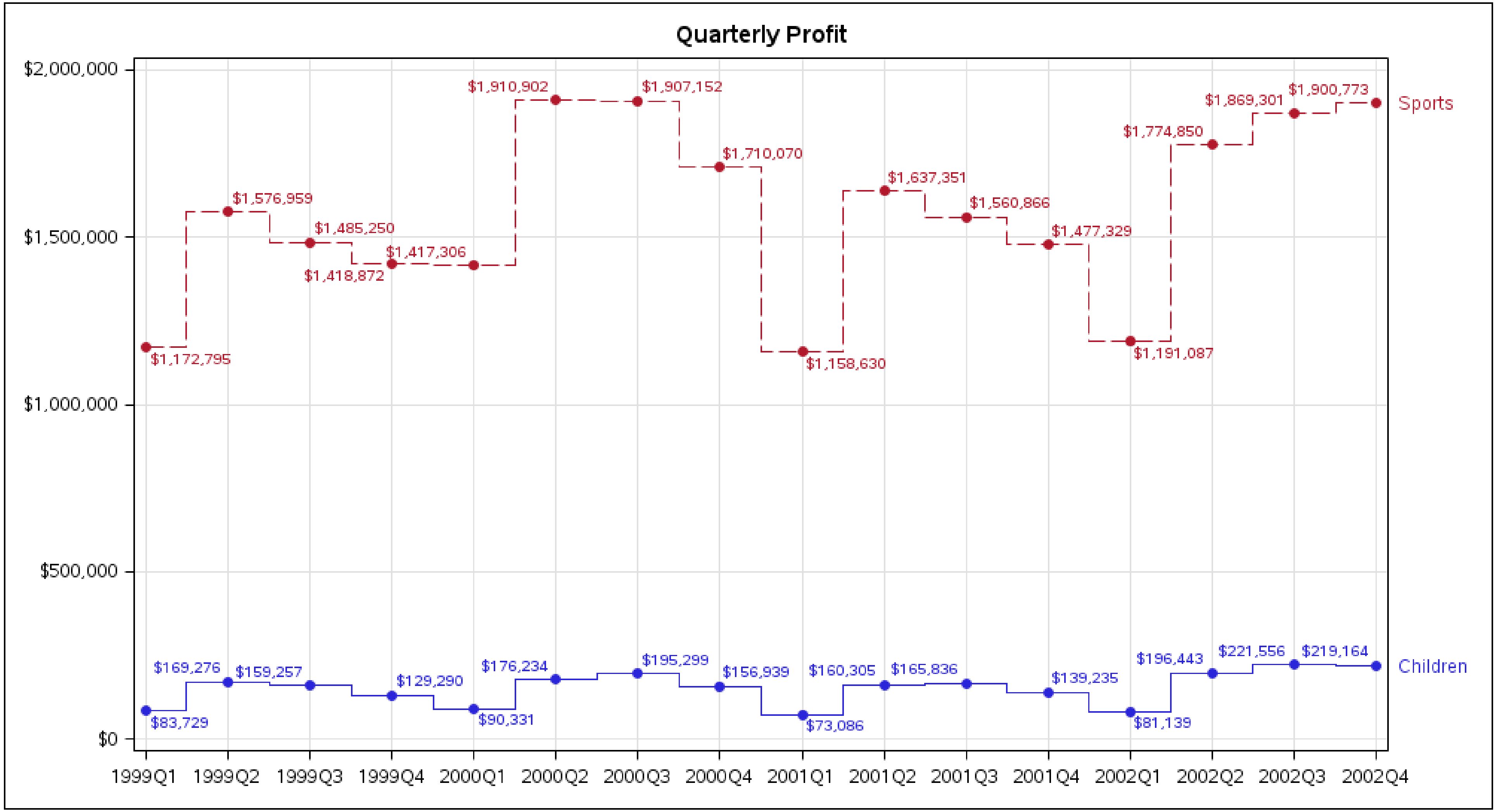
```
proc sql noprint;
create table orsalesum as
select quarter, sum(profit) as profit
from sashelp.orsales group by 1 order by 1;

proc sgplot data=orsalesum;
title "Quarterly Profit";
step x=quarter y=profit /
    markers markerattrs=(symbol=circlefilled)
    datalabel=profit
    justify=center;
format profit dollar10.;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) grid;
```



Quarterly Profit
$4,500,000
$4,000,000
$3,500,000
$3,000,000
$2,500,000
$2,593,121
$3,927,917
$3,620,647
$3,130,807
$3,092,611
$4,659,551
$4,573,776
$3,833,649
$2,607,848
$4,045,334
$3,831,663
$3,269,195
$2,700,697
$4,408,012
$4,500,670
$4,289,552
1999Q1
1999Q2
1999Q3
1999Q4
2000Q1
2000Q2
2000Q3
2000Q4
2001Q1
2001Q2
2001Q3
2001Q4
2002Q1
2002Q2
2002Q3
2002Q4

STEP CHARTS: EXERCISE 3

```
proc sql noprint;
create table orsalesum2 as
select quarter, product_line, sum(profit) as profit
from sashelp.orsales
where product_line in ('Children', 'Sports')
group by 1, 2 order by 1, 2;

proc sgplot data=orsalesum2;
title "Quarterly Profit";
step x=quarter y=profit /
    markers markerattrs=(symbol=circlefilled)
    justify=center
    datalabel
    group=product_line
    curvelabel curvelabelloc=outside;
format profit dollar10.;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) grid;
```

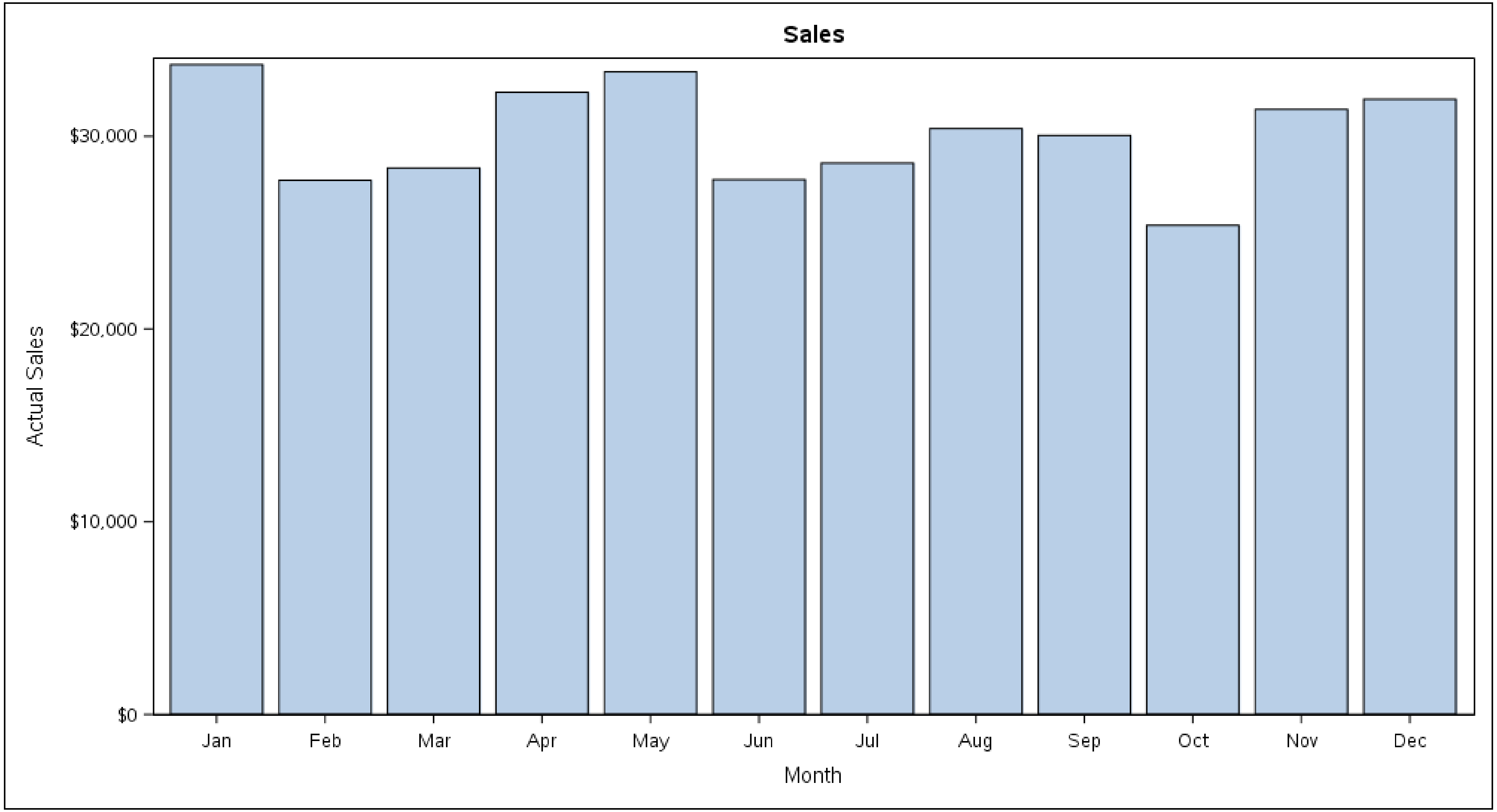


Quarterly Profit
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
1999Q1
1999Q2
1999Q3
1999Q4
2000Q1
2000Q2
2000Q3
2000Q4
2001Q1
2001Q2
2001Q3
2001Q4
2002Q1
2002Q2
2002Q3
2002Q4
Sports
Children
$1,172,795
$1,576,959
$1,485,250
$1,418,872
$1,417,306
$1,910,902
$1,907,152
$1,710,070
$1,158,630
$1,637,351
$1,560,866
$1,477,329
$1,191,087
$1,774,850
$1,869,301
$1,900,773
$83,729
$169,276
$159,257
$129,290
$90,331
$176,234
$195,299
$156,939
$73,086
$160,305
$165,836
$139,235
$81,139
$196,443
$221,556
$219,164

BAR CHARTS

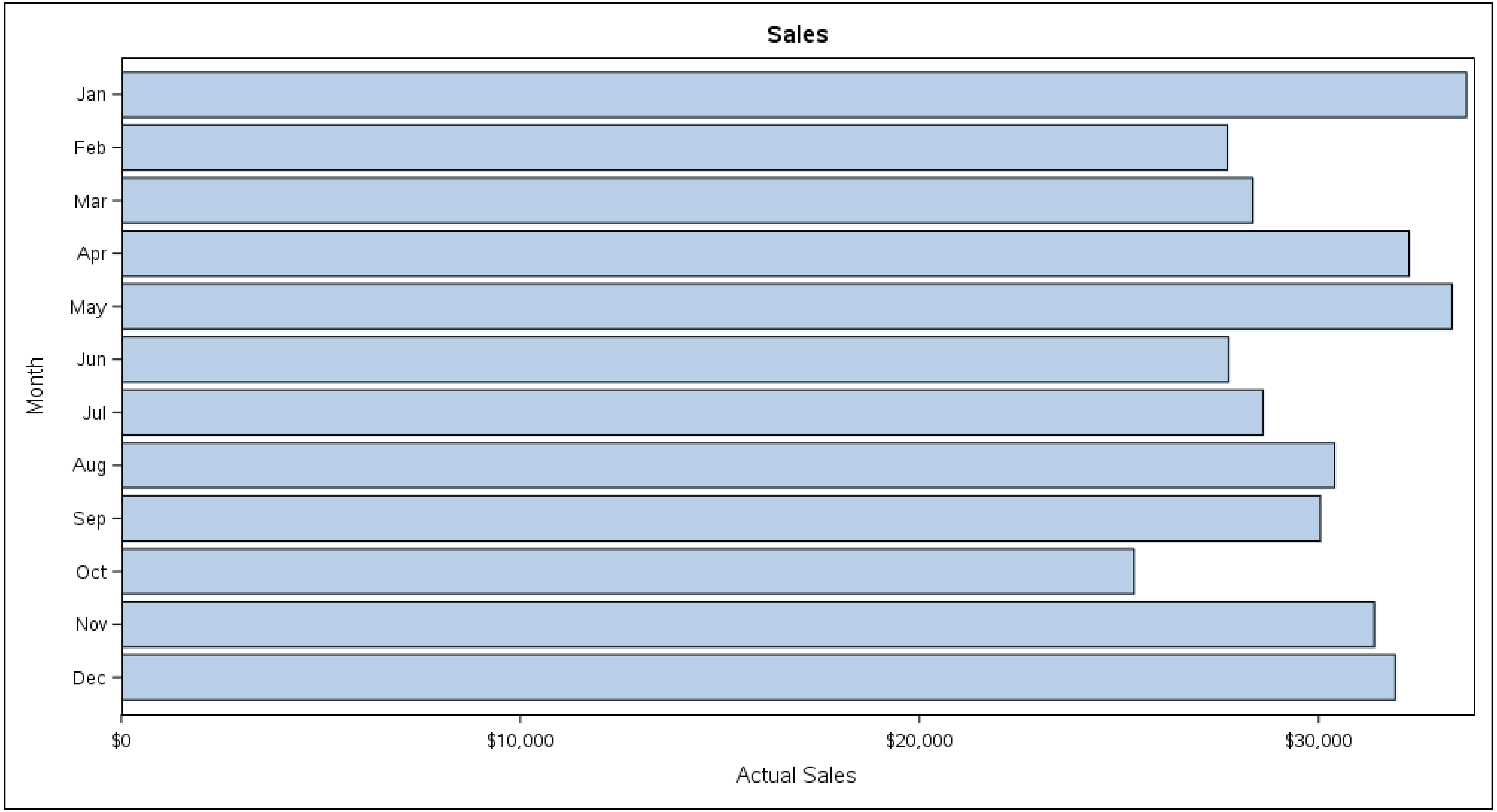
BAR CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.prdsale(where=(year(month)=1994));
title "Sales";
vbar month / response=actual;
```


Sales
$30,000
$20,000
$10,000
$0
Actual Sales
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

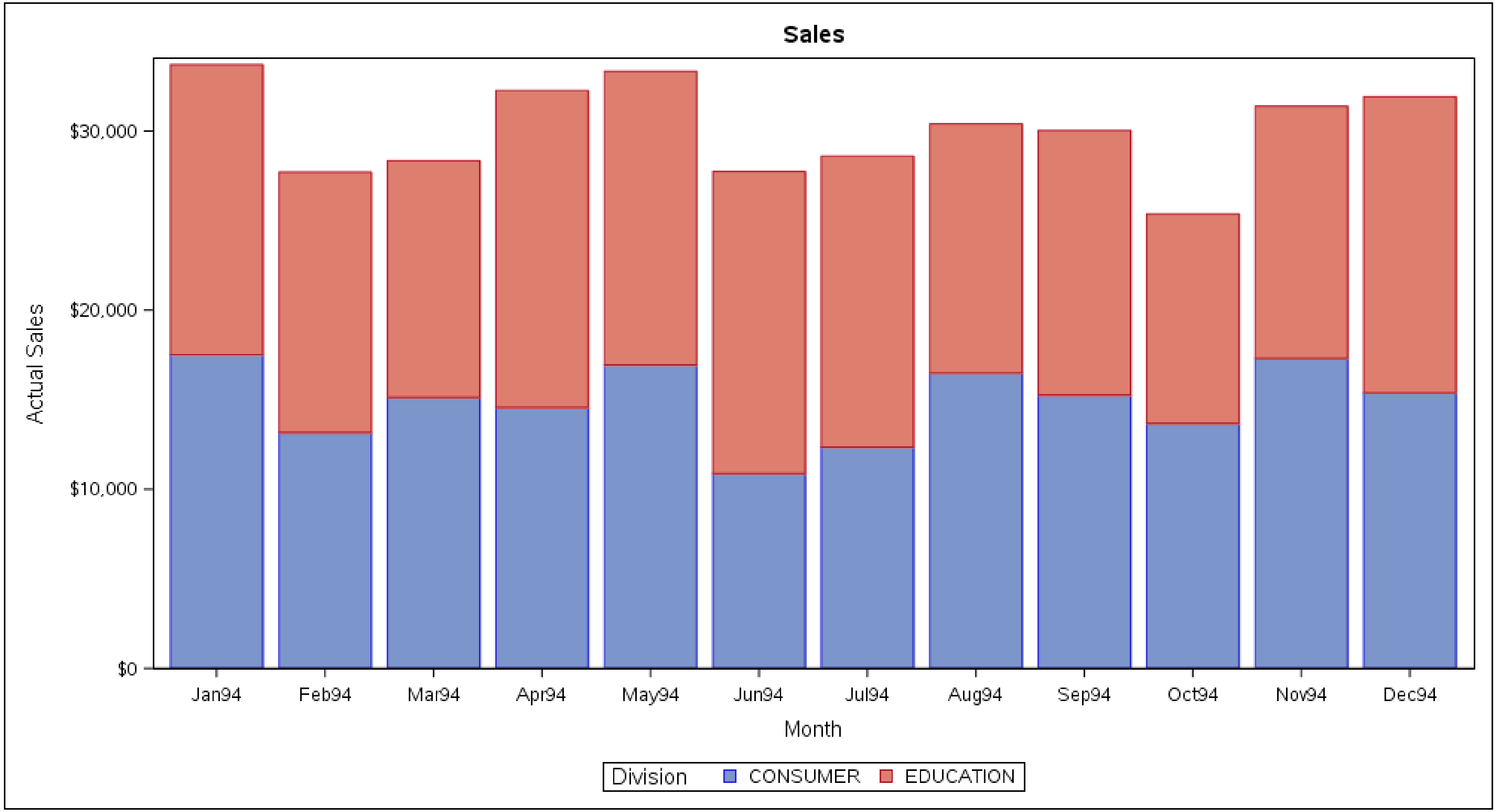
BAR CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.prdsale(where=(year(month)=1994));
title "Sales";
hbar month / response=actual;
```


Sales
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
$0
$10,000
$20,000
$30,000
Actual Sales

BAR CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.prdsale(where=(year(month)=1994));
title "Sales";
vbar month / response=actual group=division;
format month monyy5.;
```


Sales
Actual Sales
$30,000
$20,000
$10,000
$0
Jan94
Feb94
Mar94
Apr94
May94
Jun94
Jul94
Aug94
Sep94
Oct94
Nov94
Dec94
Month
Division
CONSUMER
EDUCATION

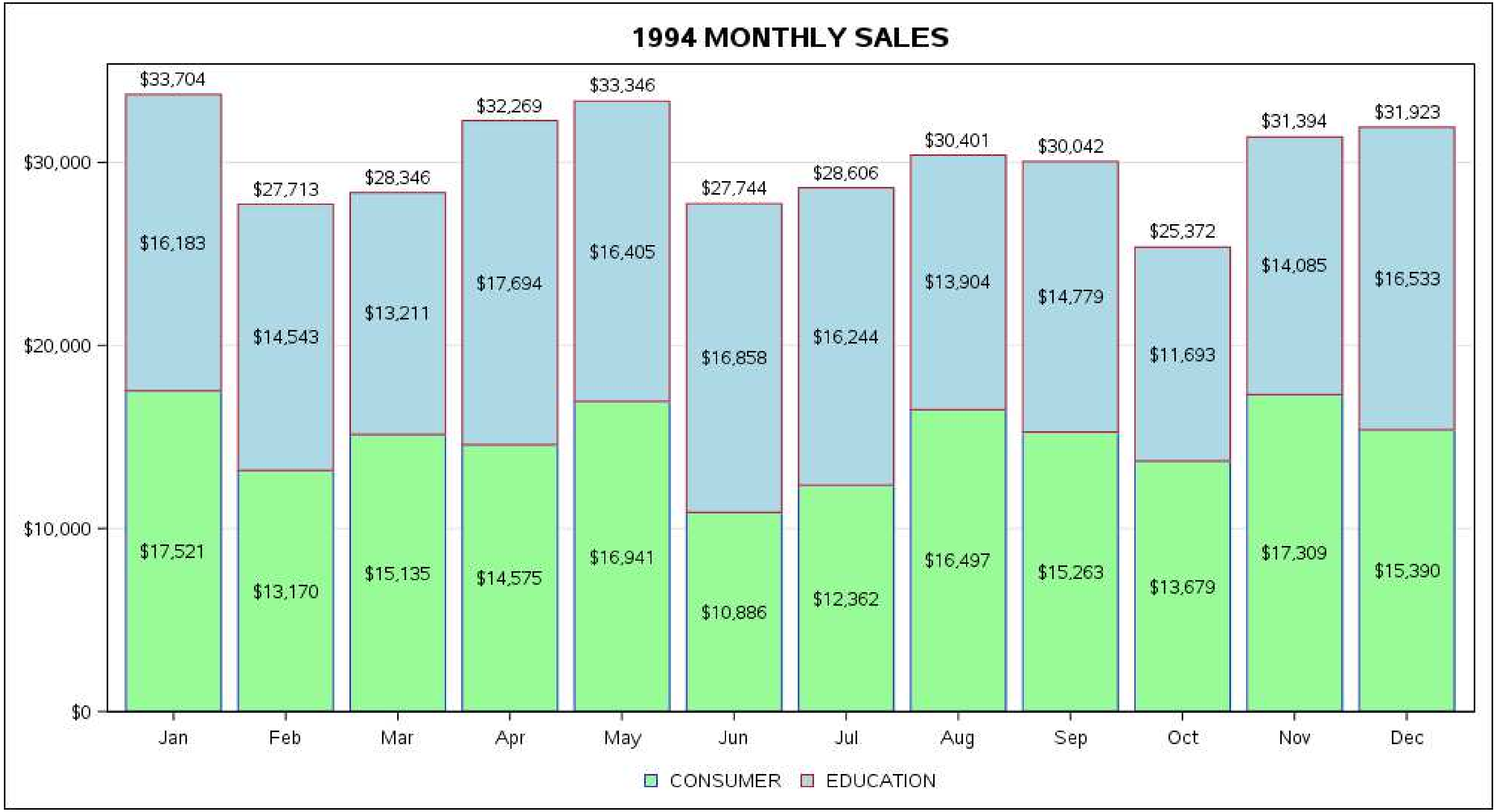
BAR CHARTS: EXERCISE 4

```
proc sgplot data=sashelp.prdsale(where=(year(month)=1994));
title "Sales";
vbar month / response=actual group=division groupdisplay=cluster;
format month monyy5.;
```


Sales
Actual Sales
$15,000
$10,000
$5,000
$0
Jan94
Feb94
Mar94
Apr94
May94
Jun94
Jul94
Aug94
Sep94
Oct94
Nov94
Dec94
Month
Division
CONSUMER
EDUCATION

BAR CHARTS: EXERCISE 5

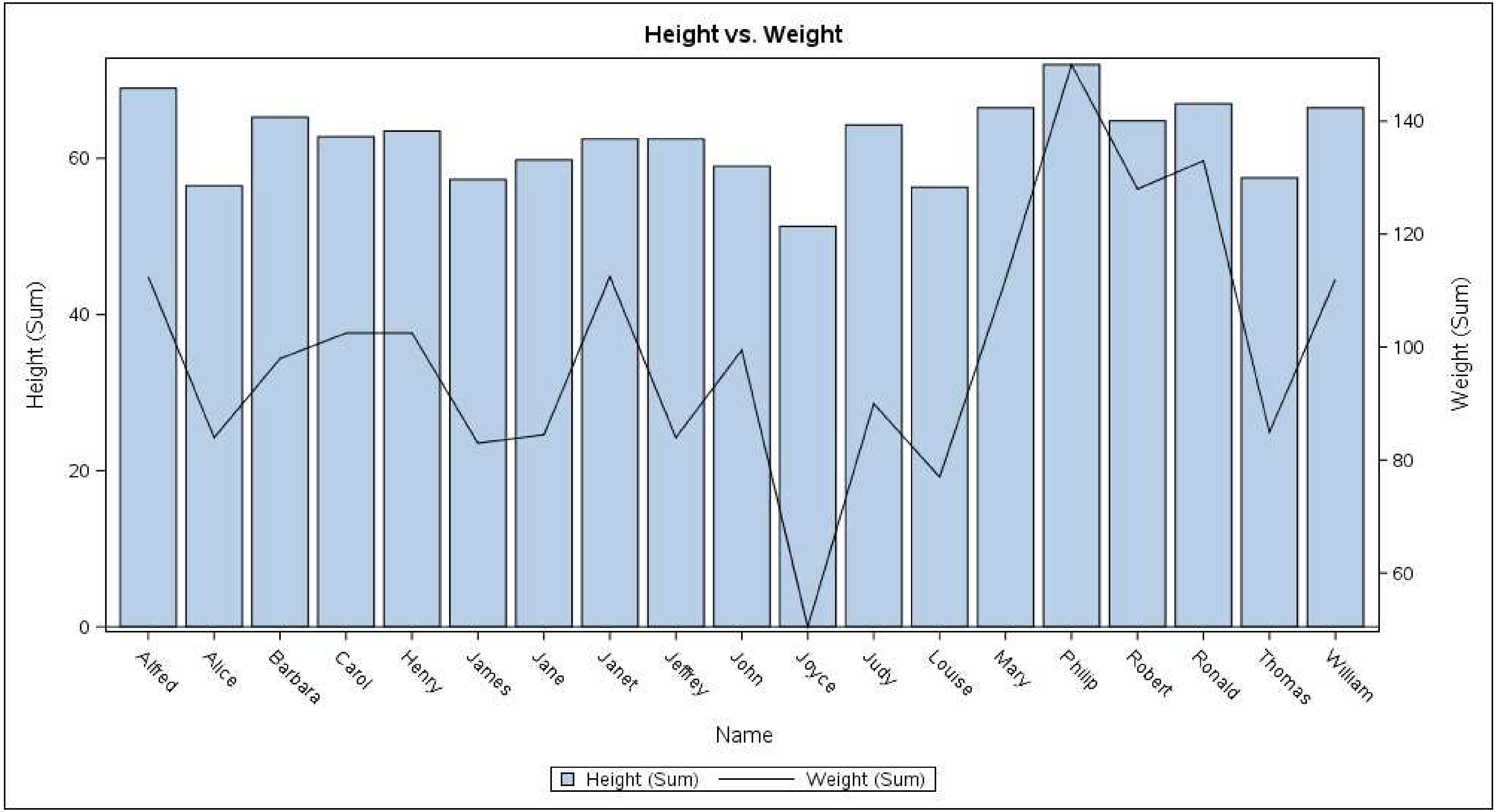
```
proc sgplot data=sashelp.prdsale(where=(year(month)=1994));
styleattrs datacolors=(palegreen lightblue);
title height=12pt "1994 MONTHLY SALES";
vbar month /  response=actual group=division
              datalabel datalabelattrs=(size=8.5pt)
              seglabel seglabelformat=dollar9. seglabelattrs=(size=8.5pt);
xaxis display=(nolabel);
yaxis display=(nolabel) grid;
keylegend / title="" noborder;
format actual dollar9. month monname3.;
```


1994 MONTHLY SALES
$30,000
$20,000
$10,000
$0
$33,704
$16,183
$17,521
$27,713
$14,543
$13,170
$28,346
$13,211
$15,135
$32,269
$17,694
$14,575
$33,346
$16,405
$16,941
$27,744
$16,858
$10,886
$28,606
$16,244
$12,362
$30,401
$13,904
$16,497
$30,042
$14,779
$15,263
$25,372
$11,693
$13,679
$31,394
$14,085
$17,309
$31,923
$16,533
$15,390
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
CONSUMER
EDUCATION

COMBO CHARTS

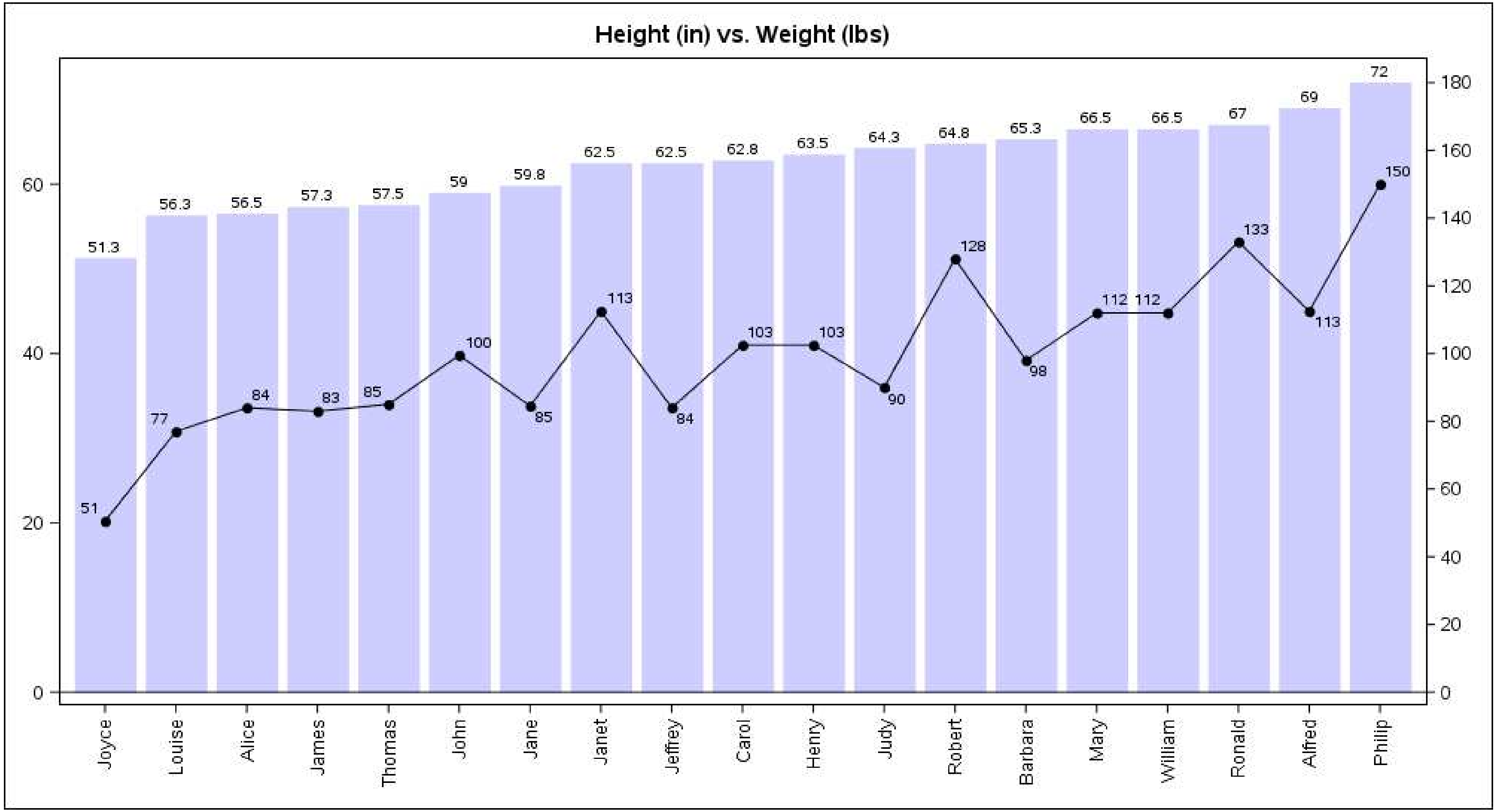
COMBO CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Height vs. Weight";
vbar name / response=height;
vline name / response=weight y2axis;
```


Height vs. Weight
Height (Sum)
Weight (Sum)
0
20
40
60
60
80
100
120
140
Name
Alfred
Alice
Barbara
Carol
Henry
James
Jane
Janet
Jeffrey
John
Joyce
Judy
Louise
Mary
Philip
Robert
Ronald
Thomas
William
Height (Sum)
Weight (Sum)

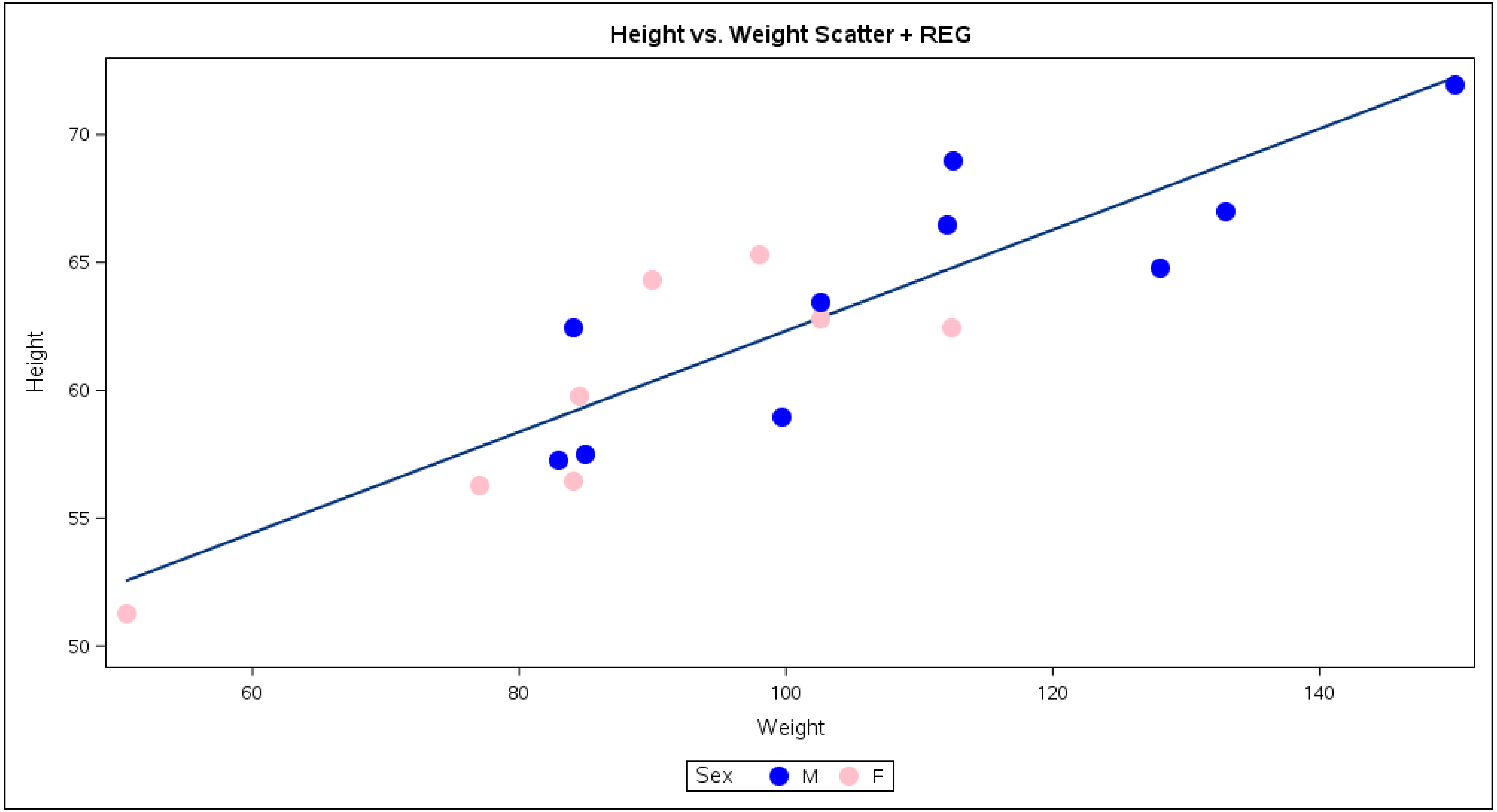
COMBO CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.class noautolegend;
title "Height (in) vs. Weight (lbs)";
vbar name / response=height
        fillattrs=(color=blue transparency=.80)
        nooutline datalabel
        datalabelattrs=(weight=bold)
        categoryorder=respasc;
vline name / response=weight y2axis
         markers markerattrs=(symbol=circlefilled)
         datalabel datalabelattrs=(weight=bold);
xaxis display=(nolabel) valuesrotate=vertical;
yaxis display=(nolabel);
y2axis display=(nolabel) values=(0 to 180 by 20);
format weight 3.;
```


Height (in) vs. Weight (lbs)
51.3
56.3
56.5
57.3
57.5
59
59.8
62.5
62.5
62.8
63.5
64.3
64.8
65.3
66.5
66.5
67
69
72
51
77
84
83
85
100
85
113
84
103
103
90
128
98
112
112
133
113
150
0
20
40
60
0
20
40
60
80
100
120
140
160
180
Joyce
Louise
Alice
James
Thomas
John
Jane
Janet
Jeffrey
Carol
Henry
Judy
Robert
Barbara
Mary
William
Ronald
Alfred
Philip

COMBO CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.class;
title "Height vs. Weight Scatter + REG";
styleattrs datacontrastcolors=(blue pink);
reg x=weight y=height;
scatter x=weight y=height /
        markerattrs=(size=10pt symbol=circlefilled)
        jitter group=sex;
```


Height vs. Weight Scatter + REG
70
65
60
55
50
Height
60
80
100
120
140
Weight
Sex
M
F

COMBO CHARTS: EXERCISE 4

```
proc sgplot data=sashelp.class;
title "Height vs. Weight Scatter + LOESS";
styleattrs datacontrastcolors=(blue pink);
loess x=weight y=height;
scatter x=weight y=height /
        markerattrs=(size=10pt symbol=circlefilled)
        jitter group=sex;
```

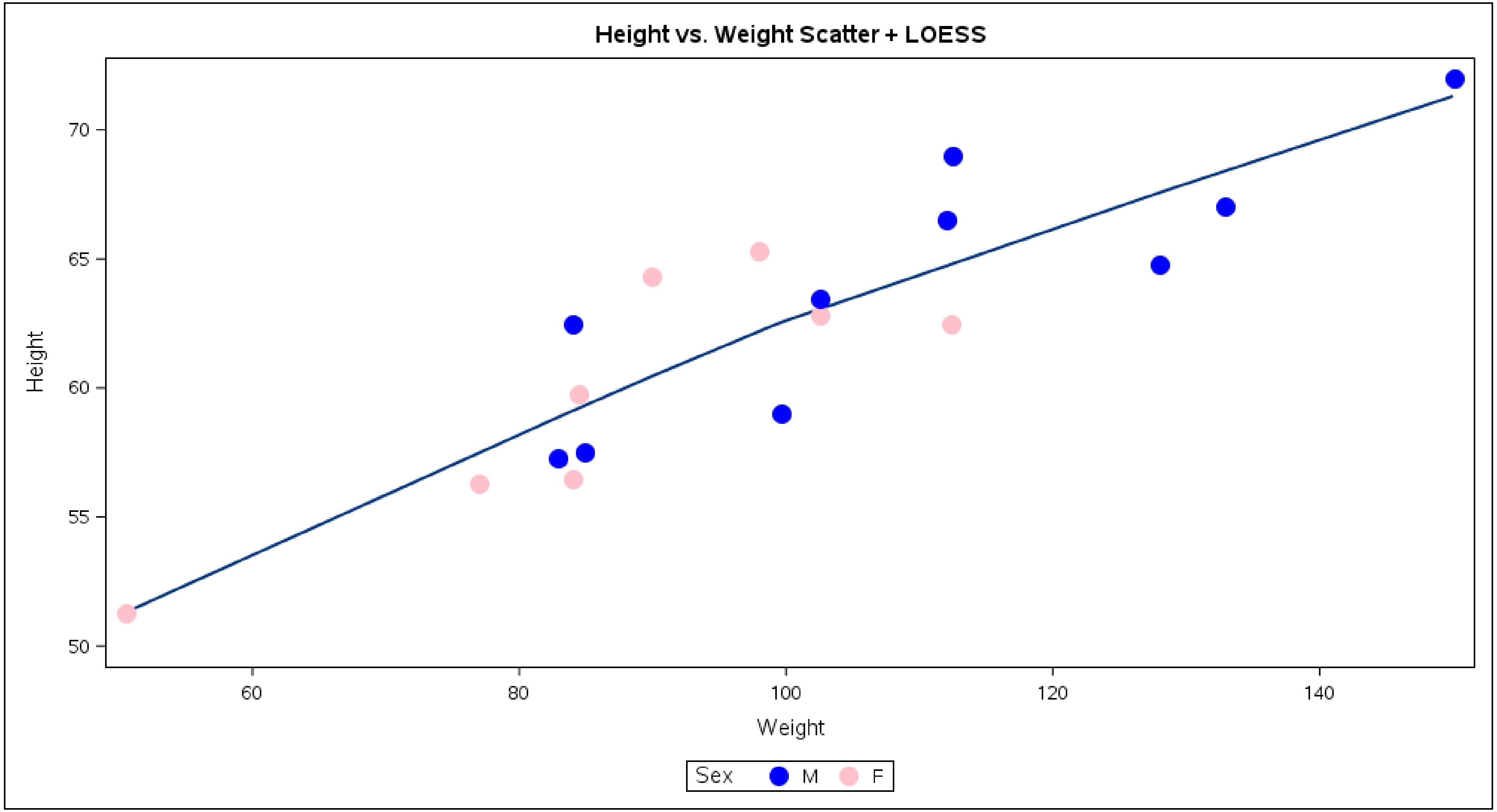
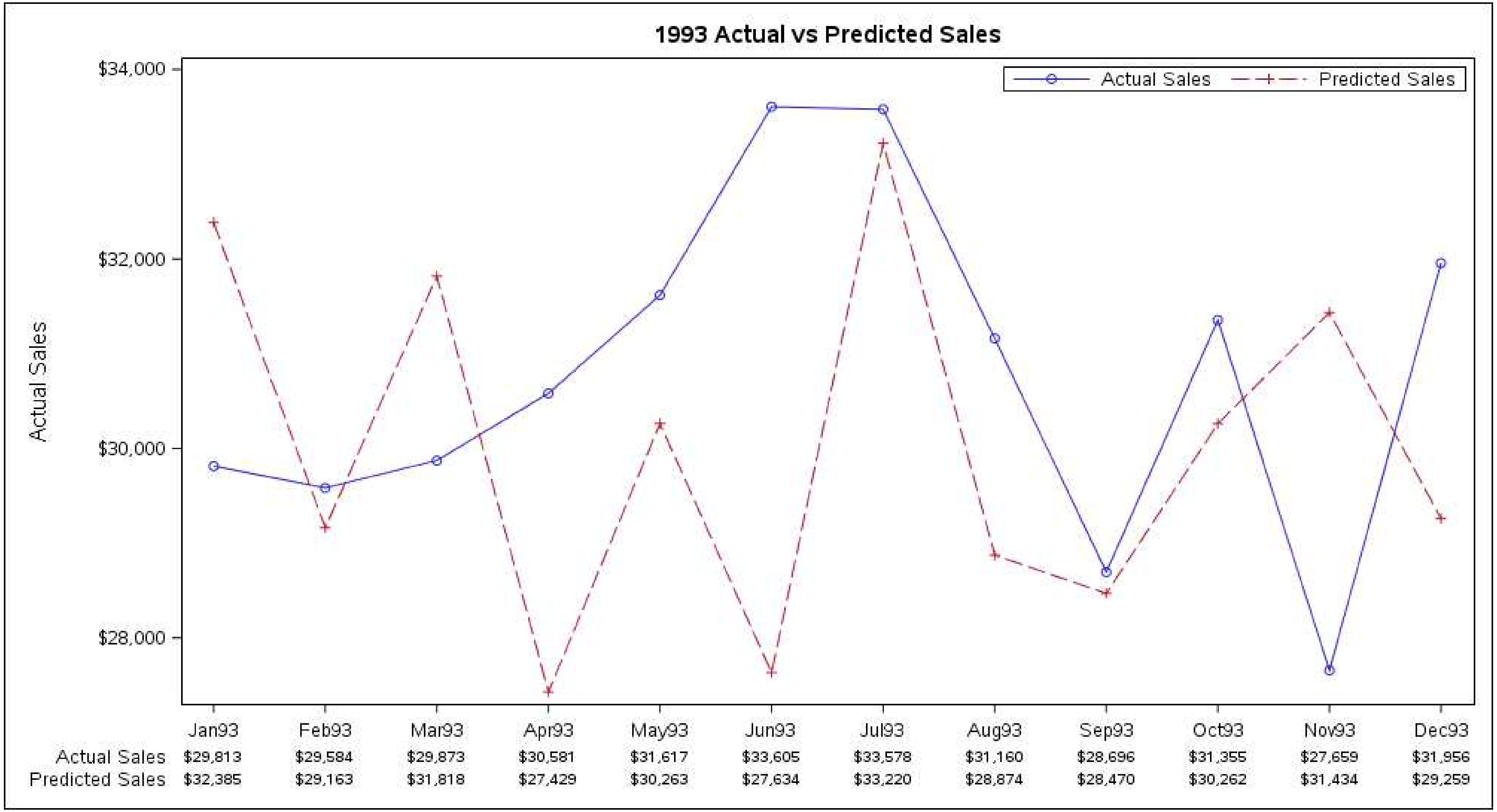

Height vs. Weight Scatter + LOESS
Height
70
65
60
55
50
60
80
100
120
140
Weight
Sex
M
F

TABLE CHARTS

TABLE CHARTS: EXERCISE 1

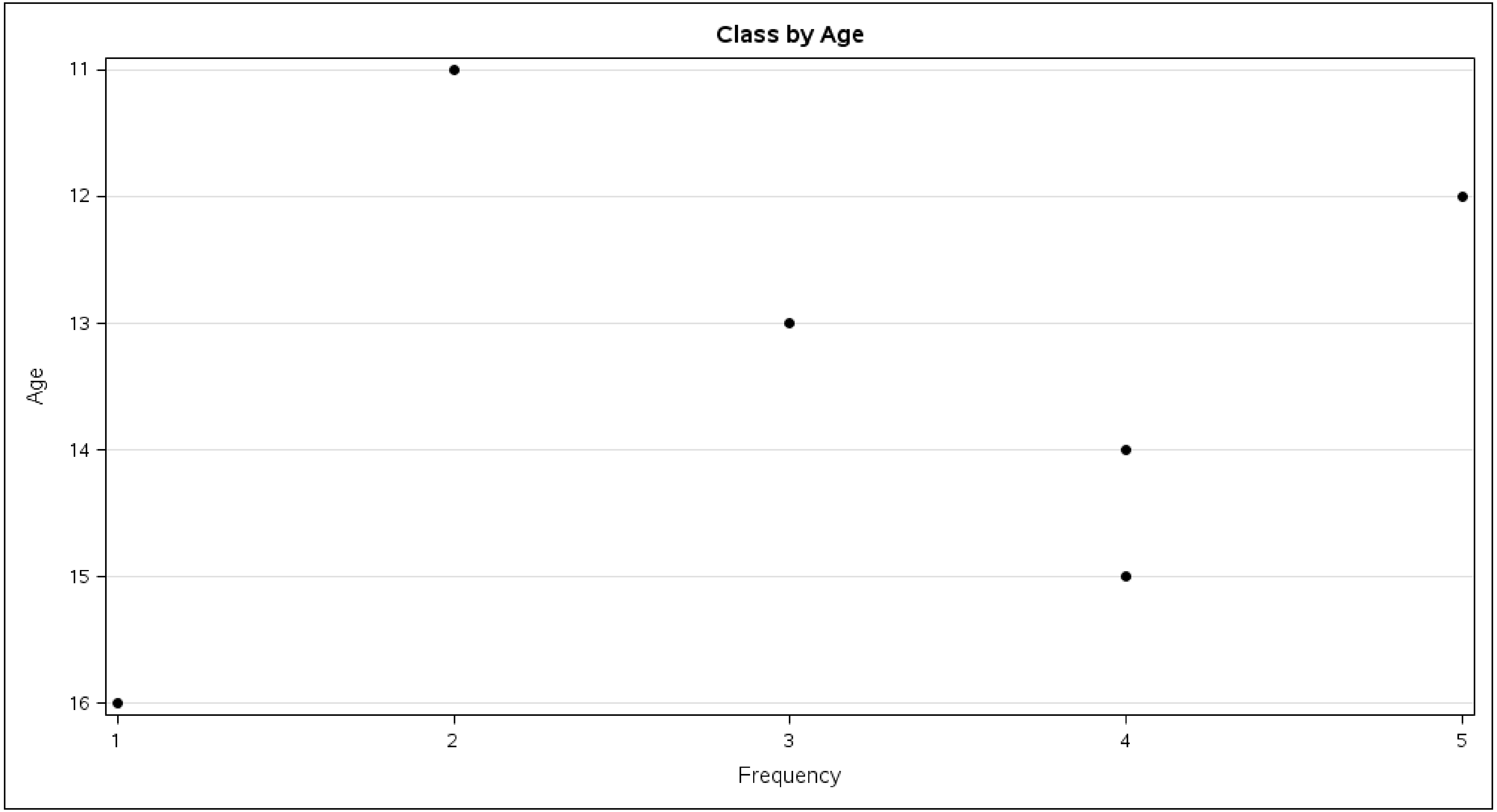
```
proc sgplot data=sashelp.prdsale(where=(year=1993));
title "1993 Actual vs Predicted Sales";
vline month  / markers response=actual;
vline month  / markers response=predict;
format month monyy5. actual predict dollar7.0;
xaxistable actual predict / location=outside;
keylegend / location=inside position=topright;
xaxis display=(nolabel);
```


1993 Actual vs Predicted Sales
Actual Sales
Predicted Sales
$34,000
$32,000
$30,000
$28,000
Actual Sales
Jan93 Feb93 Mar93 Apr93 May93 Jun93 Jul93 Aug93 Sep93 Oct93 Nov93 Dec93
Actual Sales $29,813 $29,584 $29,873 $30,581 $31,617 $33,605 $33,578 $31,160 $28,696 $31,355 $27,659 $31,956
Predicted Sales $32,385 $29,163 $31,818 $27,429 $30,263 $27,634 $33,220 $28,874 $28,470 $30,262 $31,434 $29,259

DOT CHARTS

DOT CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Class by Age";
dot age;
```


Class by Age
Age
11
12
13
14
15
16
1
2
3
4
5
Frequency

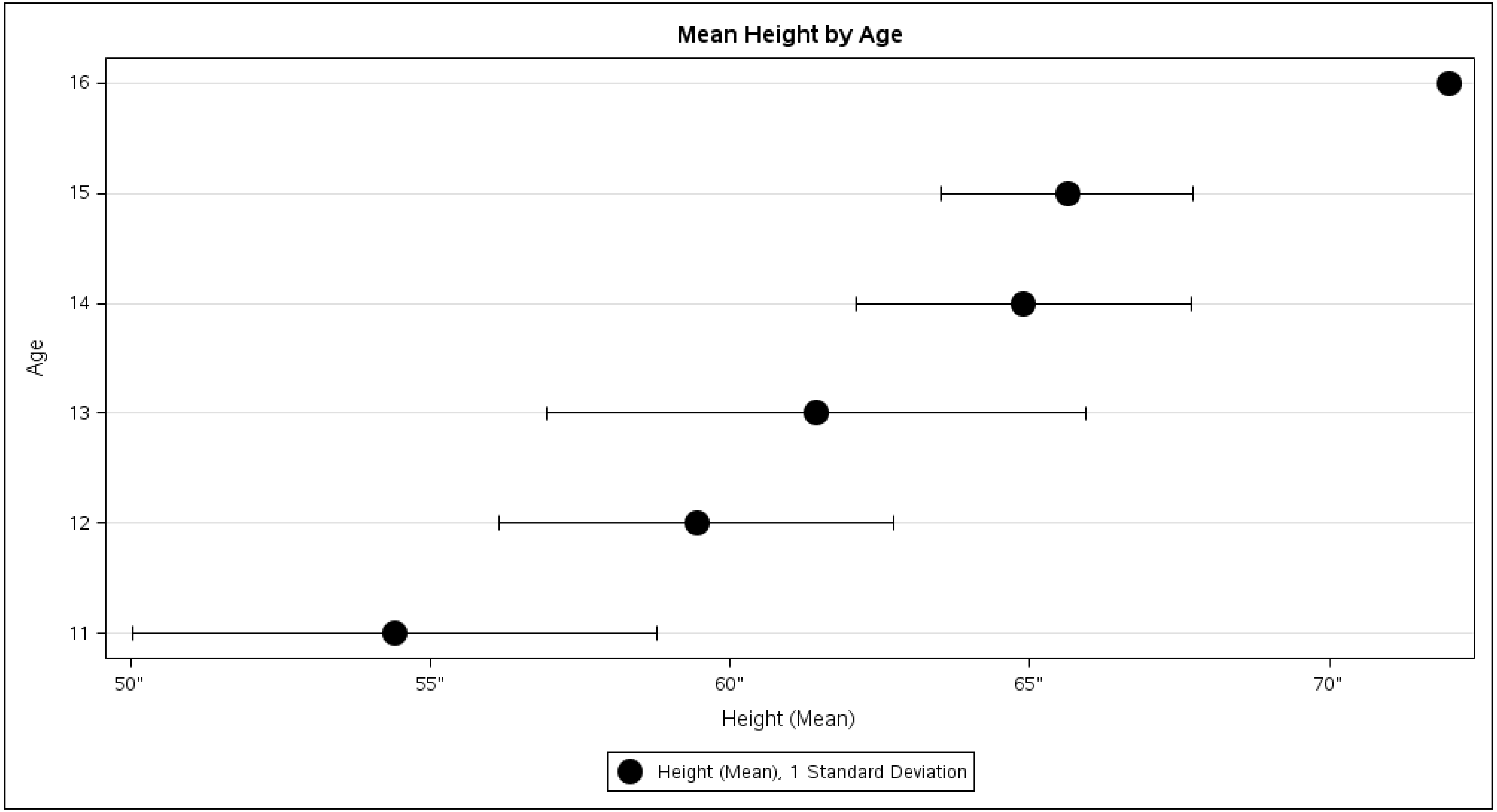
DOT CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.class;
title "Class Mean Age";
dot age / response=height stat=mean
        group=sex datalabel=sex datalabelattrs=(size=10pt);
```


Class Mean Age
Age
11
12
13
14
15
16
50
55
60
65
70
Height (Mean)
Sex F M
F
M

DOT CHARTS: EXERCISE 3

```
proc format;
picture inchF low-high ='99"';

proc sgplot data=sashelp.class;
title "Mean Height by Age";
dot age / response=height stat=mean
        limitstat=stddev numstd=1
        markerattrs=(size=12pt symbol=circlefilled);
xaxis valuesformat=inchF.;
yaxis reverse;
```

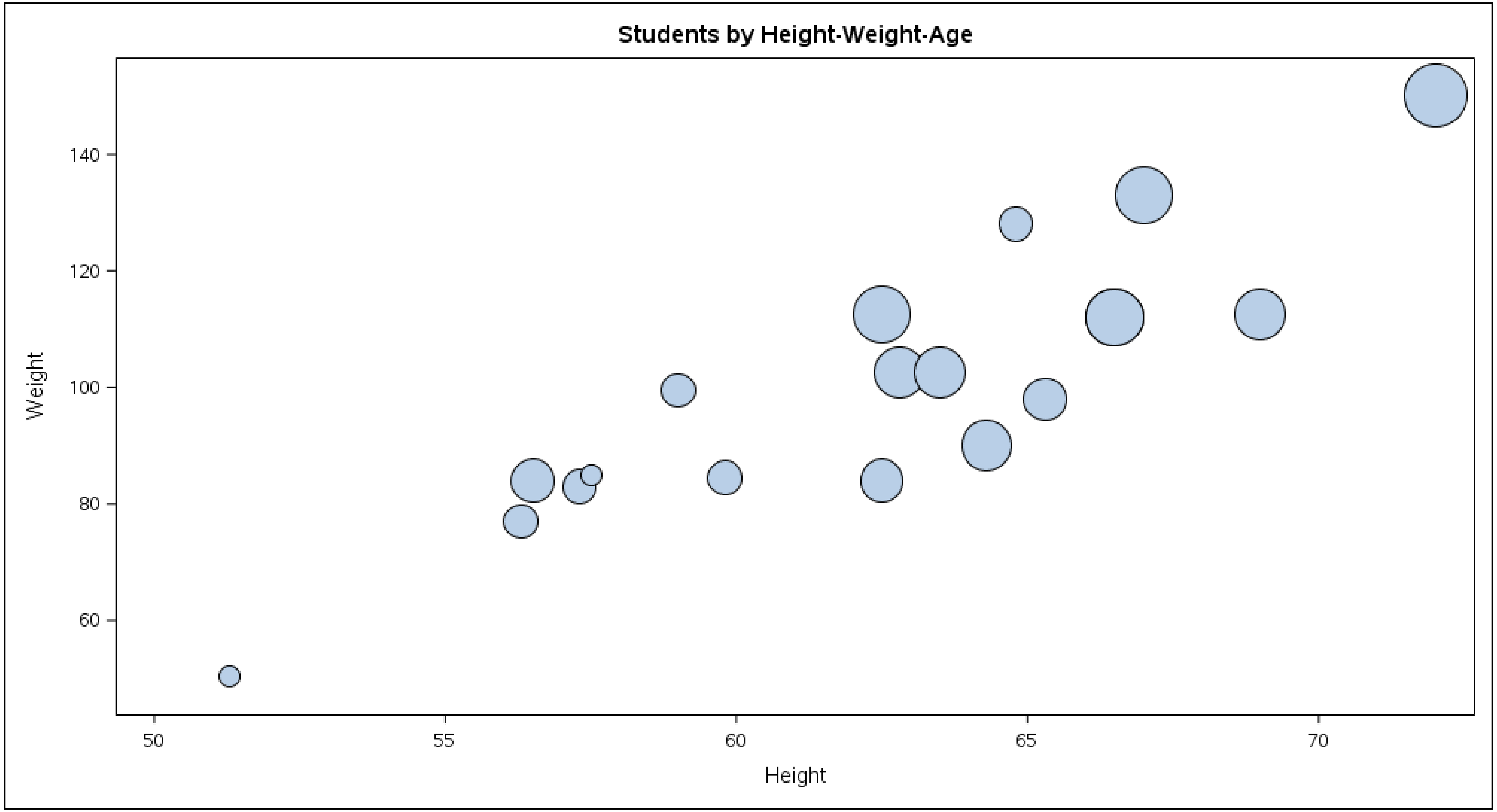


Mean Height by Age
16
15
14
13
12
11
Age
50"
55"
60"
65"
70"
Height (Mean)
Height (Mean), 1 Standard Deviation

BUBBLE CHARTS

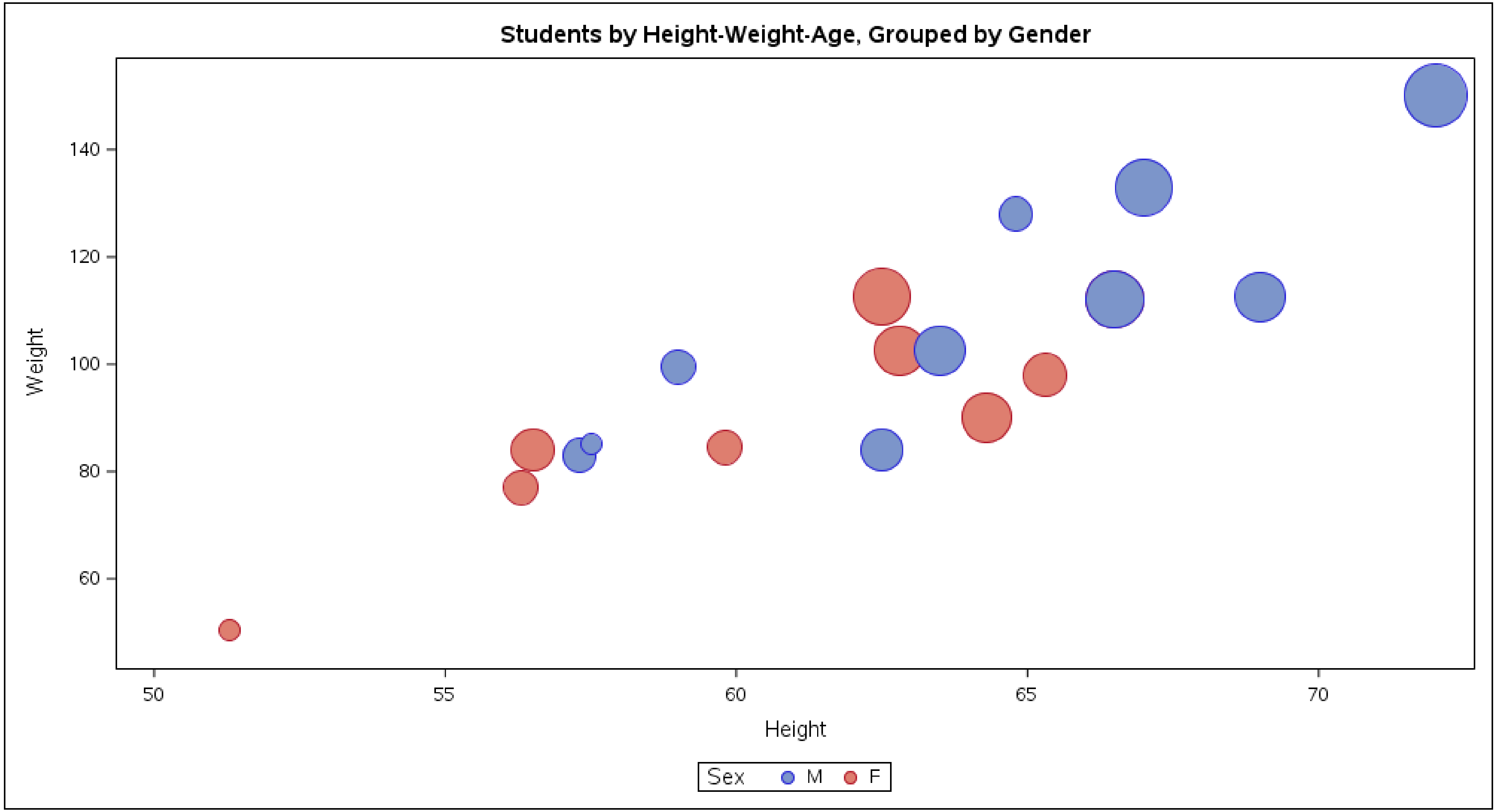
BUBBLE CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Students by Height-Weight-Age";
bubble x=height y=weight size=age;
```


Students by Height-Weight-Age
140
120
100
80
60
Weight
50
55
60
65
70
Height

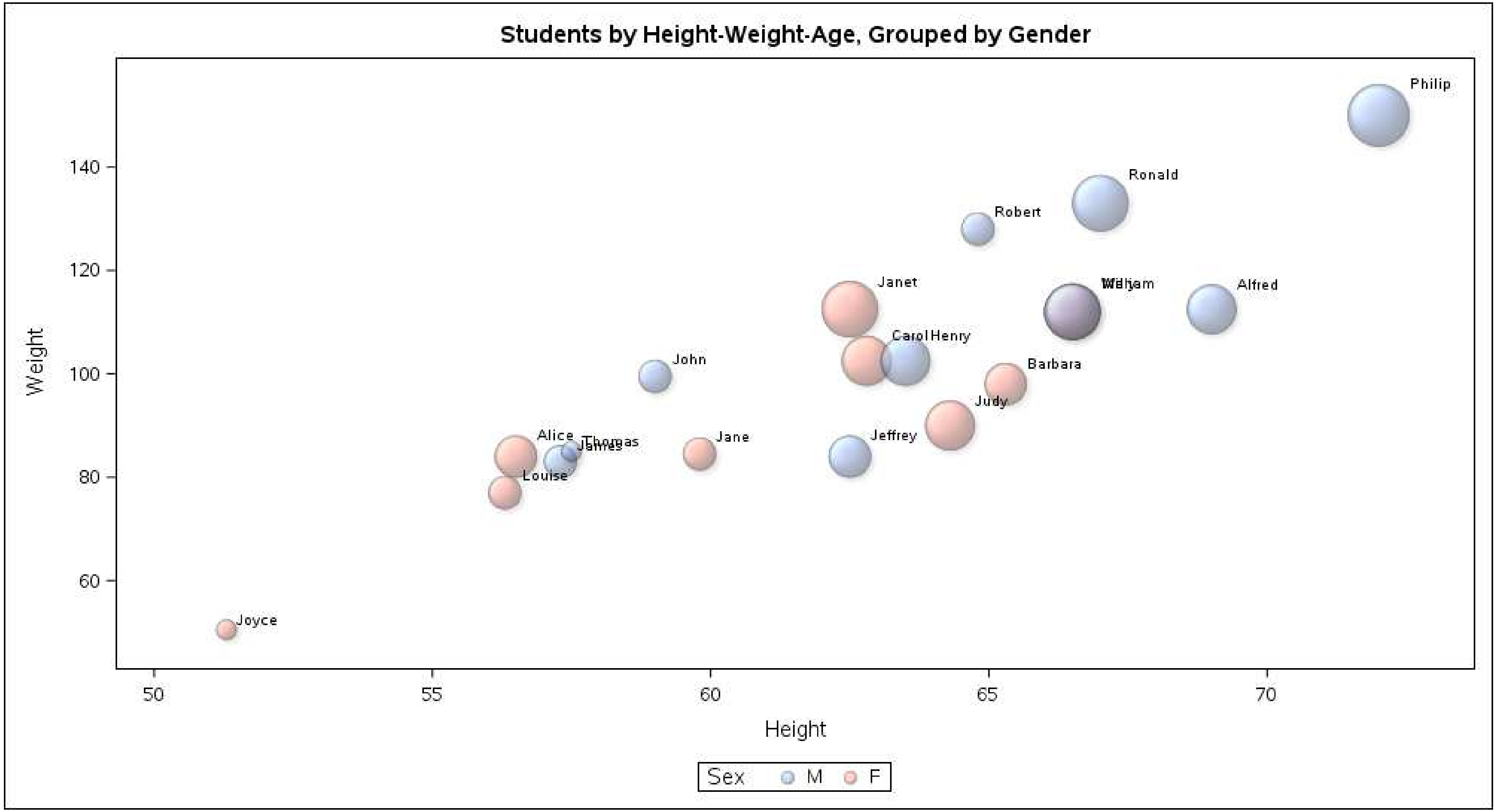
BUBBLE CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.class;
title "Students by Height-Weight-Age, Grouped by Gender";
bubble x=height y=weight size=age / group=sex;
```


Students by Height-Weight-Age, Grouped by Gender
Weight
140
120
100
80
60
50
55
60
65
70
Height
Sex
M
F

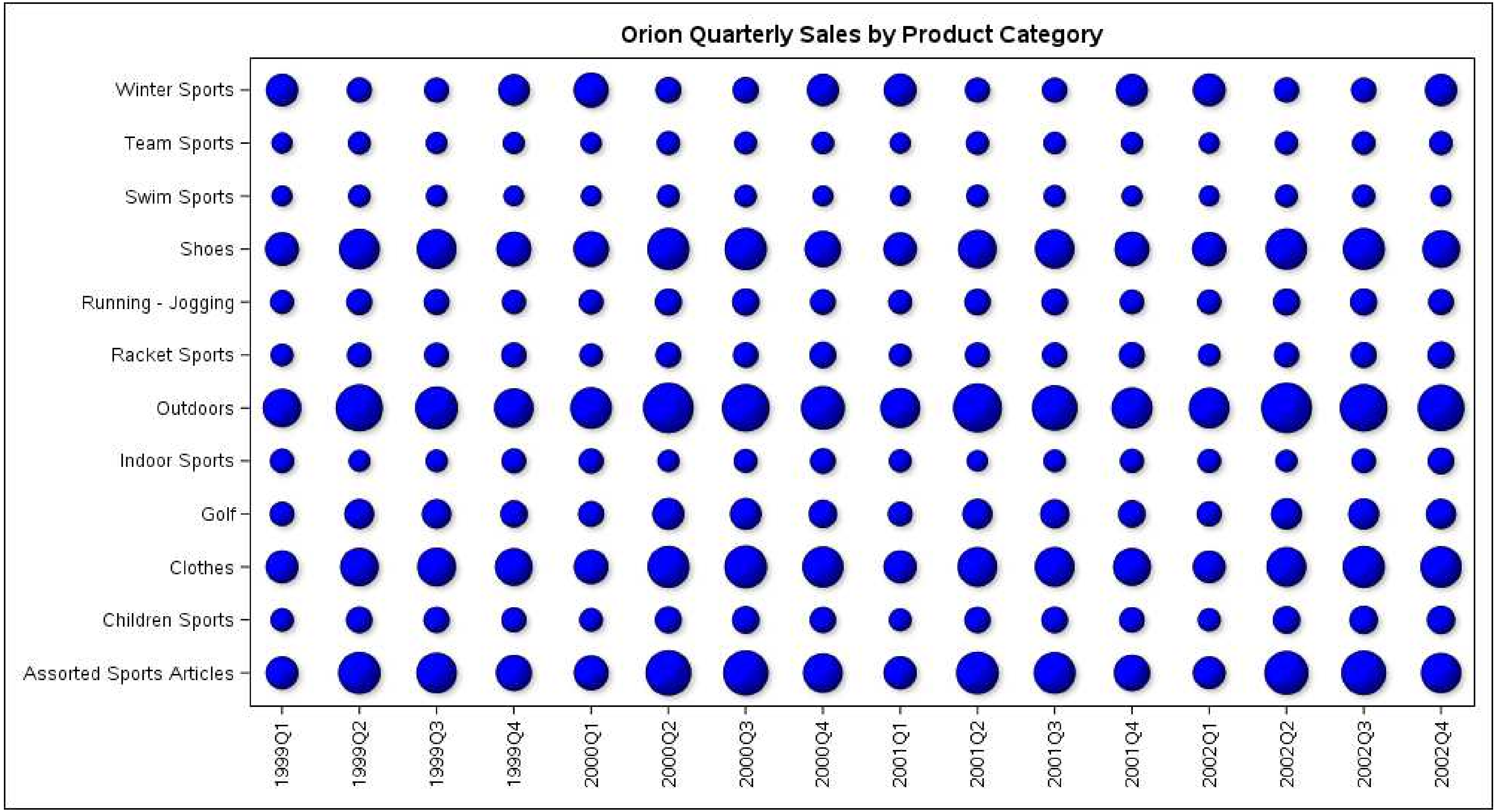
BUBBLE CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.class;
title "Students by Height-Weight-Age, Grouped by Gender";
bubble x=height y=weight size=age /
      group=sex transparency=.5 dataskin=sheen
      datalabel=name datalabelattrs=(color=black);
```


Students by Height-Weight-Age, Grouped by Gender
Philip
Ronald
Robert
Janet
William
Mary
Alfred
Carol
Henry
John
Barbara
Judy
Alice
Thomas
James
Jane
Jeffrey
Louise
Joyce
Weight
140
120
100
80
60
50
55
60
65
70
Height
Sex
M
F

BUBBLE CHARTS: EXERCISE 4

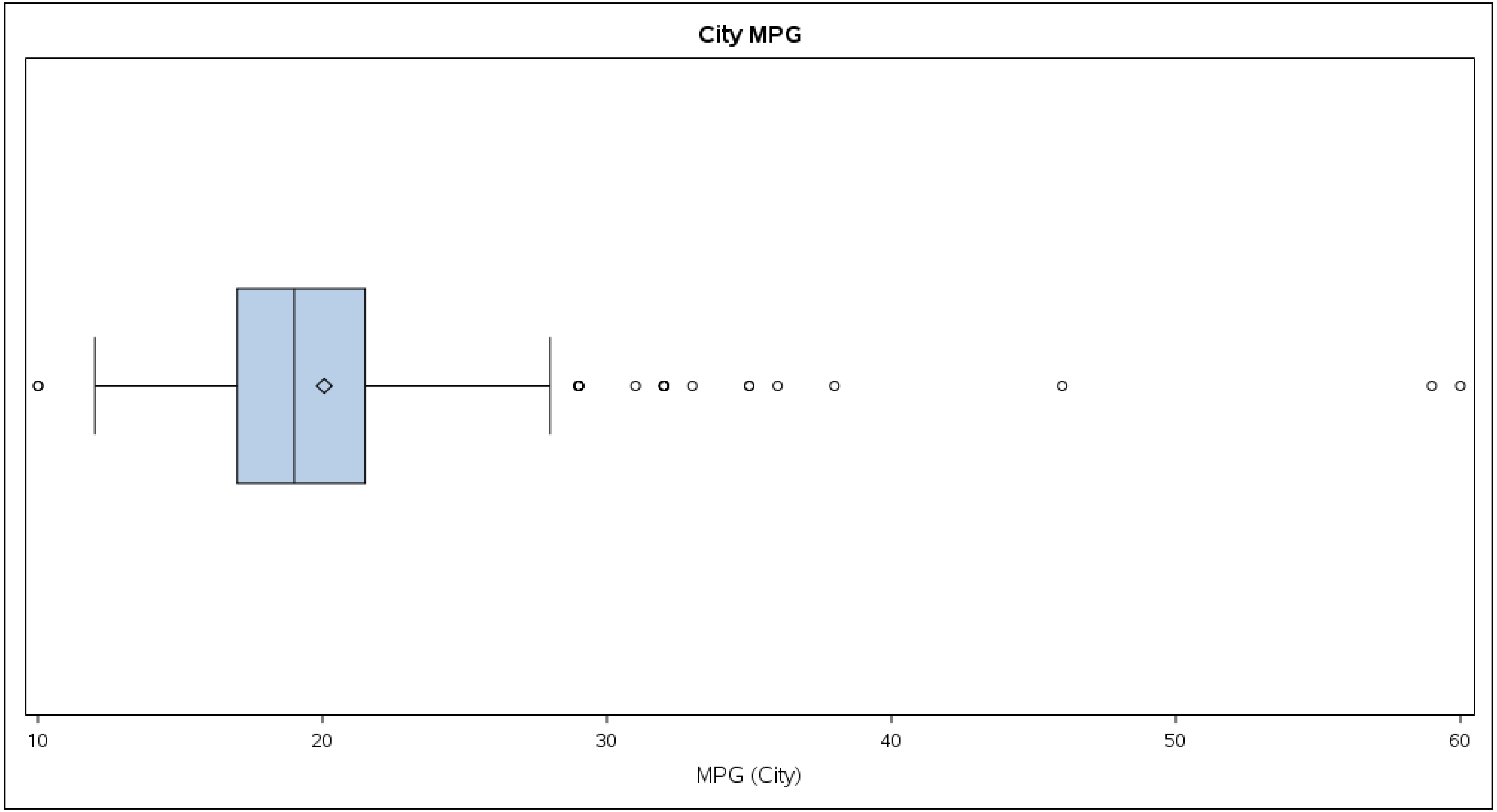
```
proc sql noprint;
create table orsalesum as
select quarter, product_category, sum(profit) as profit format=dollar10.
from sashelp.orsales group by 1, 2 order by 1, 2;

proc sgplot data=orsalesum;
title "Orion Quarterly Sales by Product Category";
bubble y=product_category x=quarter size=profit /
      bradiusmax=12pt
      dataskin=sheen fillattrs=(color=blue);
xaxis display=(nolabel) valuesrotate=vertical;
yaxis display=(nolabel);
```


Orion Quarterly Sales by Product Category
Winter Sports
Team Sports
Swim Sports
Shoes
Running - Jogging
Racket Sports
Outdoors
Indoor Sports
Golf
Clothes
Children Sports
Assorted Sports Articles
1999Q1
1999Q2
1999Q3
1999Q4
2000Q1
2000Q2
2000Q3
2000Q4
2001Q1
2001Q2
2001Q3
2001Q4
2002Q1
2002Q2
2002Q3
2002Q4

BOX CHARTS

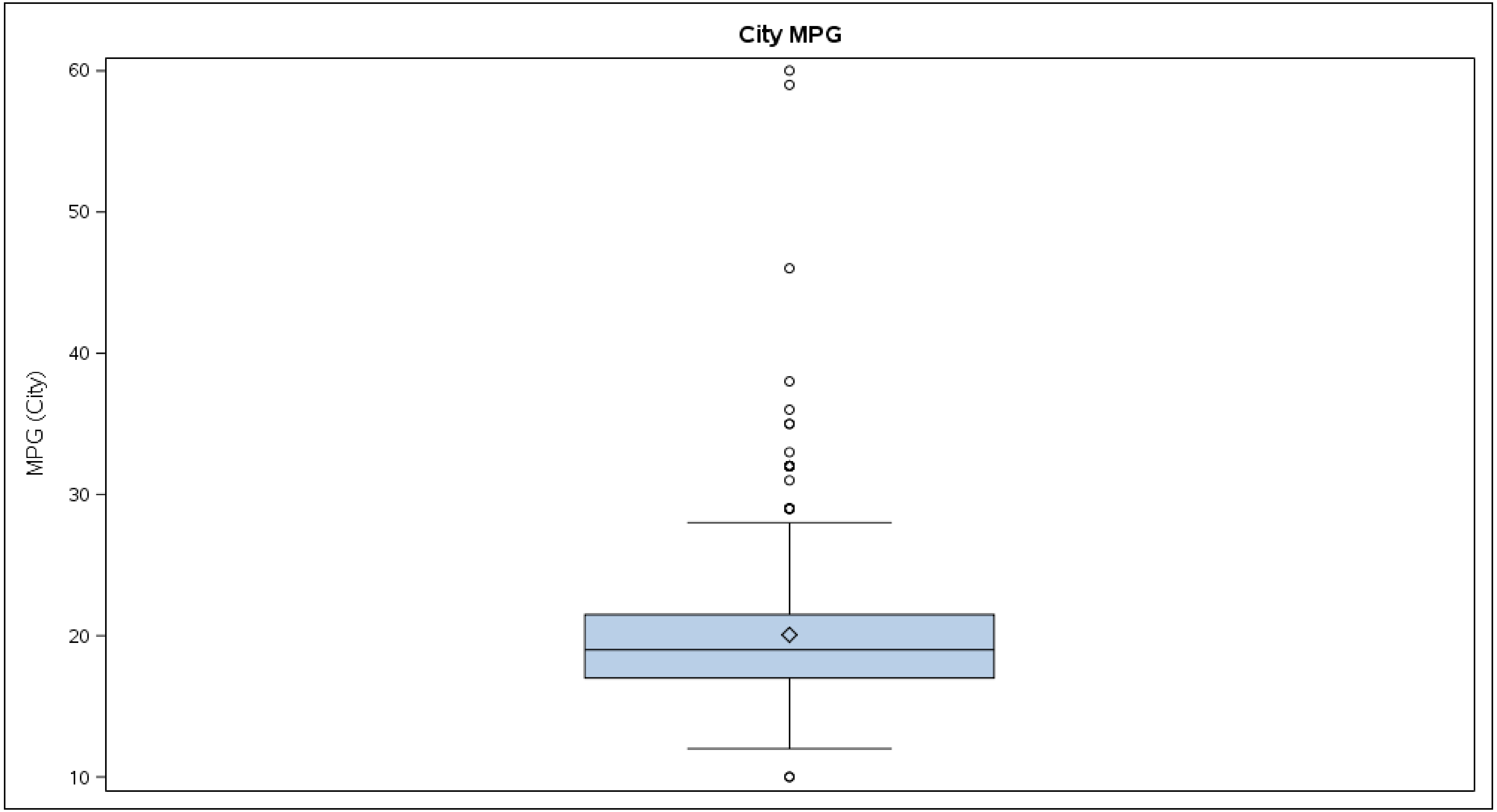
BOX CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.cars;
title "City MPG";
hbox mpg_city;
```


City MPG
10
20
30
40
50
60
MPG (City)

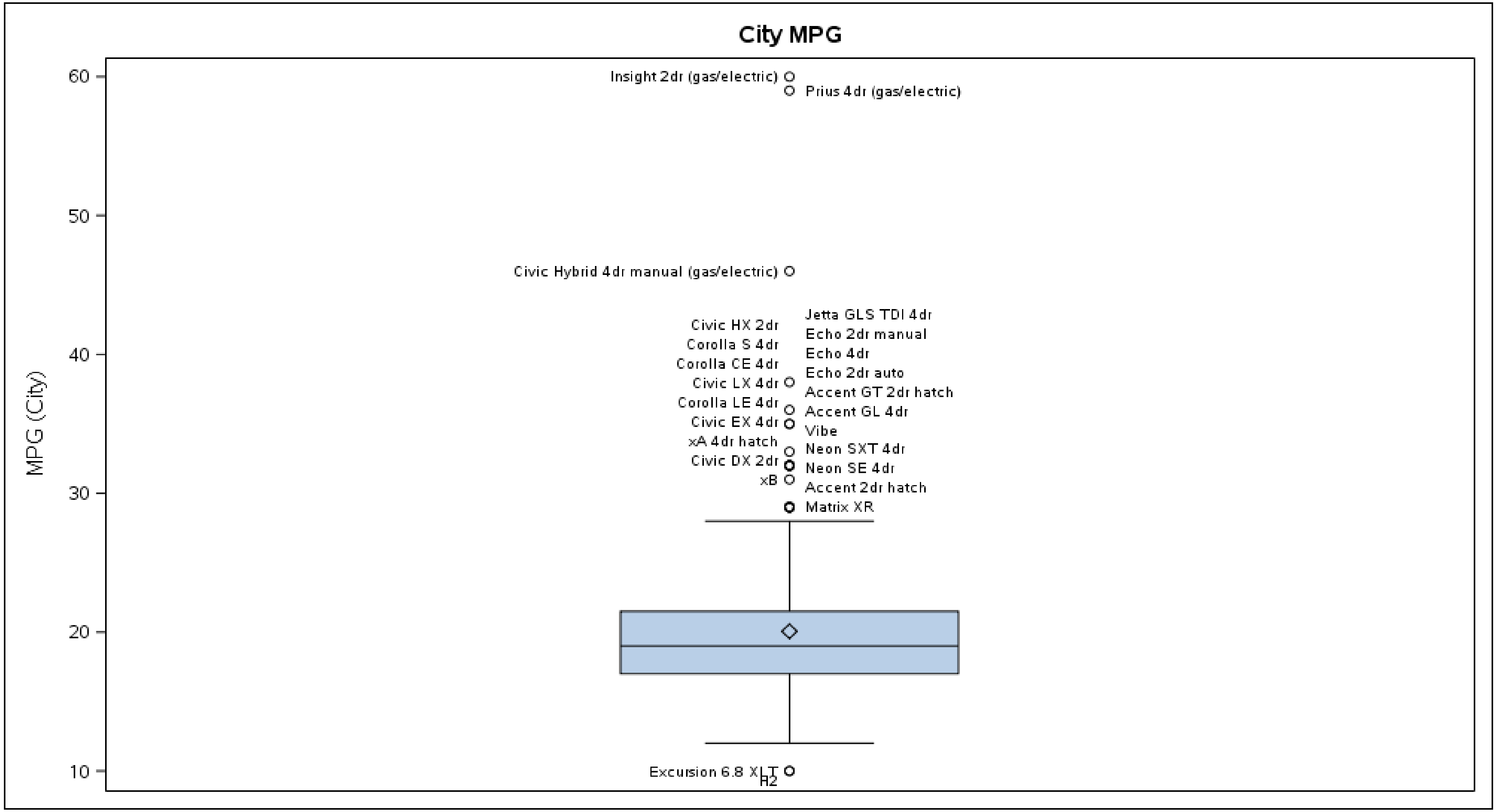
BOX CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.cars;
title "City MPG";
vbox mpg_city;
```


City MPG
MPG (City)
60
50
40
30
20
10

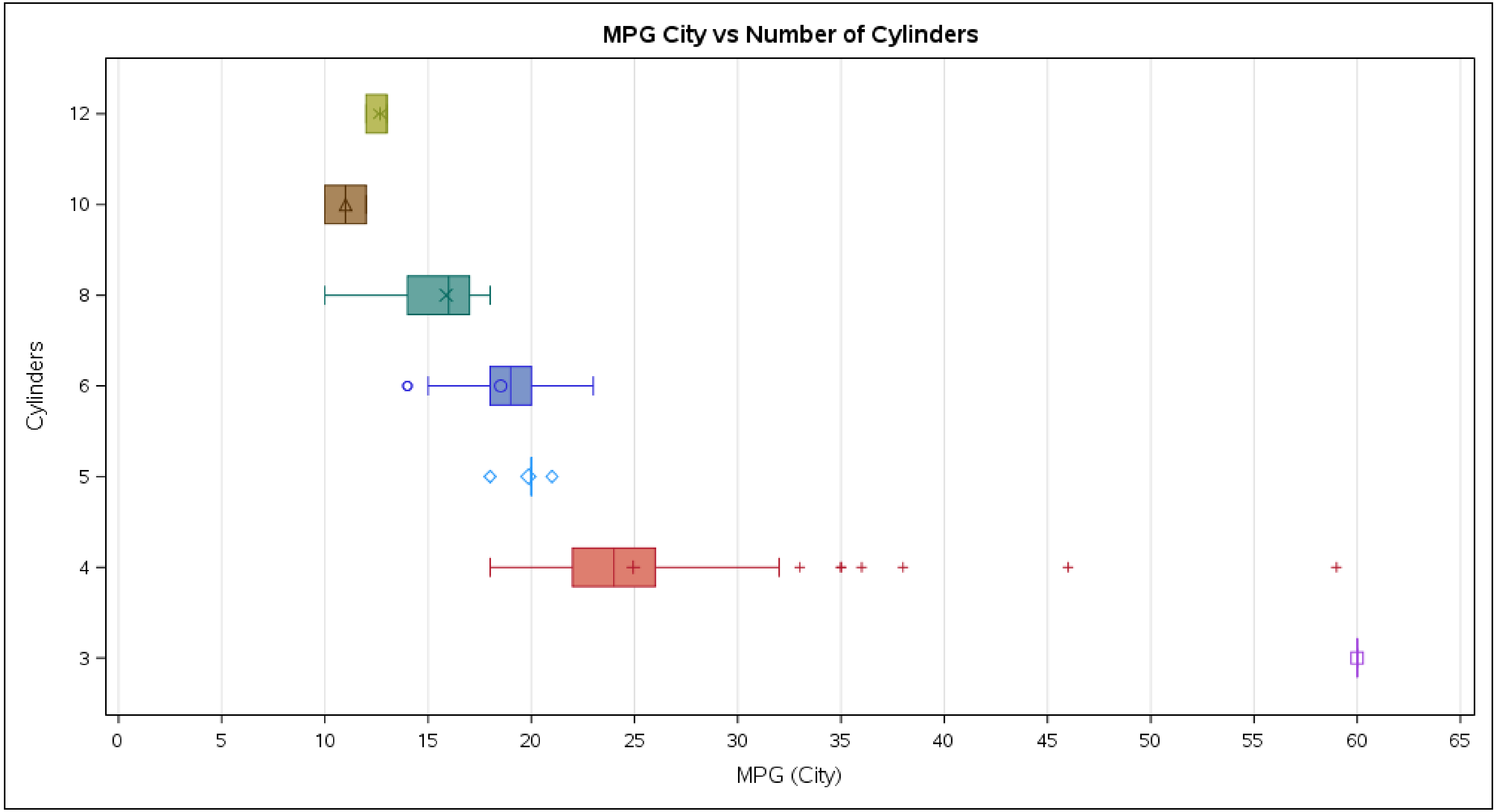
BOX CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.cars;
title "City MPG";
vbox mpg_city / datalabel=model;
```


City MPG
MPG (City)
60
50
40
30
20
10
Insight 2dr (gas/electric)
Prius 4dr (gas/electric)
Civic Hybrid 4dr manual (gas/electric)
Civic HX 2dr
Corolla S 4dr
Corolla CE 4dr
Civic LX 4dr
Corolla LE 4dr
Civic EX 4dr
xA 4dr hatch
Civic DX 2dr
xB
Jetta GLS TDI 4dr
Echo 2dr manual
Echo 4dr
Echo 2dr auto
Accent GT 2dr hatch
Accent GL 4dr
Vibe
Neon SXT 4dr
Neon SE 4dr
Accent 2dr hatch
Matrix XR
Excursion 6.8 XLT
H2

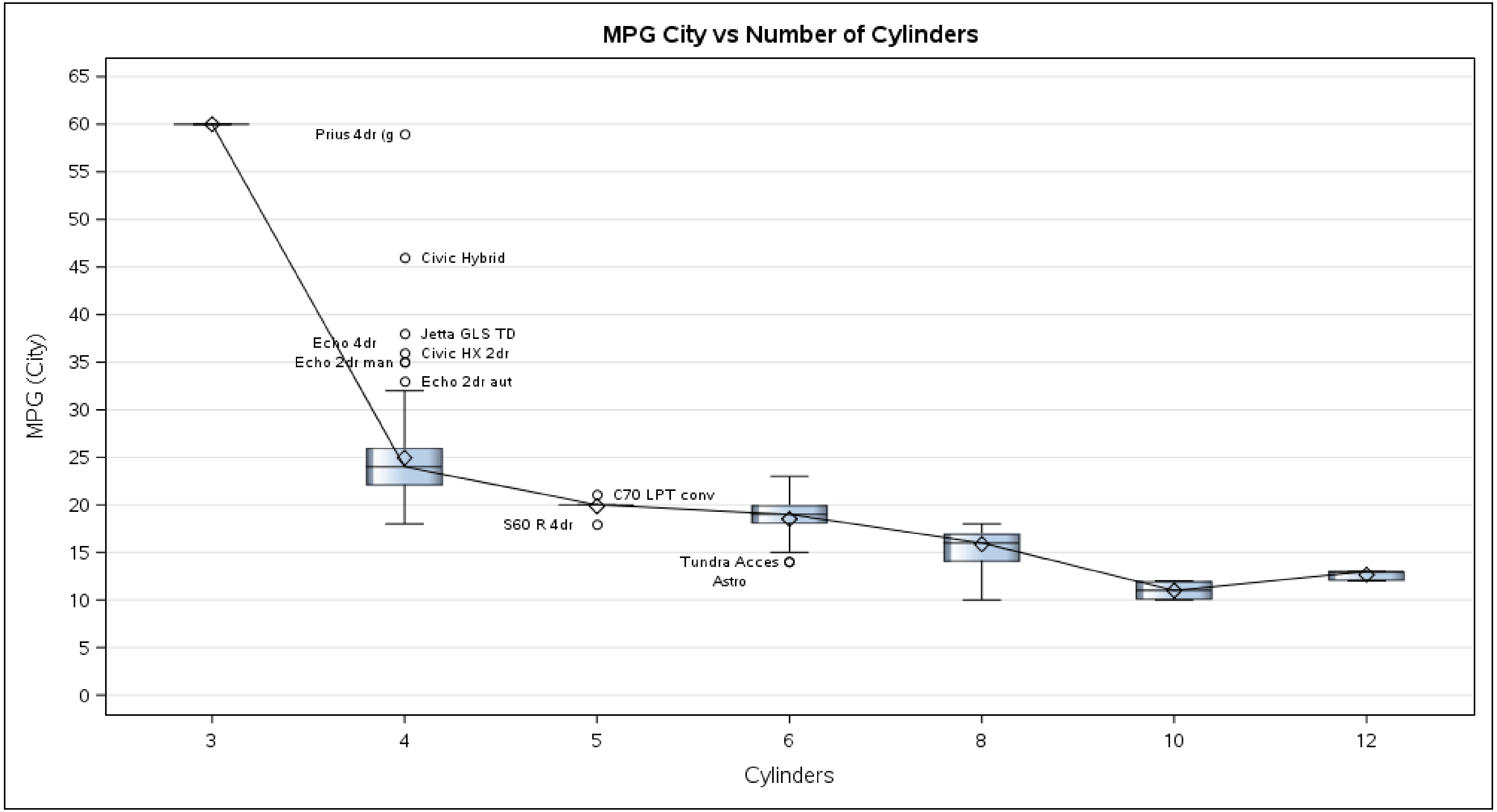
BOX CHARTS: EXERCISE 4

```
proc sgplot data=sashelp.cars noautolegend;
title "MPG City vs Number of Cylinders";
hbox mpg_city /
    group=cylinders category=cylinders;
yaxis reverse;
xaxis grid values=(0 to 65 by 5);
```


MPG City vs Number of Cylinders
Cylinders
12
10
8
6
5
4
3
0
5
10
15
20
25
30
35
40
45
50
55
60
65
MPG (City)

BOX CHARTS: EXERCISE 5

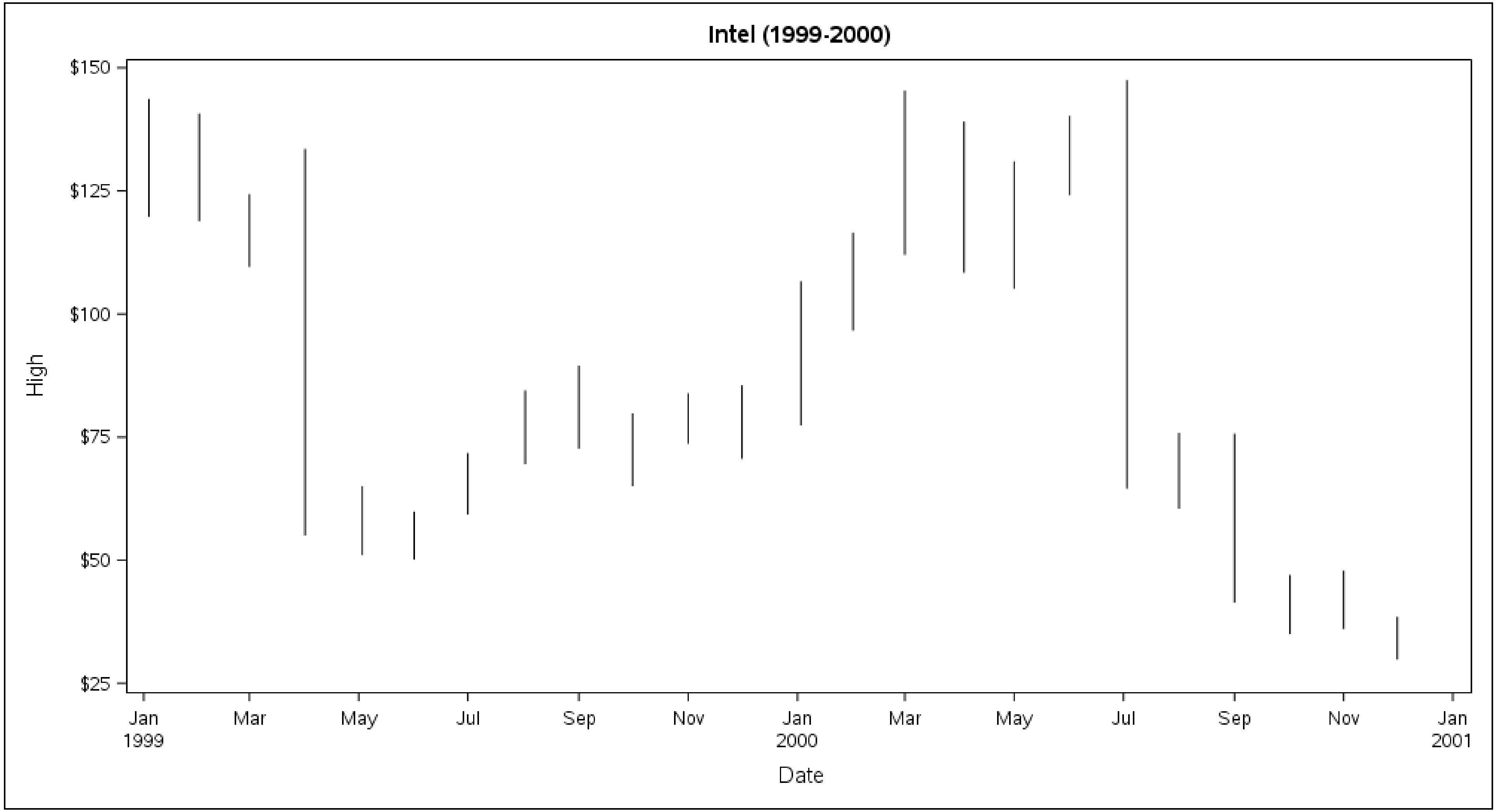
```
proc sgplot data=sashelp.cars;
title "MPG City vs Number of Cylinders";
vbox mpg_city /
    category=cylinders connect=median
    datalabel=model dataskin=gloss;
yaxis grid values=(0 to 65 by 5);
format model $13.;
```


MPG City vs Number of Cylinders
MPG (City)
Cylinders
Prius 4dr (g
Civic Hybrid
Jetta GLS TD
Civic HX 2dr
Echo 4dr
Echo 2dr man
Echo 2dr aut
C70 LPT conv
S60 R 4dr
Tundra Acces
Astro
65
60
55
50
45
40
35
30
25
20
15
10
5
0
3
4
5
6
8
10
12

HIGHLOW CHARTS

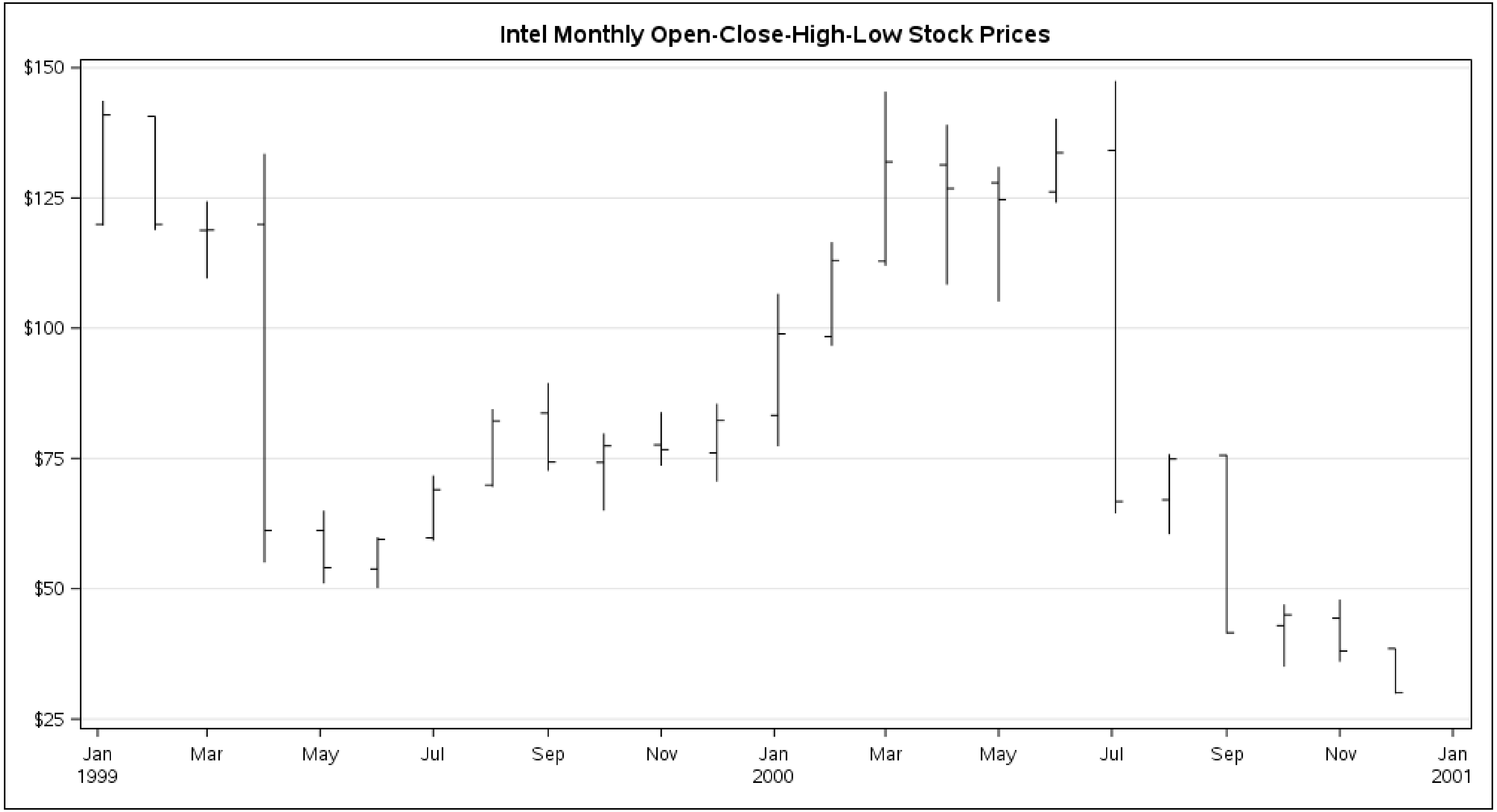
HIGHLOW CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.stocks;
title "Intel (1999-2000)";
where stock='Intel' and '01jan1999'd<=date<'01jan2001'd;
highlow x=date high=high low=low;
```


Intel (1999-2000)
$150
$125
$100
$75
$50
$25
High
Jan 1999
Mar
May
Jul
Sep
Nov
Jan 2000
Mar
May
Jul
Sep
Nov
Jan 2001
Date

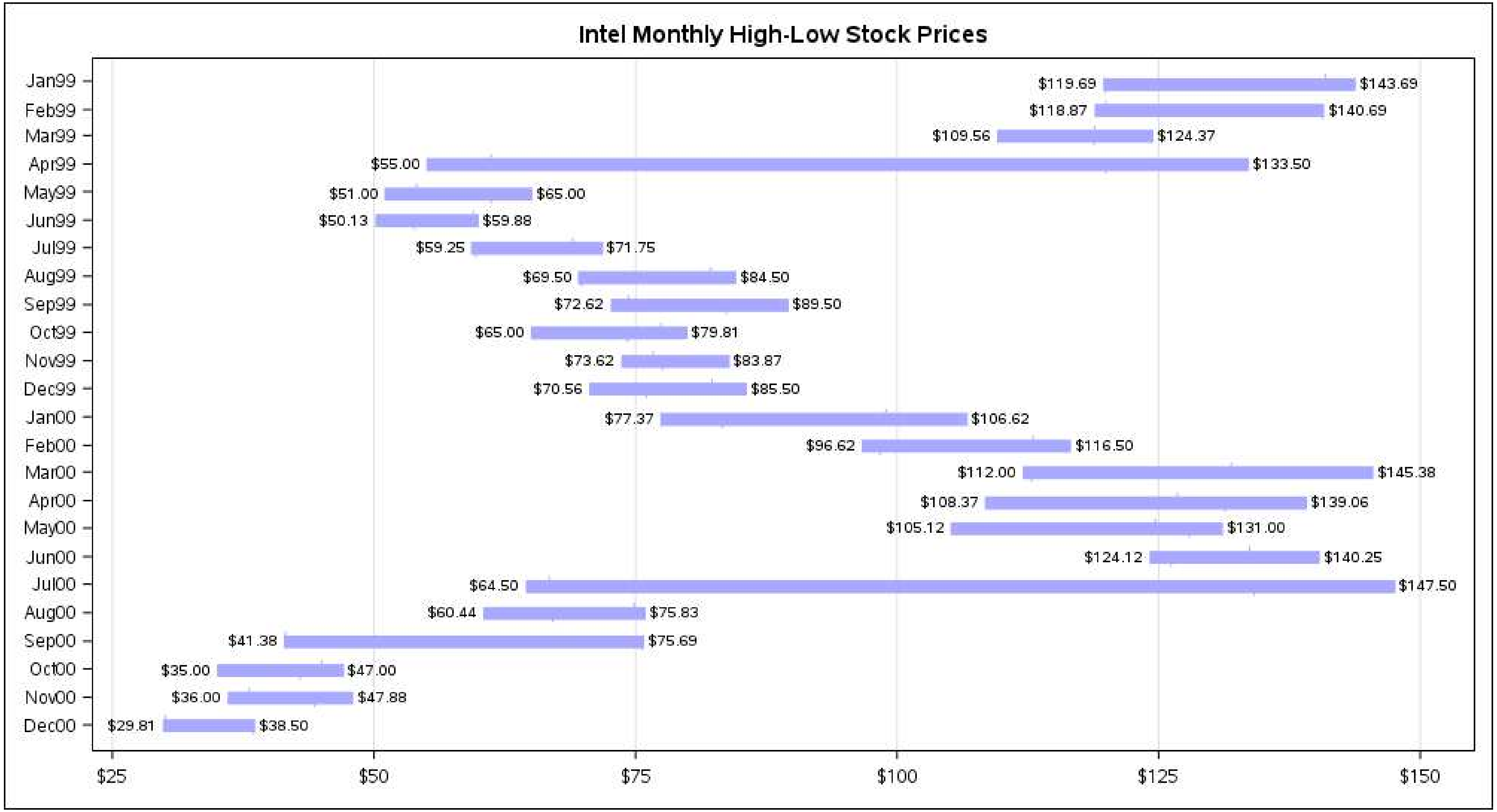
HIGHLOW CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.stocks;
title "Intel Monthly Open-Close-High-Low Stock Prices";
where stock='Intel' and '01jan1999'd<=date<'01jan2001'd;
highlow x=date high=high low=low /
      open=open close=close;
xaxis display=(nolabel);
yaxis display=(nolabel) grid;
```


Intel Monthly Open-Close-High-Low Stock Prices
$150
$125
$100
$75
$50
$25
Jan 1999
Mar
May
Jul
Sep
Nov
Jan 2000
Mar
May
Jul
Sep
Nov
Jan 2001

HIGHLOW CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.stocks;
title "Intel Monthly High-Low Stock Prices";
where stock='Intel' and '01jan1999'd<=date<'01jan2001'd;
highlow y=date high=high low=low /
	type=bar nooutline barwidth=.75
	fill fillattrs=(color="verylightblue")
	lowlabel=low highlabel=high
	open=open close=close;
xaxis display=(nolabel) grid valueattrs=(size=8pt);
yaxis display=(nolabel) interval=month reverse
    valuesformat=monyy5. valueattrs=(size=8pt);
```

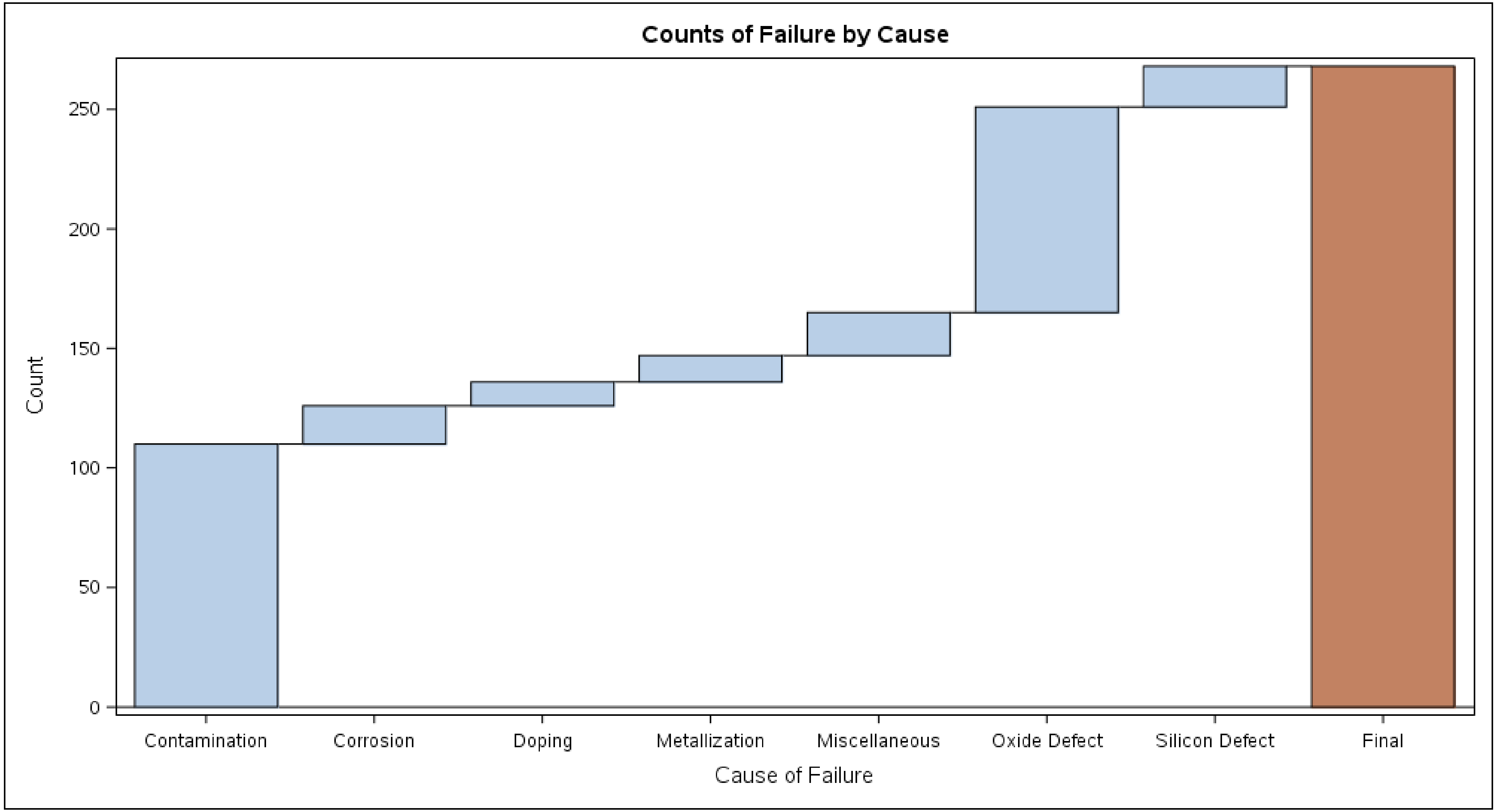


Intel Monthly High-Low Stock Prices
Jan99
Feb99
Mar99
Apr99
May99
Jun99
Jul99
Aug99
Sep99
Oct99
Nov99
Dec99
Jan00
Feb00
Mar00
Apr00
May00
Jun00
Jul00
Aug00
Sep00
Oct00
Nov00
Dec00
$119.69
$143.69
$118.87
$140.69
$109.56
$124.37
$55.00
$133.50
$51.00
$65.00
$50.13
$59.88
$59.25
$71.75
$69.50
$84.50
$72.62
$89.50
$65.00
$79.81
$73.62
$83.87
$70.56
$85.50
$77.37
$106.62
$96.62
$116.50
$112.00
$145.38
$108.37
$139.06
$105.12
$131.00
$124.12
$140.25
$64.50
$147.50
$60.44
$75.83
$41.38
$75.69
$35.00
$47.00
$36.00
$47.88
$29.81
$38.50
$25
$50
$75
$100
$125
$150

WATERFALL CHARTS

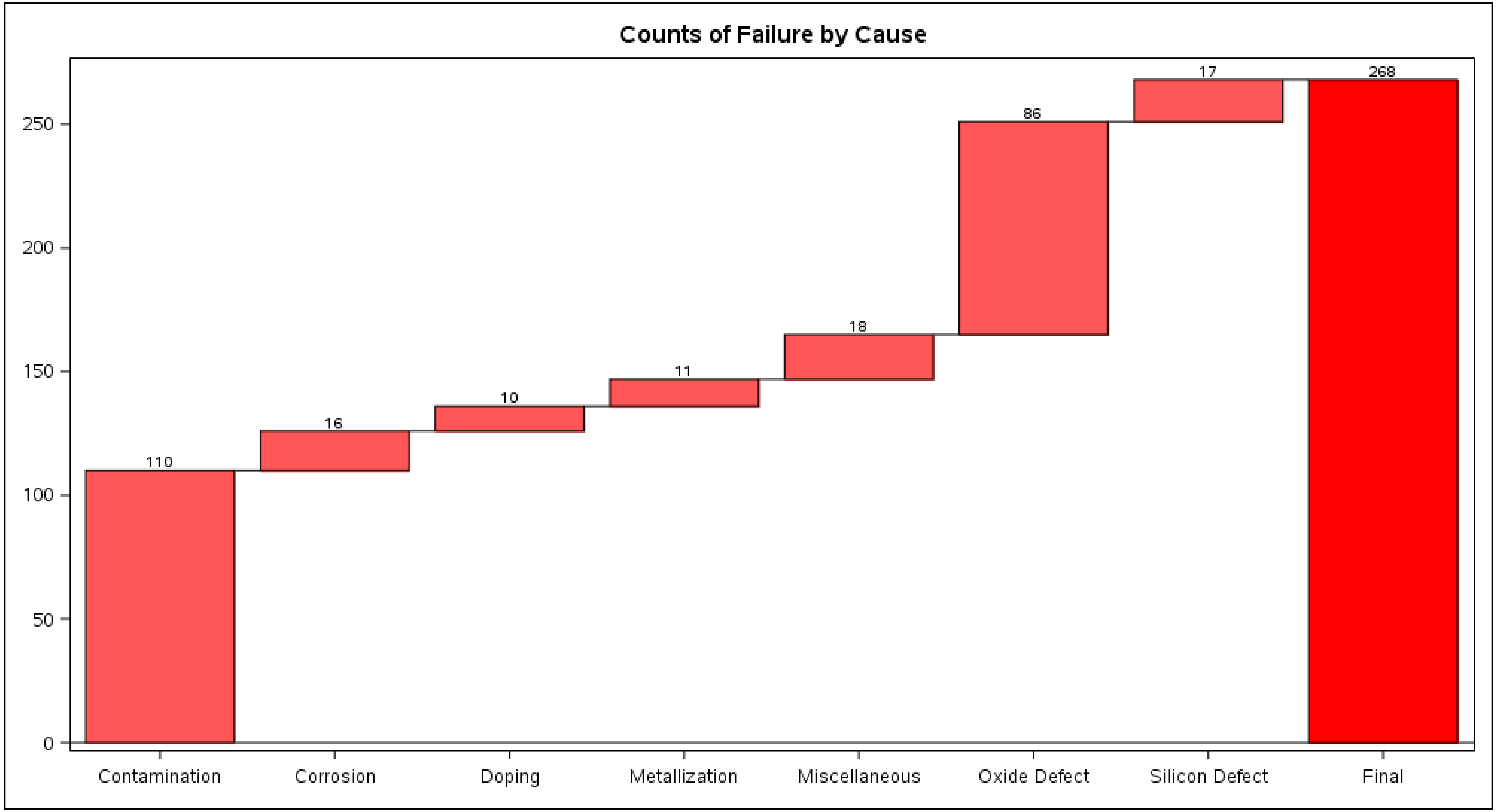
WATERFALL CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.failure;
title "Counts of Failure by Cause";
waterfall category=cause response=count;
```


Counts of Failure by Cause
Count
0
50
100
150
200
250
Contamination
Corrosion
Doping
Metallization
Miscellaneous
Oxide Defect
Silicon Defect
Final
Cause of Failure

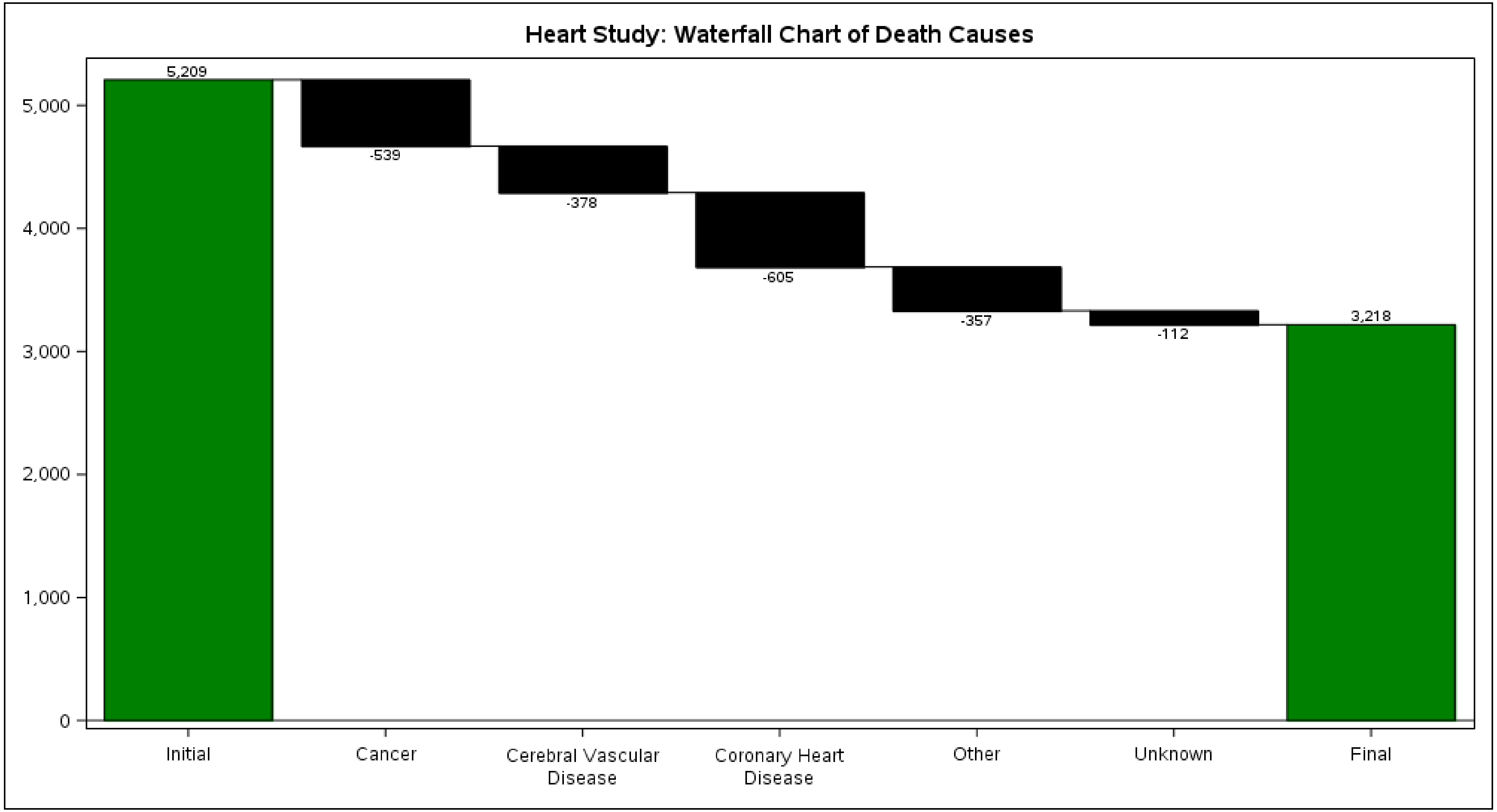
WATERFALL CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.failure;
title "Counts of Failure by Cause";
waterfall category=cause response=count /
        datalabel fillattrs=(color=lightred)
        finalbarattrs=(color=red);
xaxis display=(nolabel);
yaxis display=(nolabel);
```


Counts of Failure by Cause
250
200
150
100
50
0
110
16
10
11
18
86
17
268
Contamination
Corrosion
Doping
Metallization
Miscellaneous
Oxide Defect
Silicon Defect
Final

WATERFALL CHARTS: EXERCISE 3

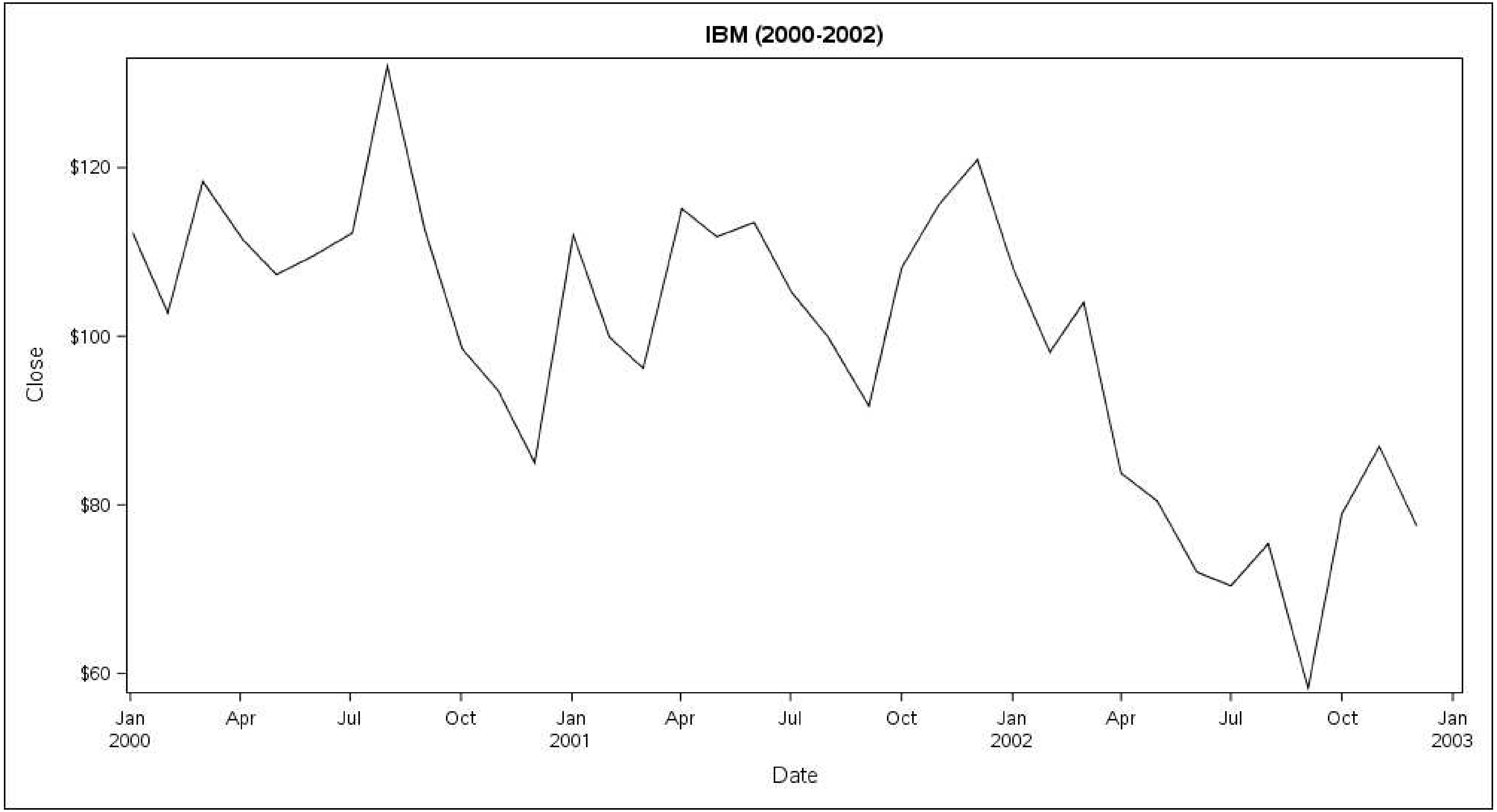
```
proc sql noprint;
create table heartdeaths as
select deathcause, sum(-1) as Deaths
from sashelp.heart where status='Dead' group by 1;
select count(*) into :Participants from sashelp.heart;
proc sgplot data=heartdeaths;
title "Heart Study: Waterfall Chart of Death Causes";
waterfall category=deathcause response=deaths /
        datalabel fillattrs=(color=black)
        initialbarvalue=&Participants
        initialbarattrs=(color=green)
        finalbarattrs=(color=green);
xaxis display=(nolabel);
yaxis display=(nolabel);
format deaths comma7.;
```


Heart Study: Waterfall Chart of Death Causes
5,209
-539
-378
-605
-357
-112
3,218
5,000
4,000
3,000
2,000
1,000
0
Initial
Cancer
Cerebral Vascular Disease
Coronary Heart Disease
Other
Unknown
Final

SERIES CHARTS

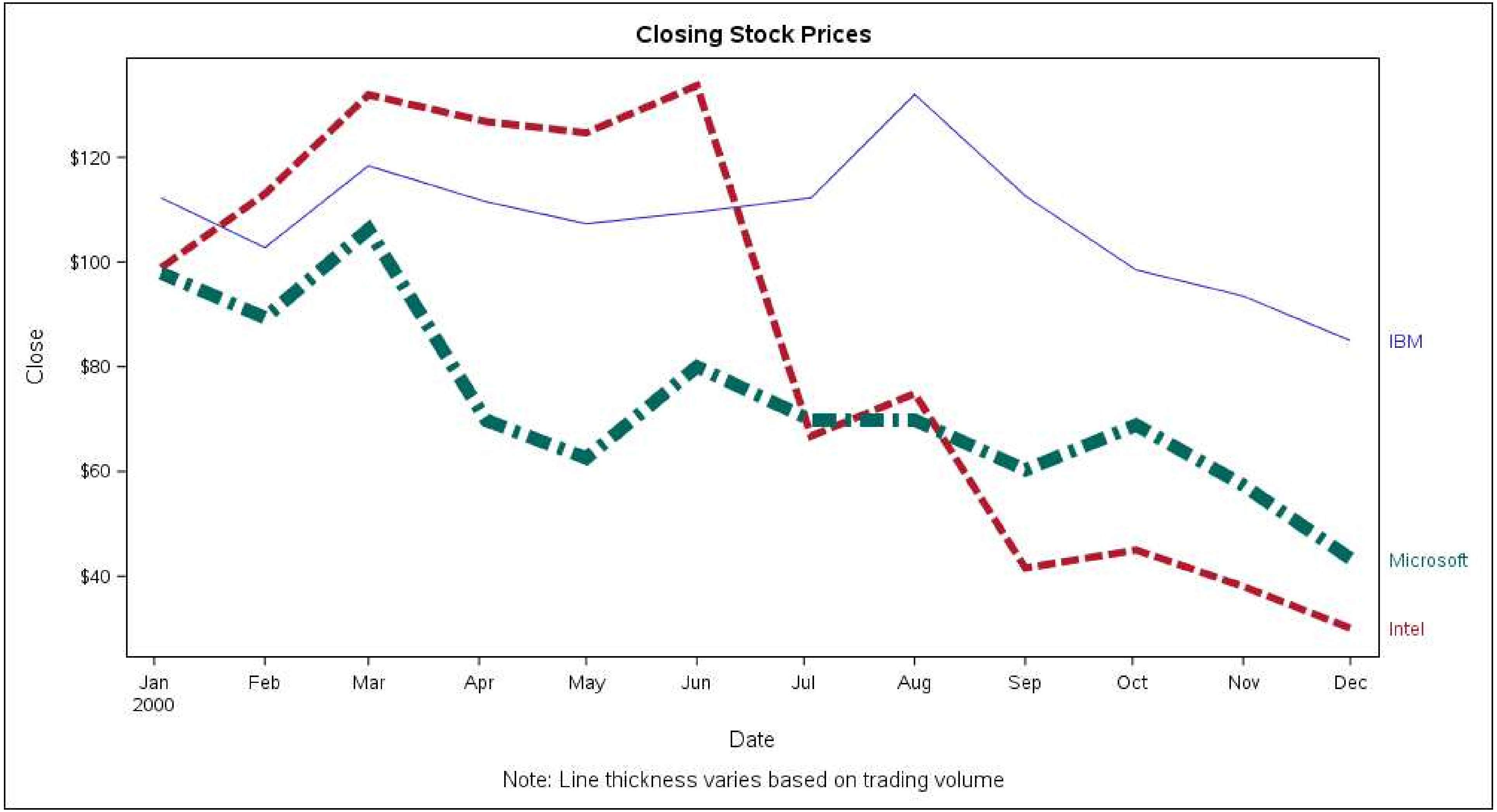
SERIES CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.stocks;
title "IBM (2000-2002)";
where stock="IBM" and '01jan2000'd<=date<'01jan2003'd;
series x=date y=close;
```


IBM (2000-2002)
$120
$100
$80
$60
Close
Jan 2000
Apr
Jul
Oct
Jan 2001
Apr
Jul
Oct
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

SERIES CHARTS: EXERCISE 2

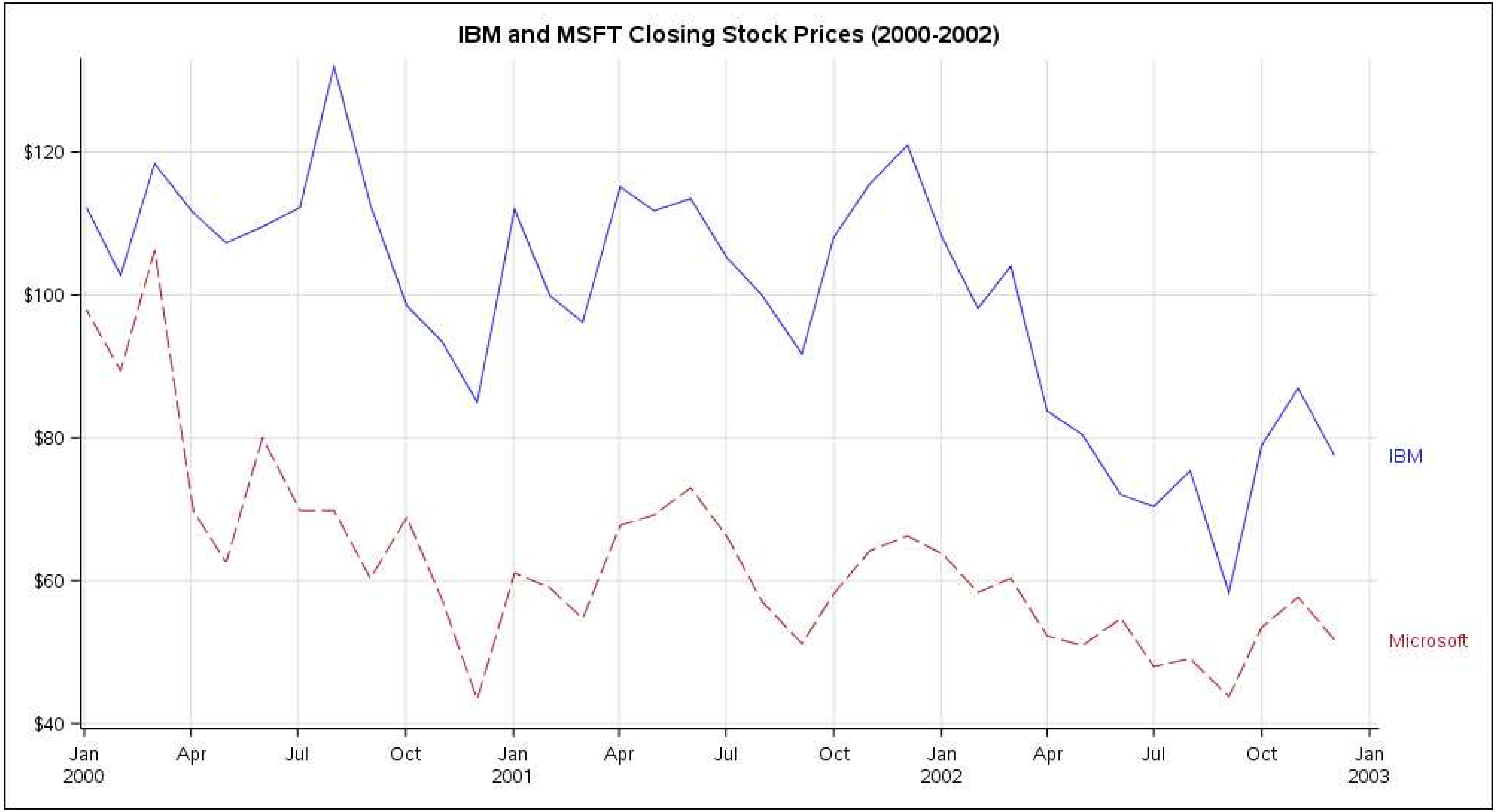
```
proc sgplot data=sashelp.stocks;
title "Closing Stock Prices";
where '01jan2000'd<=date<'01jan2001'd;
series x=date y=close /
      group=stock thickresp=volume
      curvelabel curvelabelloc=outside;
footnote "Note: Line thickness varies based on trading volume";
footnote;
```



Closing Stock Prices
$120
$100
$80
$60
$40
Close
IBM
Microsoft
Intel
Jan 2000
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Note: Line thickness varies based on trading volume

SERIES CHARTS: EXERCISE 3

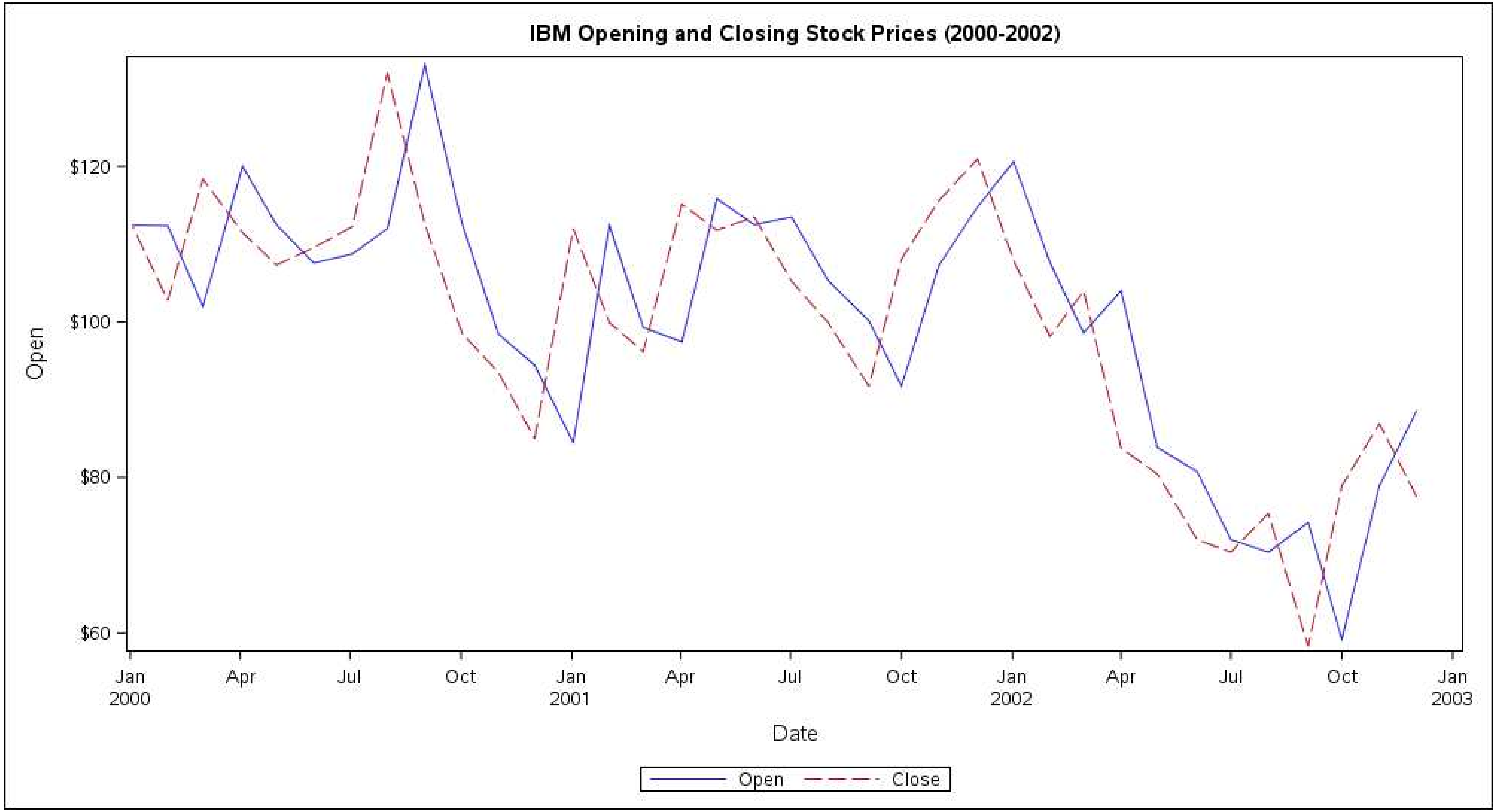
```
proc sgplot data=sashelp.stocks noborder;
title "IBM and MSFT Closing Stock Prices (2000-2002)";
where stock in ("IBM" "Microsoft") and '01jan2000'd<='date<'01jan2003'd;
series x=date y=close / group=stock curvelabel curvelabelloc=outside;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) grid;
```



IBM and MSFT Closing Stock Prices (2000-2002)
$120
$100
$80
$60
$40
Jan 2000
Apr
Jul
Oct
Jan 2001
Apr
Jul
Oct
Jan 2002
Apr
Jul
Oct
Jan 2003
IBM
Microsoft

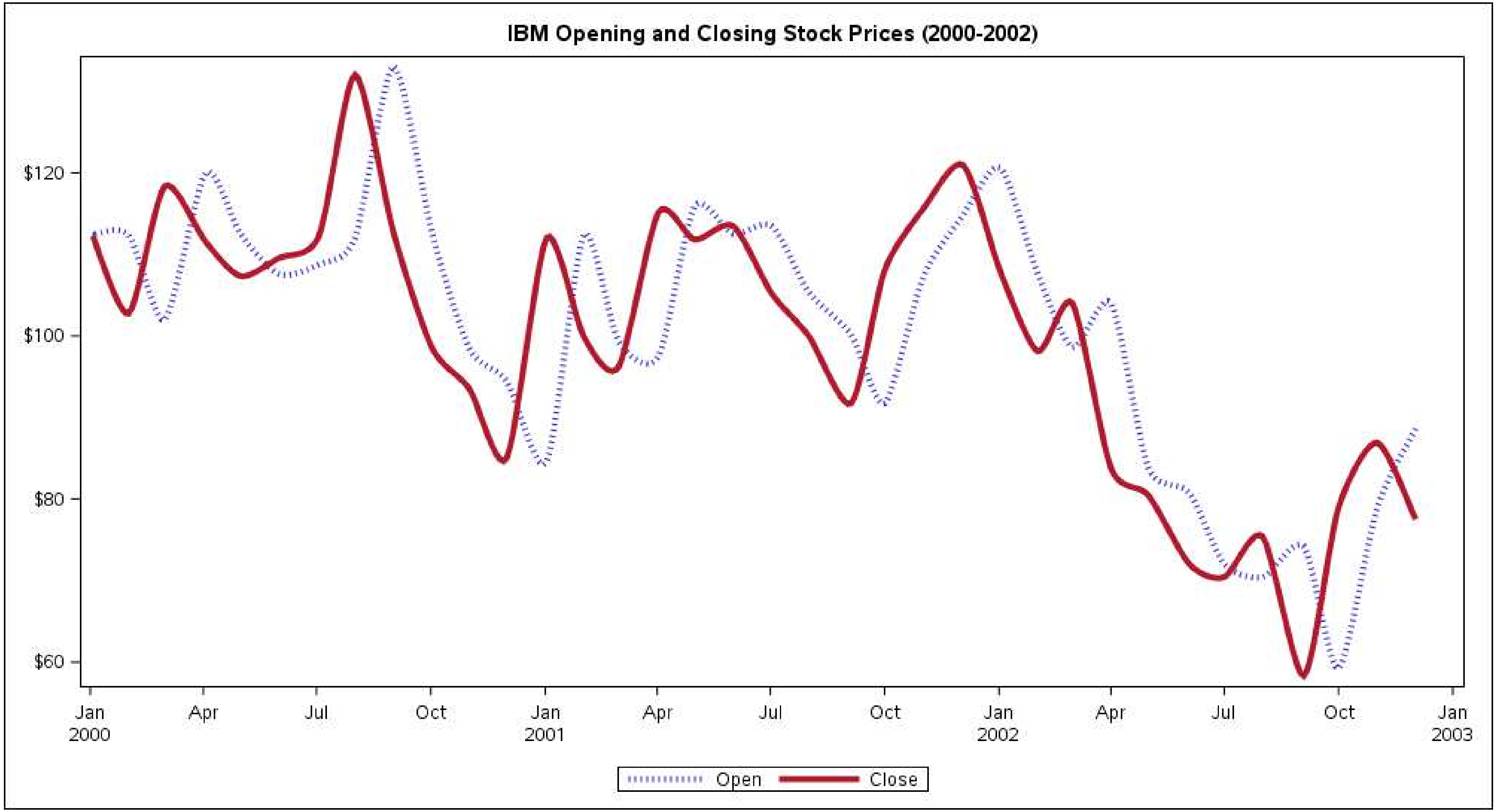
SERIES CHARTS: EXERCISE 4

```
proc sgplot data=sashelp.stocks;
where stock="IBM" and '01jan2000'd<=date<'01jan2003'd;
title height=10pt "IBM Opening and Closing Stock Prices (2000-2002)";
series x=date y=open;
series x=date y=close;
```


IBM Opening and Closing Stock Prices (2000-2002)
$120
$100
$80
$60
Open
Jan 2000
Apr
Jul
Oct
Jan 2001
Apr
Jul
Oct
Jan 2002
Apr
Jul
Oct
Jan 2003
Date
Open
Close

SERIES CHARTS: EXERCISE 5

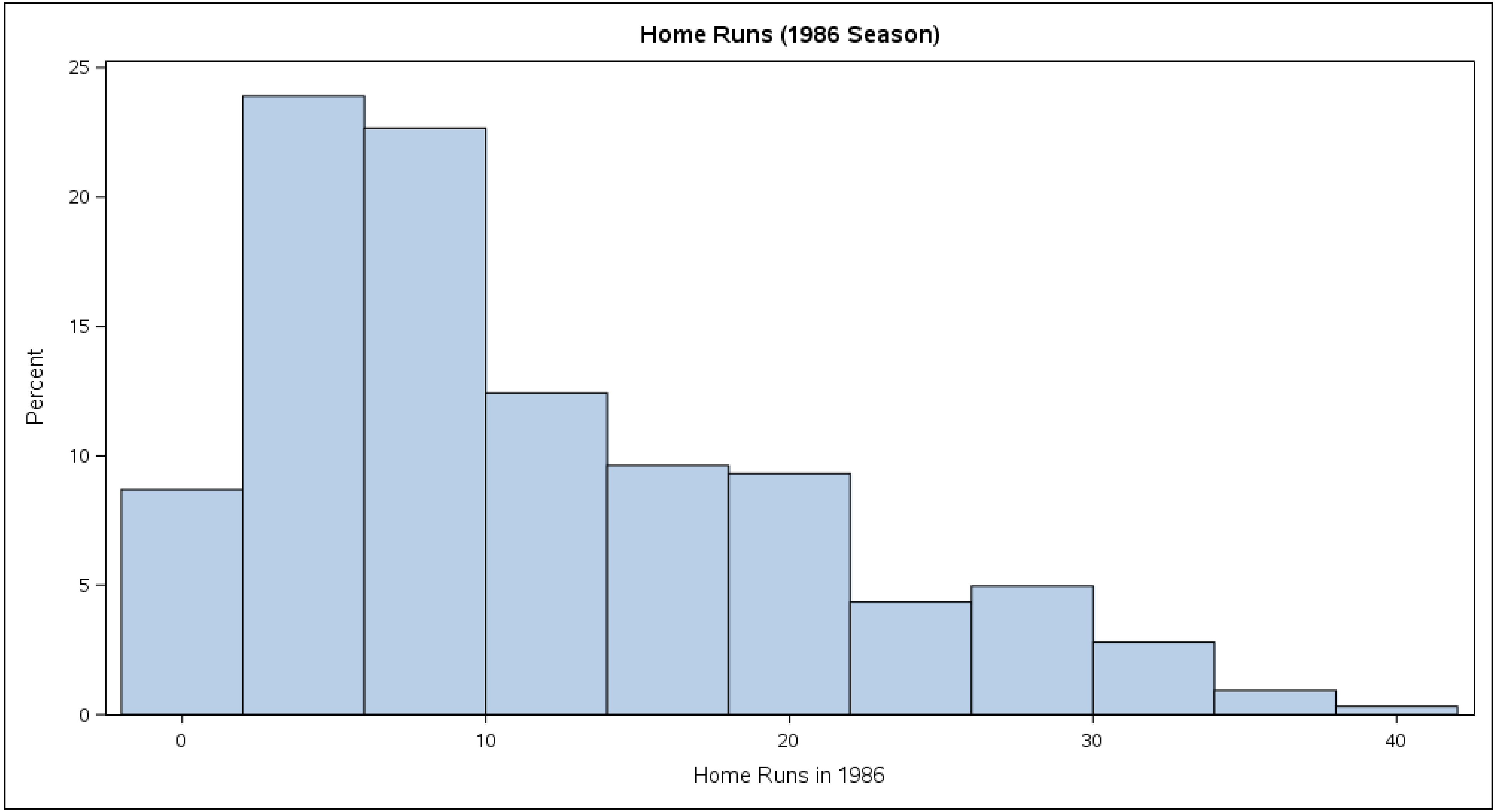
```
proc sgplot data=sashelp.stocks;
where stock="IBM" and '01jan2000'd<=date<'01jan2003'd;
title height=10pt "IBM Opening and Closing Stock Prices (2000-2002)";
series x=date y=open / lineattrs=(pattern=dot thickness=3pt) smoothconnect;
series x=date y=close / lineattrs=(pattern=solid thickness=3pt) smoothconnect;
xaxis display=(nolabel);
yaxis display=(nolabel);
```


IBM Opening and Closing Stock Prices (2000-2002)
$120
$100
$80
$60
Jan 2000
Apr
Jul
Oct
Jan 2001
Apr
Jul
Oct
Jan 2002
Apr
Jul
Oct
Jan 2003
Open
Close

HISTOGRAM CHARTS

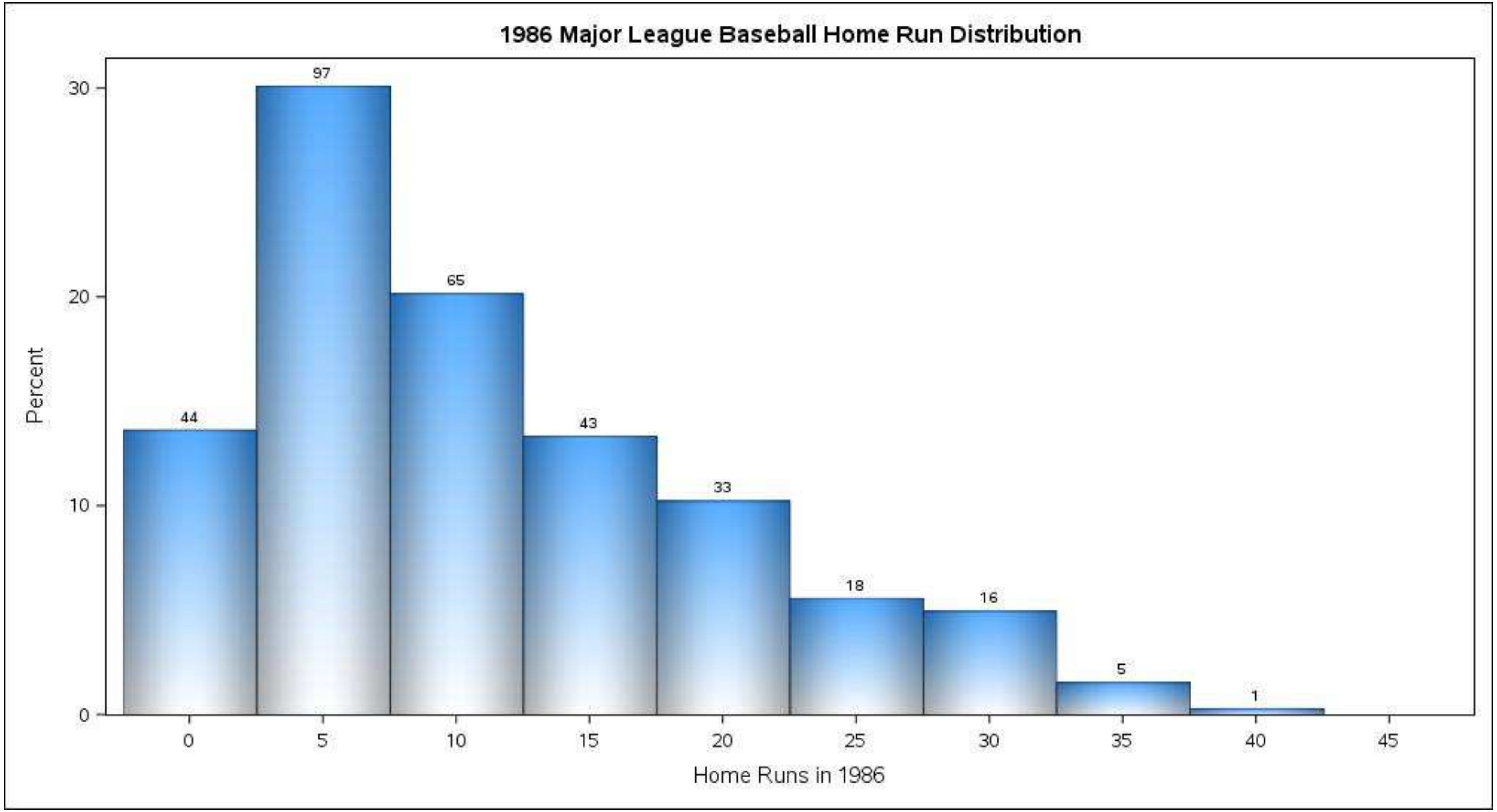
HISTOGRAM CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.baseball;
title "Home Runs (1986 Season)";
histogram nhome;
```


Home Runs (1986 Season)
Percent
25
20
15
10
5
0
0
10
20
30
40
Home Runs in 1986

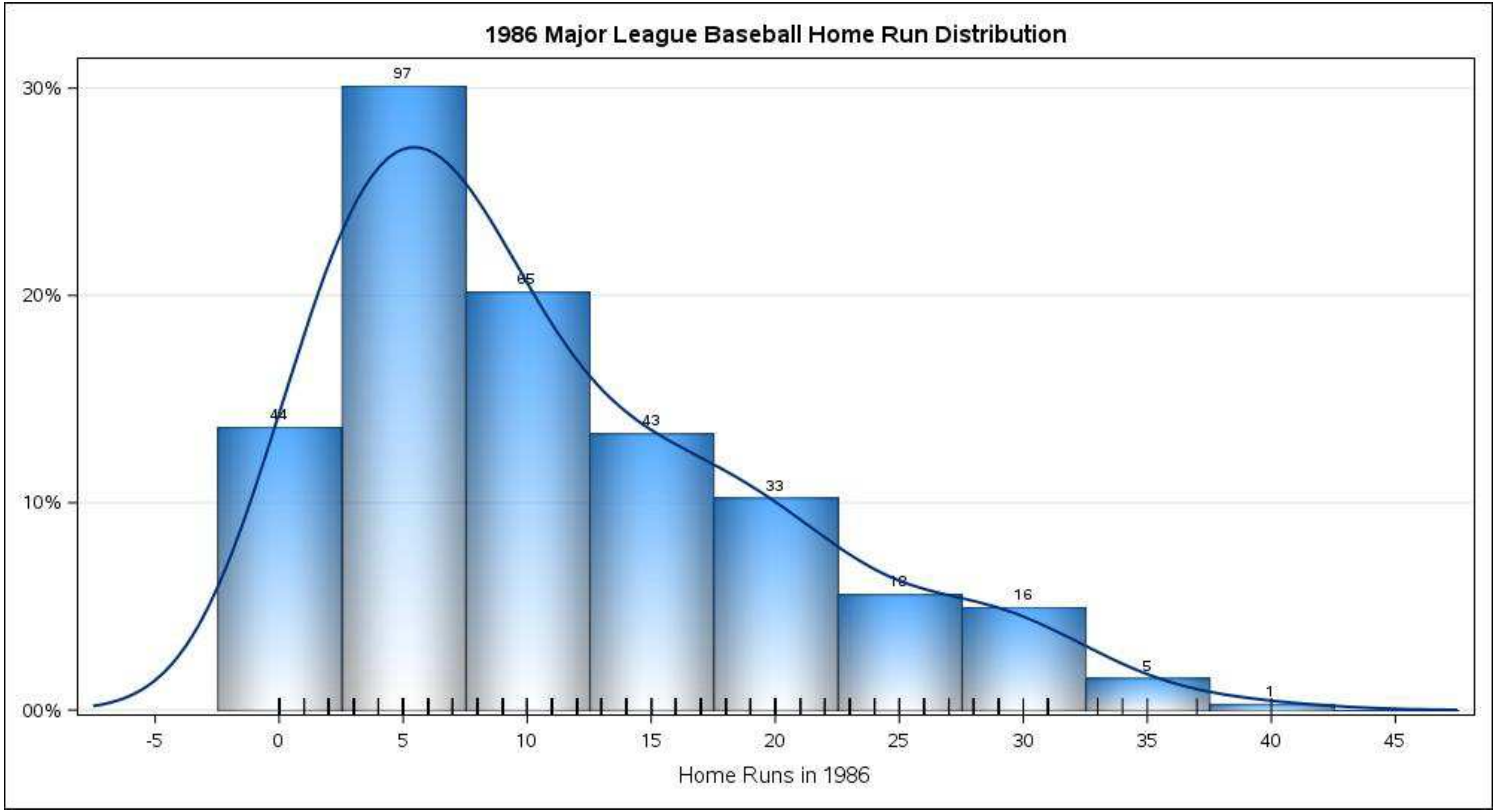
HISTOGRAM CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.baseball;
title "1986 Major League Baseball Home Run Distribution";
histogram nhome /
        datalabel=count nbins=10 showbins
        dataskin=pressed filltype=gradient
        fillattrs=(color=dodgerblue);
```


1986 Major League Baseball Home Run Distribution
Percent
30
20
10
0
97
65
44
43
33
18
16
5
1
0
5
10
15
20
25
30
35
40
45
Home Runs in 1986

HISTOGRAM CHARTS: EXERCISE 3

```
proc format;
picture pctF low-high ='099%';

proc sgplot data=sashelp.baseball noautolegend;
title "1986 Major League Baseball Home Run Distribution";
histogram nhome /
        datalabel=count nbins=10 showbins
        dataskin=pressed filltype=gradient
        fillattrs=(color=dodgerblue);
density nhome / type=kernel;
fringe nhome;
yaxis display=(nolabel) valuesformat=pctf. grid;
```

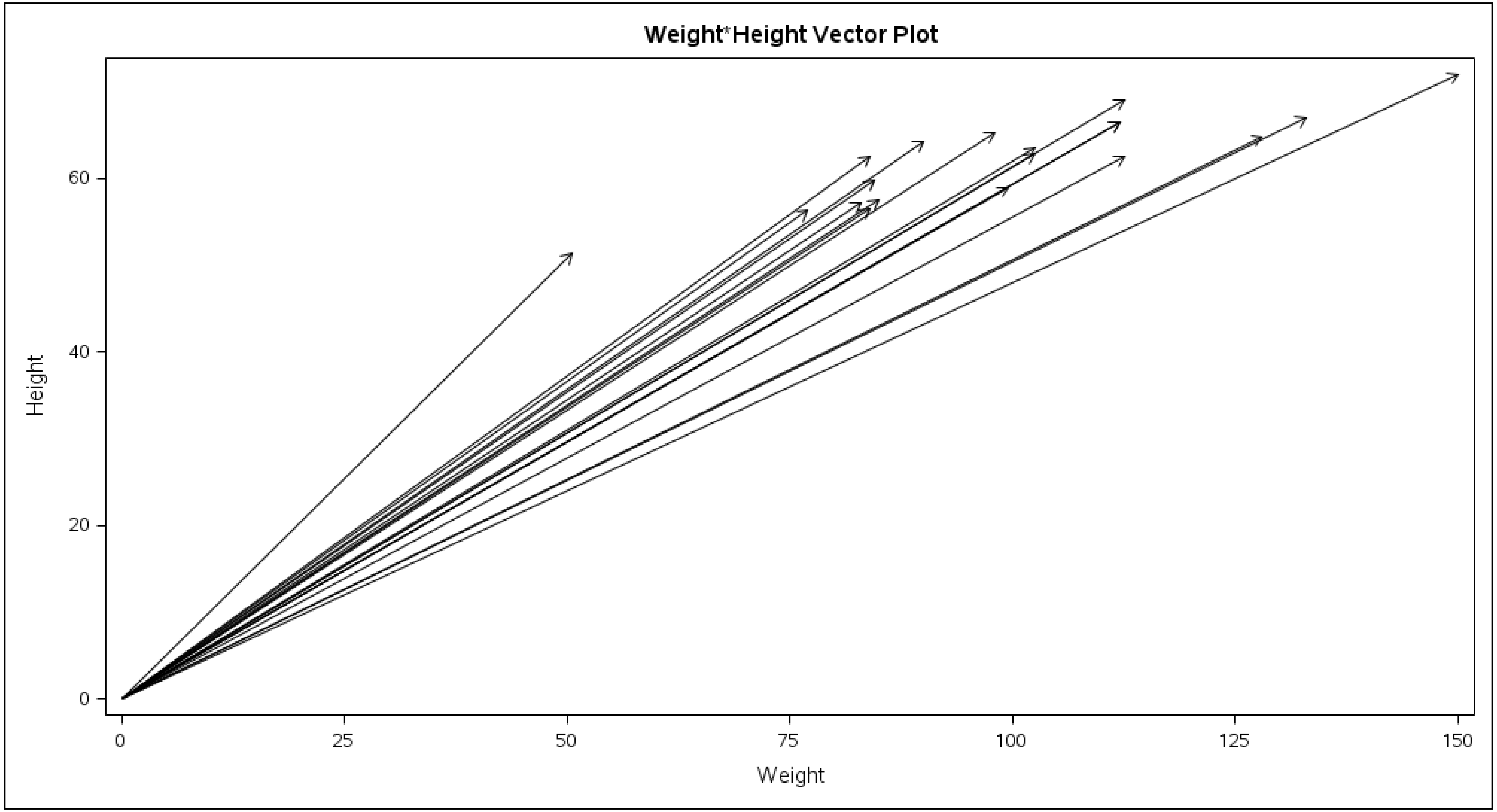


1986 Major League Baseball Home Run Distribution
30%
20%
10%
00%
97
65
44
43
33
16
5
1
-5
0
5
10
15
20
25
30
35
40
45
Home Runs in 1986

VECTOR CHARTS

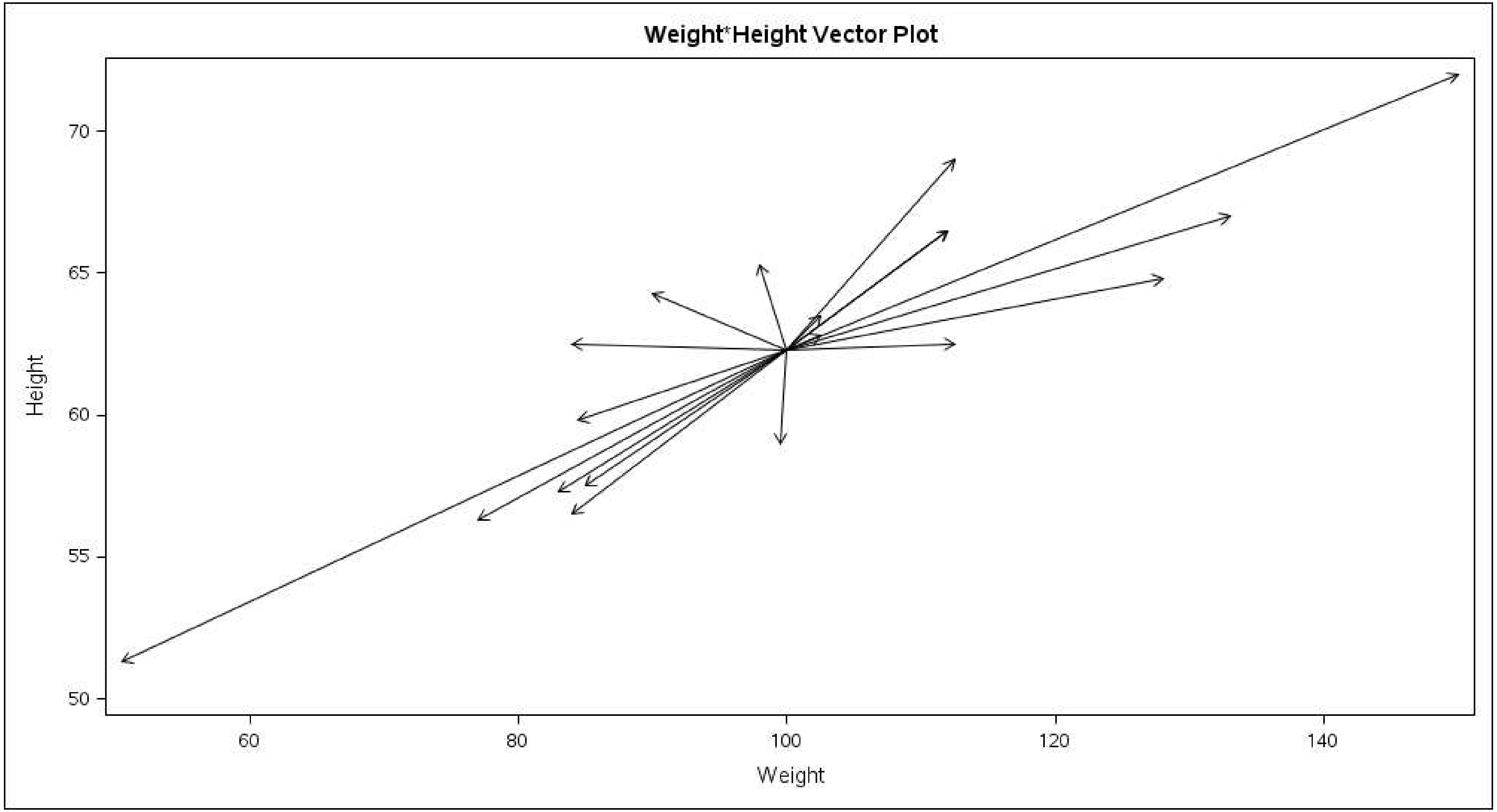
VECTOR CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Weight*Height Vector Plot";
vector x=weight y=height;
```


Weight*Height Vector Plot
Height
60
40
20
0
0
25
50
75
100
125
150
Weight

VECTOR CHARTS: EXERCISE 2

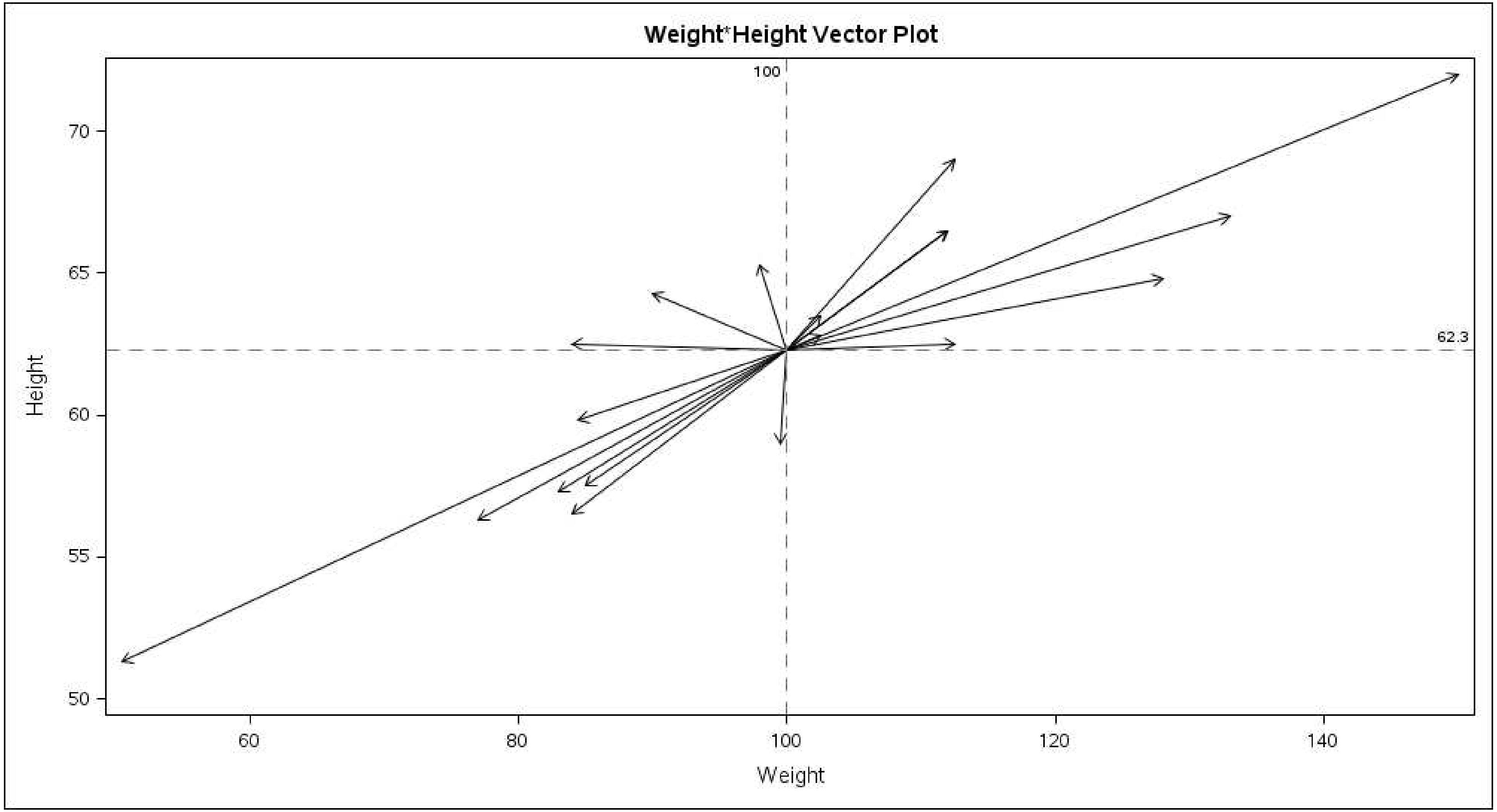
```
proc sql noprint;
select avg(weight) format=5.1, avg(height) format=5.1
into :avgweight, :avgheight from sashelp.class;

proc sgplot data=sashelp.class;
title "Weight*Height Vector Plot";
vector x=weight y=height / xorigin=&avgweight yorigin=&avgheight;
```



Weight*Height Vector Plot
70
65
60
55
50
Height
60
80
100
120
140
Weight

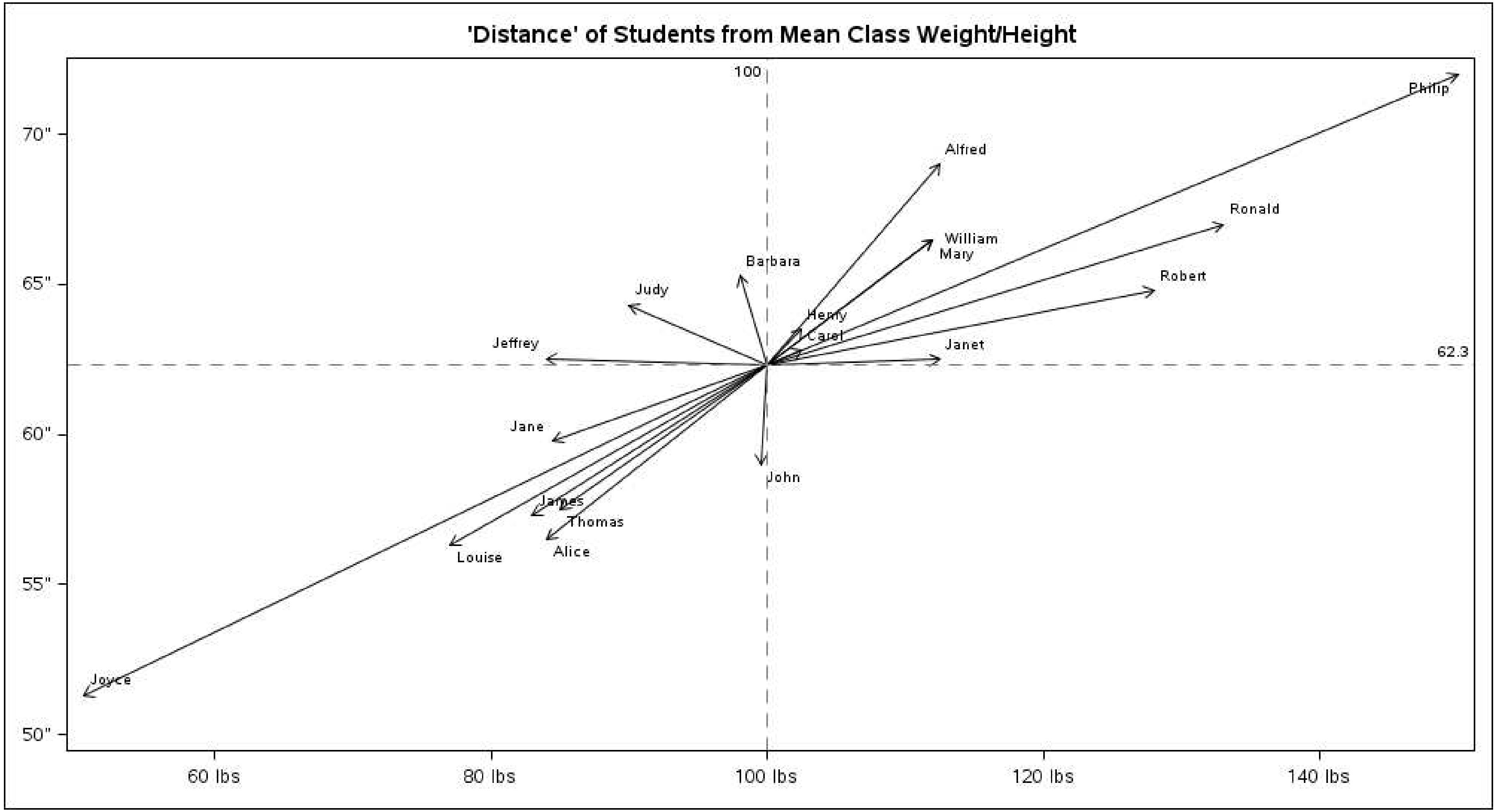
VECTOR CHARTS: EXERCISE 3

```
proc sgplot data=sashelp.class;
title "Weight*Height Vector Plot";
vector x=weight y=height /
      xorigin=&avgweight yorigin=&avgheight;
refline &avgweight /
       axis=x labelloc=inside label labelattrs=(size=7pt) lineattrs=(pattern=dash);
refline &avgheight /
       axis=y labelloc=inside label labelattrs=(size=7pt) lineattrs=(pattern=dash);
```


Weight*Height Vector Plot
100
62.3
70
65
60
55
50
Height
60
80
100
120
140
Weight

VECTOR CHARTS: EXERCISE 4

```
proc format;
picture inchF low-high ='99"';
picture lbsF low-high ='009 lbs';

proc sgplot data=sashelp.class;
title "'Distance' of Students from Mean Class Weight/Height";
vector x=weight y=height /
      xorigin=&avgweight yorigin=&avgheight datalabel=name;
refline &avgweight /
       axis=x labelloc=inside label labelattrs=(size=7pt) lineattrs=(pattern=dash);
refline &avgheight /
       axis=y labelloc=inside label labelattrs=(size=7pt) lineattrs=(pattern=dash);
xaxis display=(nolabel);
yaxis display=(nolabel);
format weight lbsF. height inchF.;
```


'Distance' of Students from Mean Class Weight/Height
100
Philip
70"
Alfred
Ronald
William
Mary
Barbara
Robert
65"
Judy
Henry
Carol
Jeffrey
Janet
62.3
60"
Jane
John
James
Thomas
Alice
Louise
55"
Joyce
50"
60 lbs
80 lbs
100 lbs
120 lbs
140 lbs

TEXT CHARTS

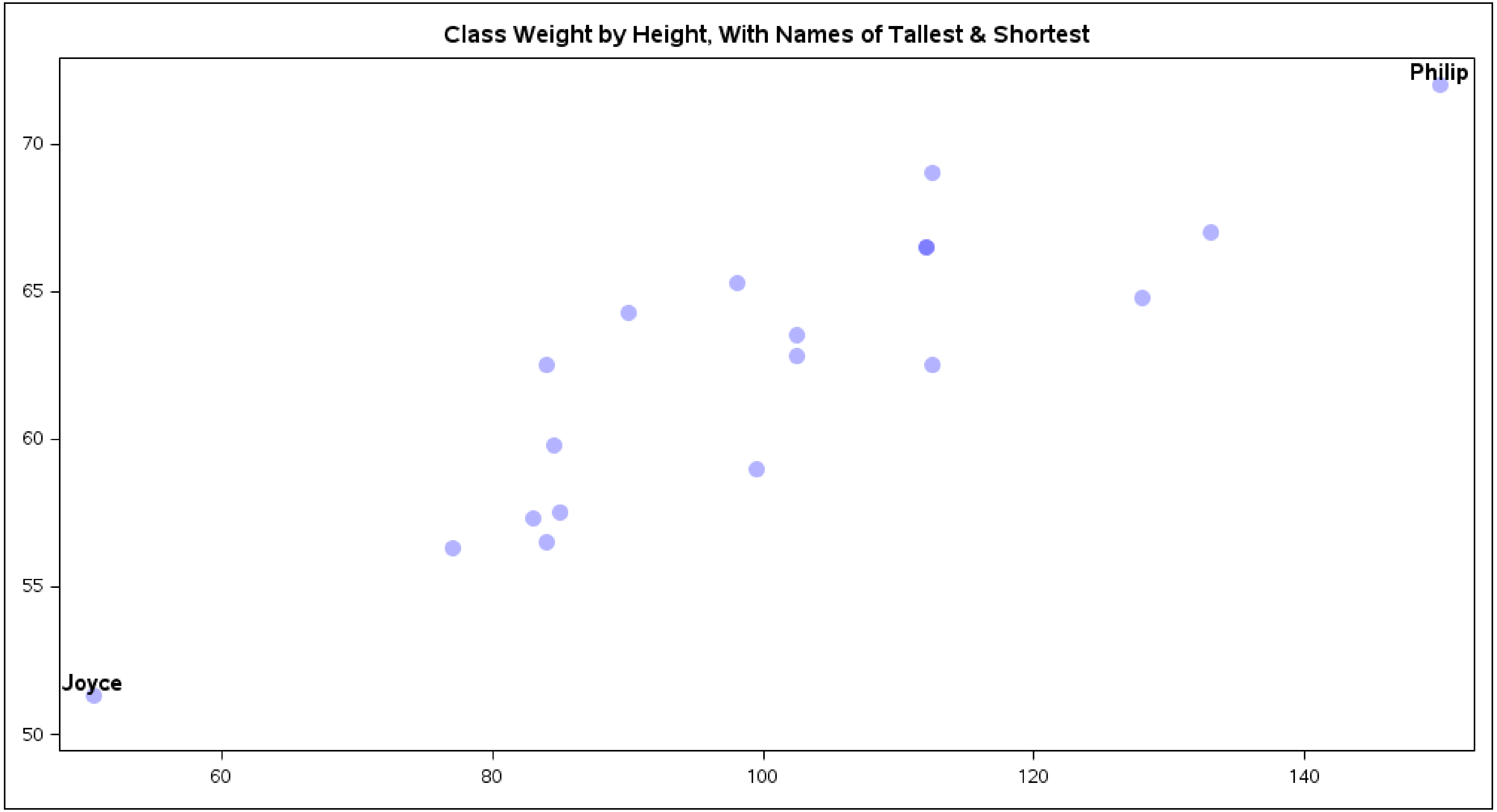
TEXT CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Weight*Height Text Plot";
text x=weight y=height text=name;
```


Weight*Height Text Plot
Philip
Alfred
Ronald
William
Barbara
Robert
Judy
Henry
Carol
Jeffrey
Janet
Jane
John
Thomas
James
Alice
Louise
Joyce
Height
Weight
70
65
60
55
50
60
80
100
120
140

TEXT CHARTS: EXERCISE 2

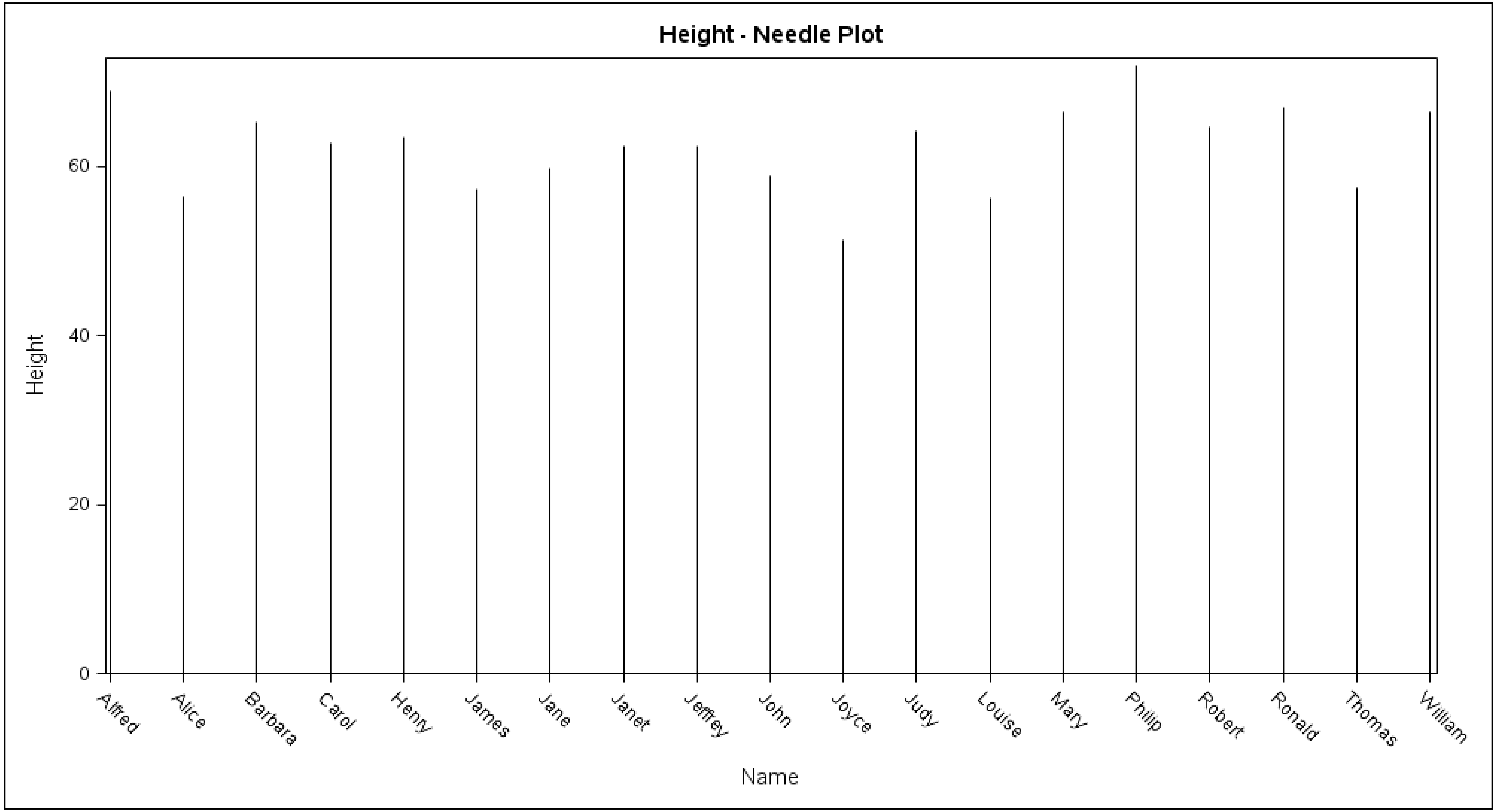
```
proc sql noprint;
create table classminmax as
select c.*,
      case when height=minheight or height=maxheight
          then name end as showname
from sashelp.class c,
(select min(height) as minheight,
       max(height) as maxheight
 from sashelp.class) as minmax;

proc sgplot data=classminmax nowall noautolegend;
title "Class Weight by Height, With Names of Tallest & Shortest";
scatter x=weight y=height /
       transparency=.7
       markerattrs=(symbol=circlefilled size=8pt color=blue);
text x=weight y=height text=showname /
    textattrs=(size=10pt color=black weight=bold) position=top strip;
xaxis display=(nolabel);
yaxis display=(nolabel);
```


Class Weight by Height, With Names of Tallest & Shortest
Philip
Joyce
70
65
60
55
50
60
80
100
120
140

NEEDLE CHARTS

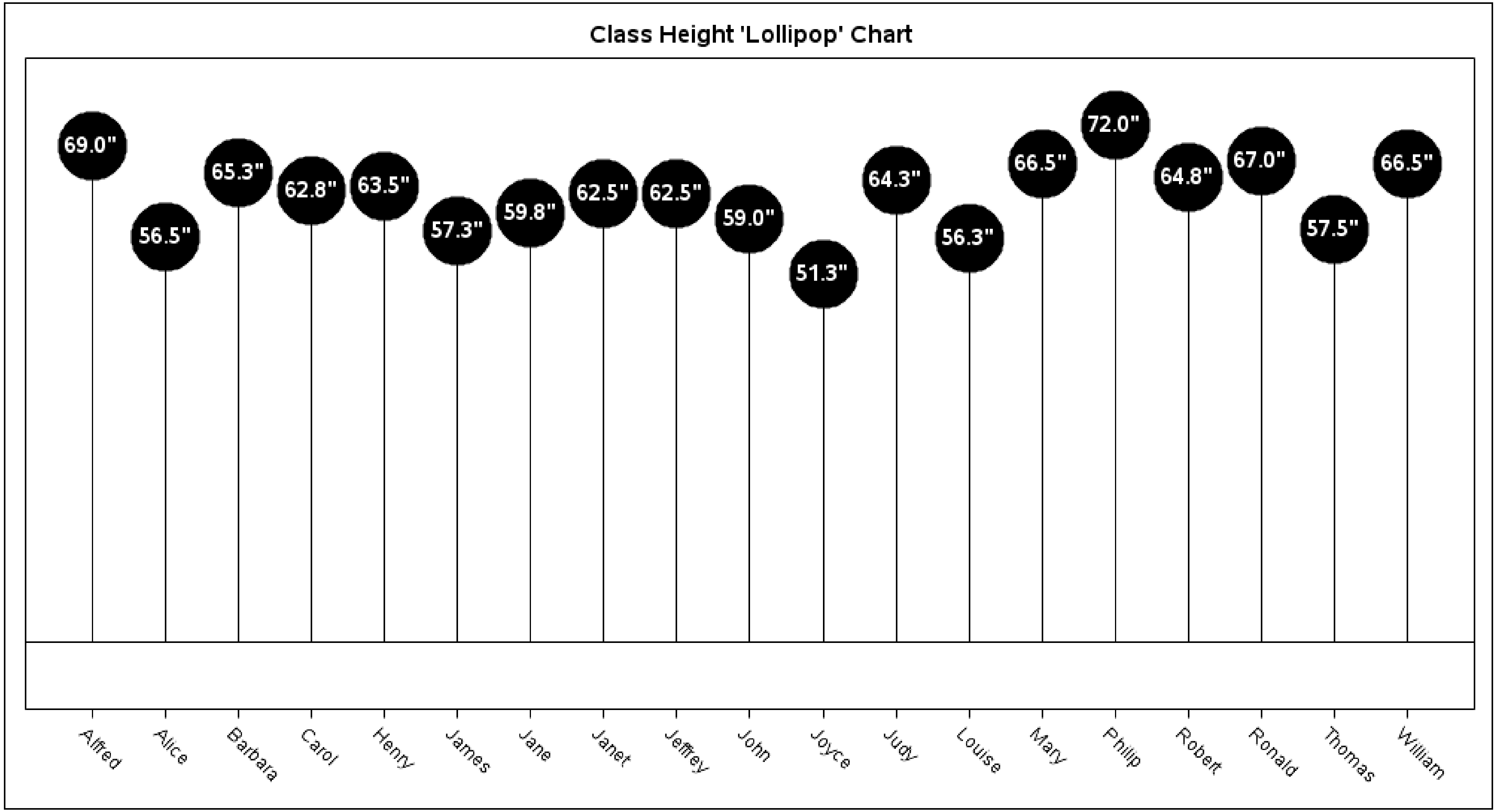
NEEDLE CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.class;
title "Height - Needle Plot";
needle x=name y=height;
```


Height - Needle Plot
Height
0
20
40
60
Name
Alfred
Alice
Barbara
Carol
Henry
James
Jane
Janet
Jeffrey
John
Joyce
Judy
Louise
Mary
Philip
Robert
Ronald
Thomas
William

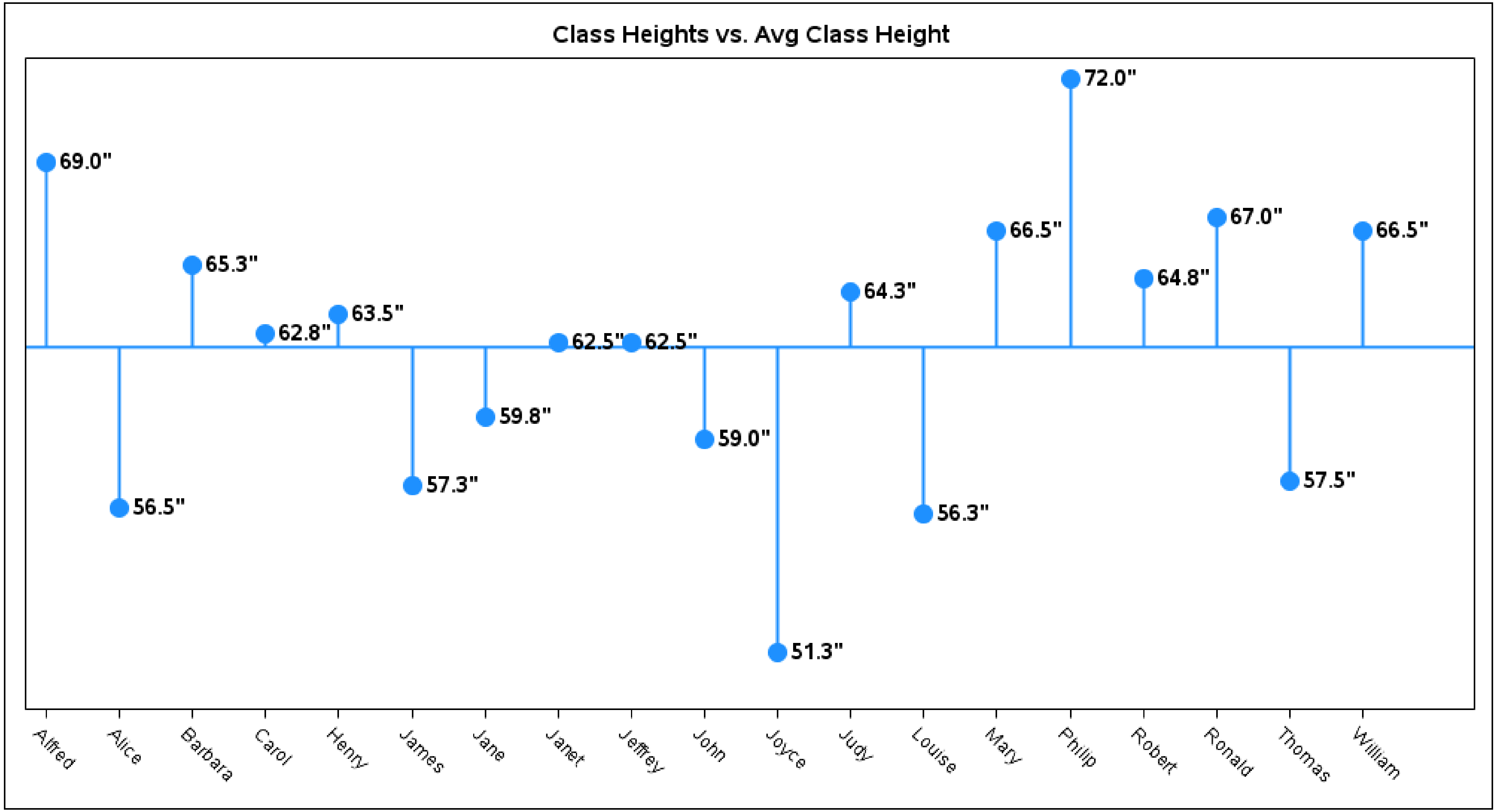
NEEDLE CHARTS: EXERCISE 2

```
proc format;
picture inchF low-high ='99.9"';

proc sgplot data=sashelp.class;
title "Class Height 'Lollipop' Chart";
needle x=name y=height /
      datalabel datalabelpos=center
      datalabelattrs=(color=white size=10pt weight=bold)
      markers markerattrs=(symbol=circlefilled size=32pt);
xaxis display=(nolabel);
yaxis display=none;
format height inchF.;
```


Class Height 'Lollipop' Chart
69.0"
56.5"
65.3"
62.8"
63.5"
57.3"
59.8"
62.5"
62.5"
59.0"
51.3"
64.3"
56.3"
66.5"
72.0"
64.8"
67.0"
57.5"
66.5"
Alfred
Alice
Barbara
Carol
Henry
James
Jane
Janet
Jeffrey
John
Joyce
Judy
Louise
Mary
Philip
Robert
Ronald
Thomas
William

NEEDLE CHARTS: EXERCISE 3

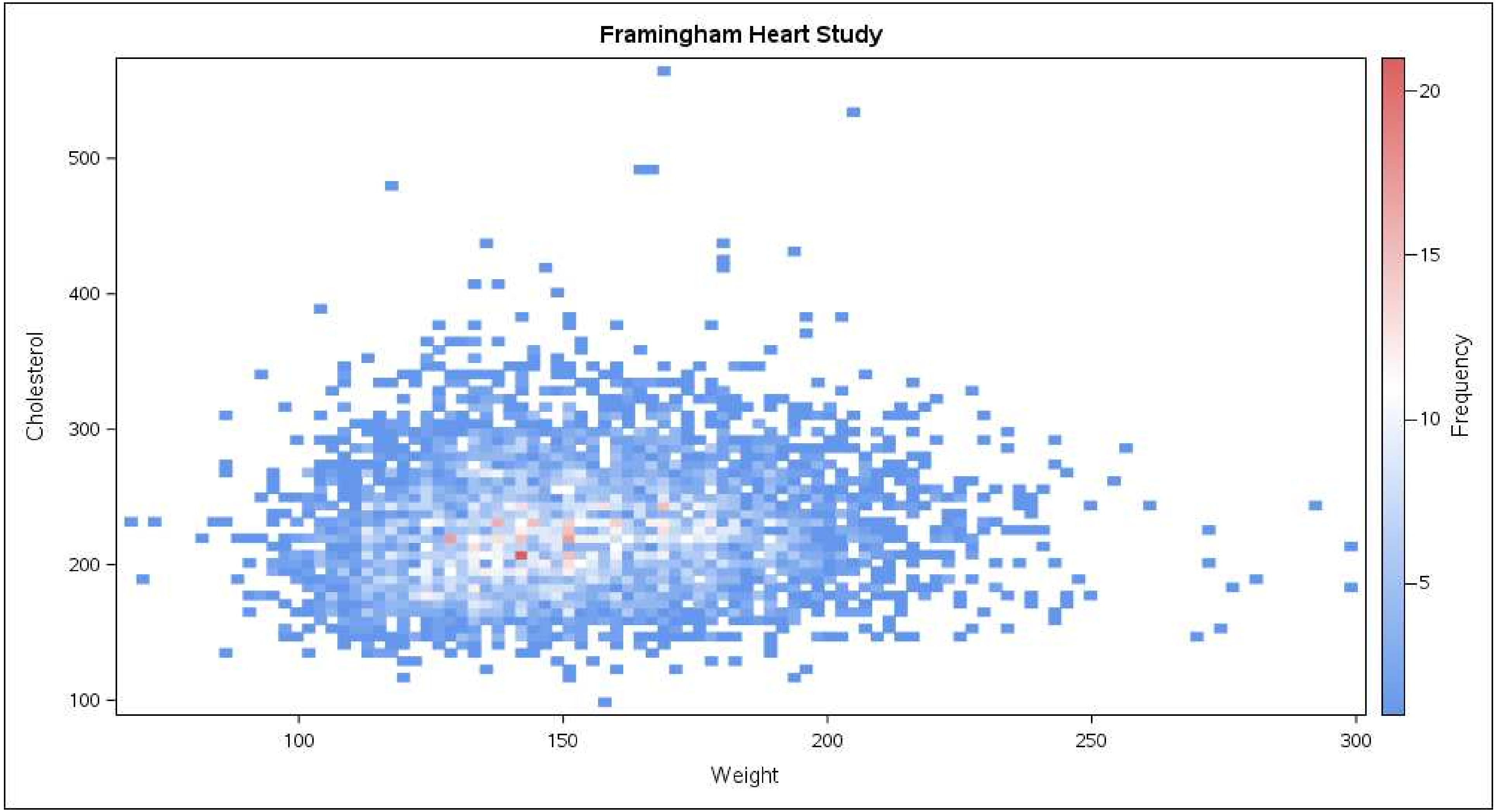
```
proc format;
picture inchF low-high ='99.9"';

proc sql noprint;
select avg(height) into :avgheight from sashelp.class;

proc sgplot data=sashelp.class;
title "Class Heights vs. Avg Class Height";
needle x=name y=height / datalabel datalabelpos=right
     datalabelattrs=(color=black size=10pt weight=bold)
     lineattrs=(thickness=2pt color=dodgerblue)
     markers markerattrs=(symbol=circlefilled color=dodgerblue size=10pt)
     baseline=&avgHeight baselineattrs=(color=dodgerblue thickness=2pt);
xaxis display=(nolabel);
yaxis display=none;
format height inchF.;
```


Class Heights vs. Avg Class Height
69.0"
56.5"
65.3"
62.8"
63.5"
57.3"
59.8"
62.5"
62.5"
59.0"
51.3"
64.3"
56.3"
66.5"
72.0"
64.8"
67.0"
57.5"
66.5"
Alfred
Alice
Barbara
Carol
Henry
James
Jane
Janet
Jeffrey
John
Joyce
Judy
Louise
Mary
Philip
Robert
Ronald
Thomas
William

HEATMAP CHARTS

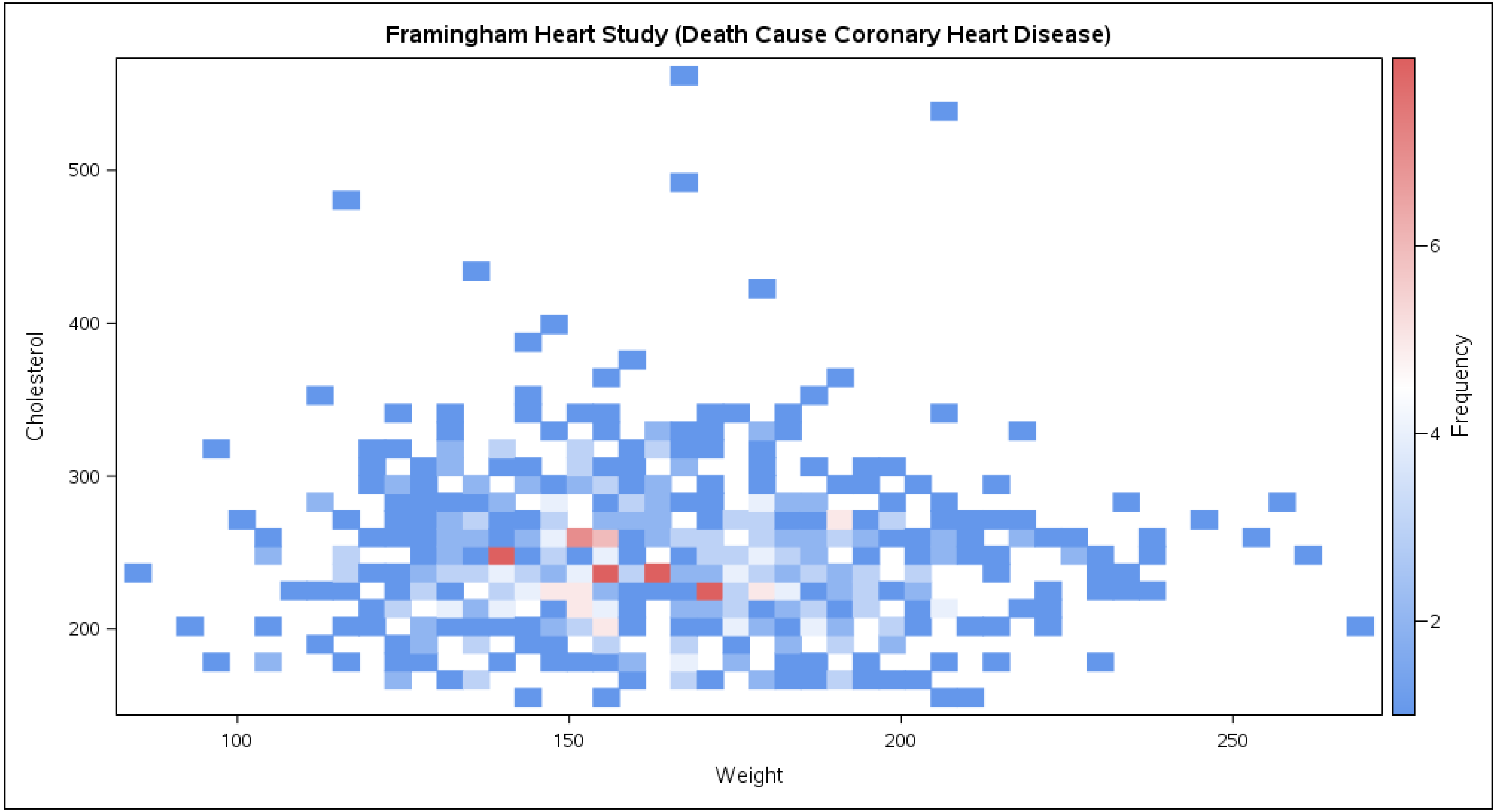
HEATMAP CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.heart;
title "Framingham Heart Study";
heatmap x=weight y=cholesterol;
```


Framingham Heart Study
Cholesterol
500
400
300
200
100
100
150
200
250
300
Weight
20
15
10
5
Frequency

HEATMAP CHARTS: EXERCISE 2

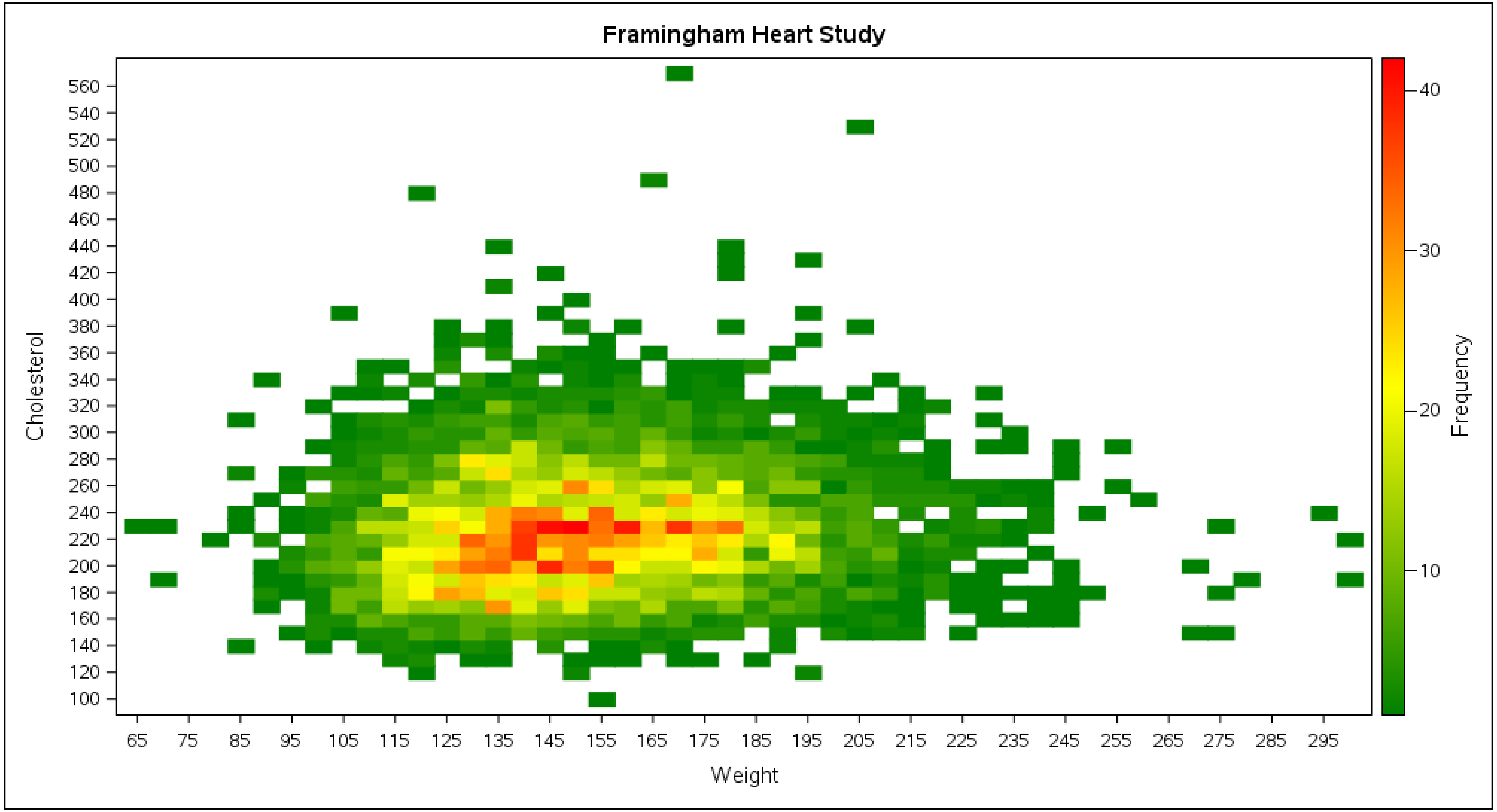
```
proc sgplot data=sashelp.heart;
title "Framingham Heart Study (Death Cause Coronary Heart Disease)";
where deathcause="Coronary Heart Disease";
heatmap x=weight y=cholesterol;
```



Framingham Heart Study (Death Cause Coronary Heart Disease)
Cholesterol
500
400
300
200
100
150
200
250
Weight
Frequency
6
4
2

HEATMAP CHARTS: EXERCISE 3

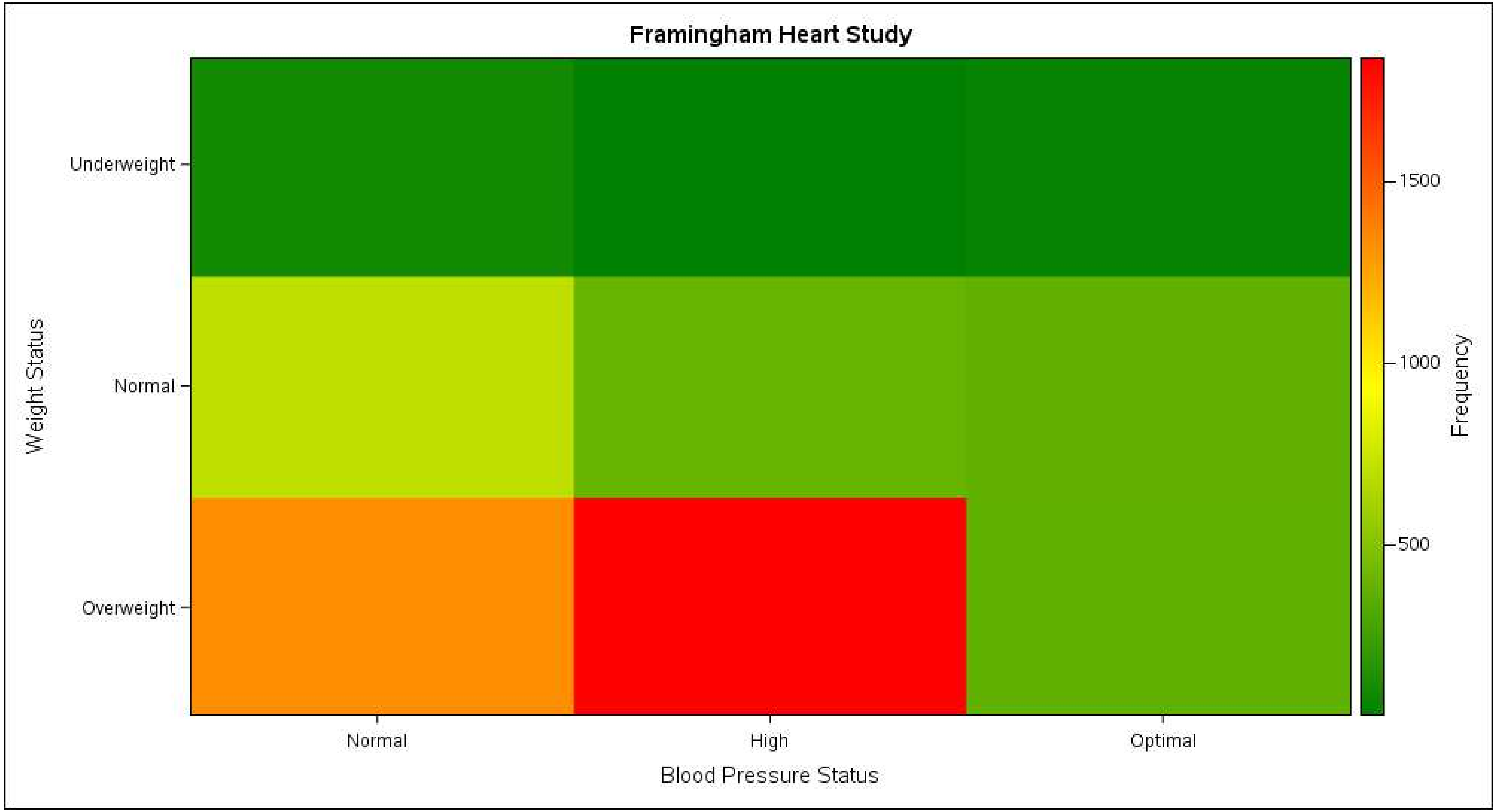
```
proc sgplot data=sashelp.heart;
title "Framingham Heart Study";
heatmap x=weight y=cholesterol /
	colormodel=(green yellow red)
	nxbins=50 nybins=50 showxbins showybins;
```



Framingham Heart Study
Cholesterol
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
65
75
85
95
105
115
125
135
145
155
165
175
185
195
205
215
225
235
245
255
265
275
285
295
Weight
Frequency
40
30
20
10

HEATMAP CHARTS: EXERCISE 4

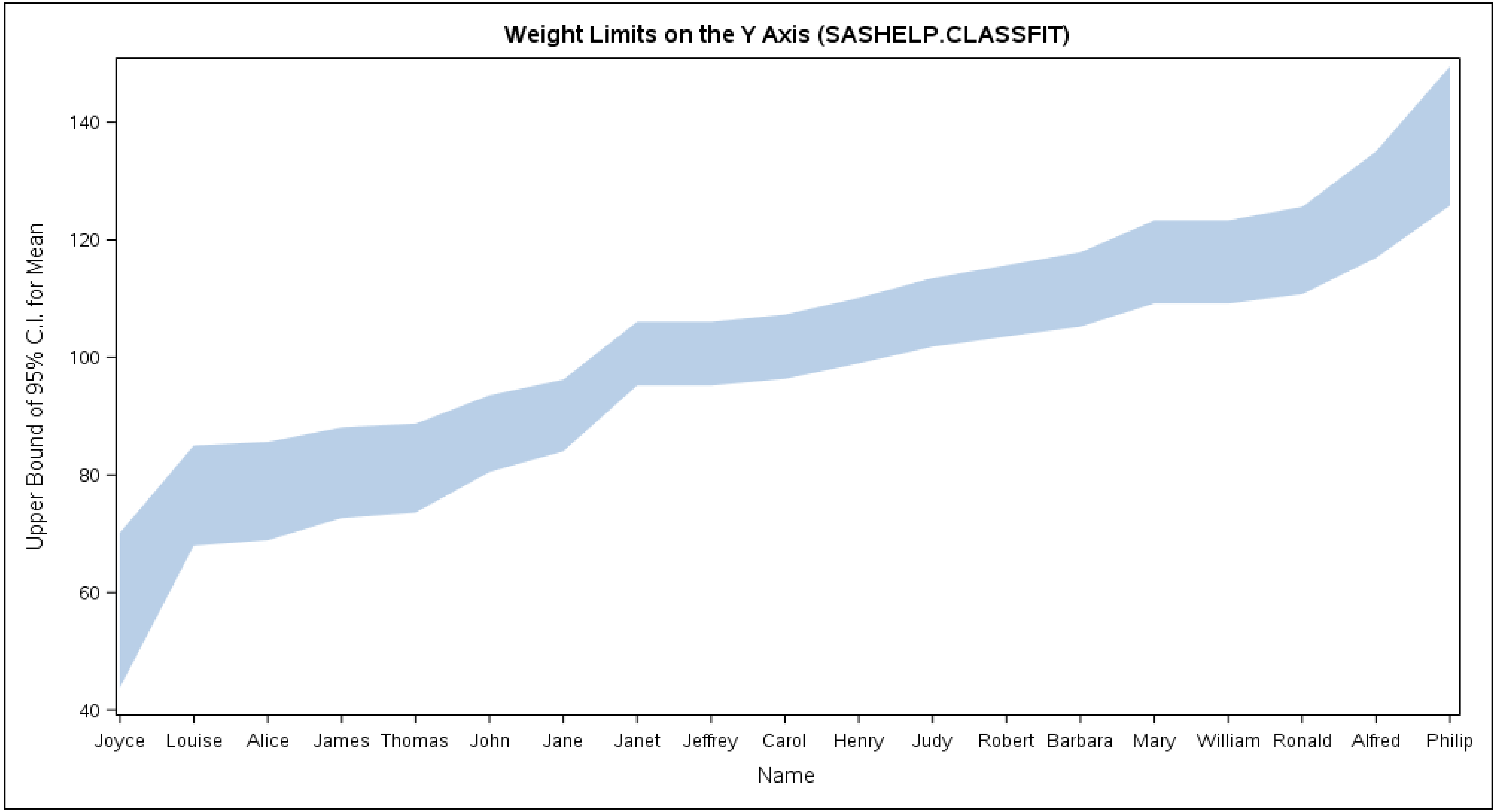
```
proc sgplot data=sashelp.heart;
title "Framingham Heart Study";
heatmap x=bp_status y=weight_status /
      colormodel=(green yellow red);
```


Framingham Heart Study
Underweight
Normal
Overweight
Weight Status
Normal
High
Optimal
Blood Pressure Status
1500
1000
500
Frequency

BAND CHARTS

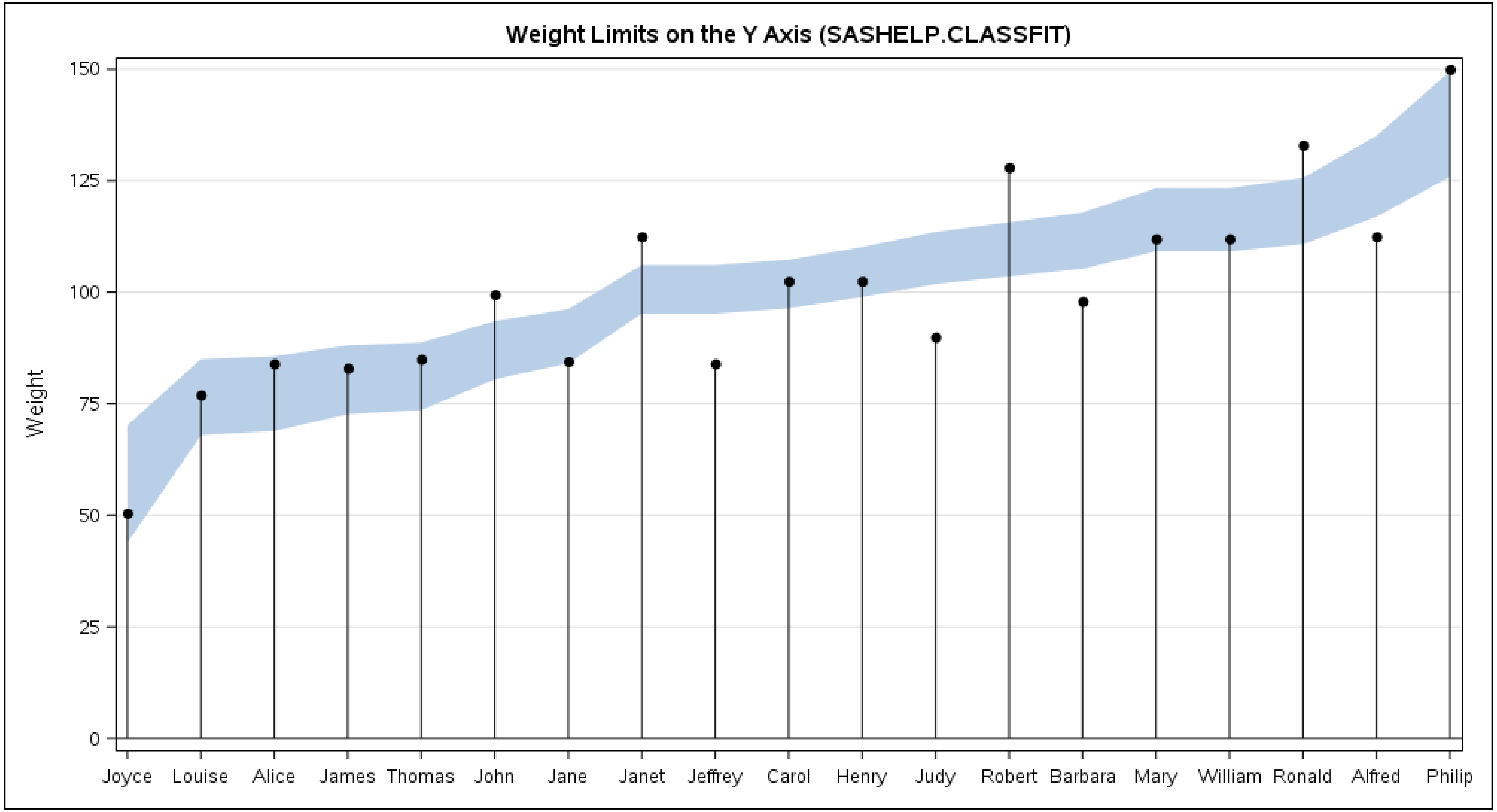
BAND CHARTS: EXERCISE 1

```
proc sgplot data=sashelp.classfit;
title "Weight Limits on the Y Axis (SASHELP.CLASSFIT)";
band x=name lower=lowermean upper=uppermean;
```


Weight Limits on the Y Axis (SASHELP.CLASSFIT)
Upper Bound of 95% C.I. for Mean
140
120
100
80
60
40
Joyce
Louise
Alice
James
Thomas
John
Jane
Janet
Jeffrey
Carol
Henry
Judy
Robert
Barbara
Mary
William
Ronald
Alfred
Philip
Name

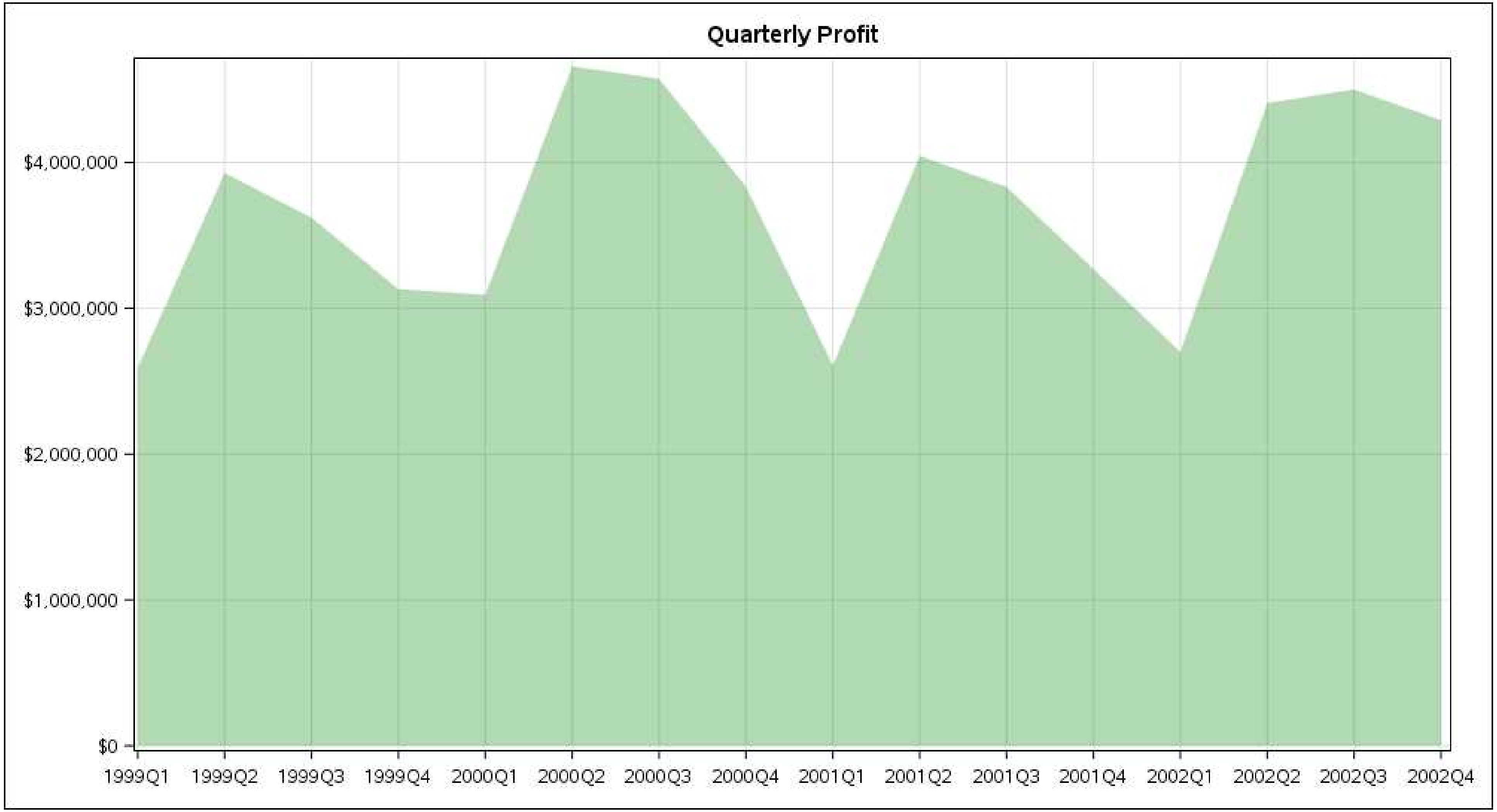
BAND CHARTS: EXERCISE 2

```
proc sgplot data=sashelp.classfit noautolegend;
title "Weight Limits on the Y Axis (SASHELP.CLASSFIT)";
band x=name lower=lowermean upper=uppermean;
needle x=name y=weight /
      markers markerattrs=(symbol=circlefilled);
xaxis display=(nolabel);
yaxis grid;
```


Weight Limits on the Y Axis (SASHELP.CLASSFIT)
Weight
150
125
100
75
50
25
0
Joyce
Louise
Alice
James
Thomas
John
Jane
Janet
Jeffrey
Carol
Henry
Judy
Robert
Barbara
Mary
William
Ronald
Alfred
Philip

BAND CHARTS: EXERCISE 3

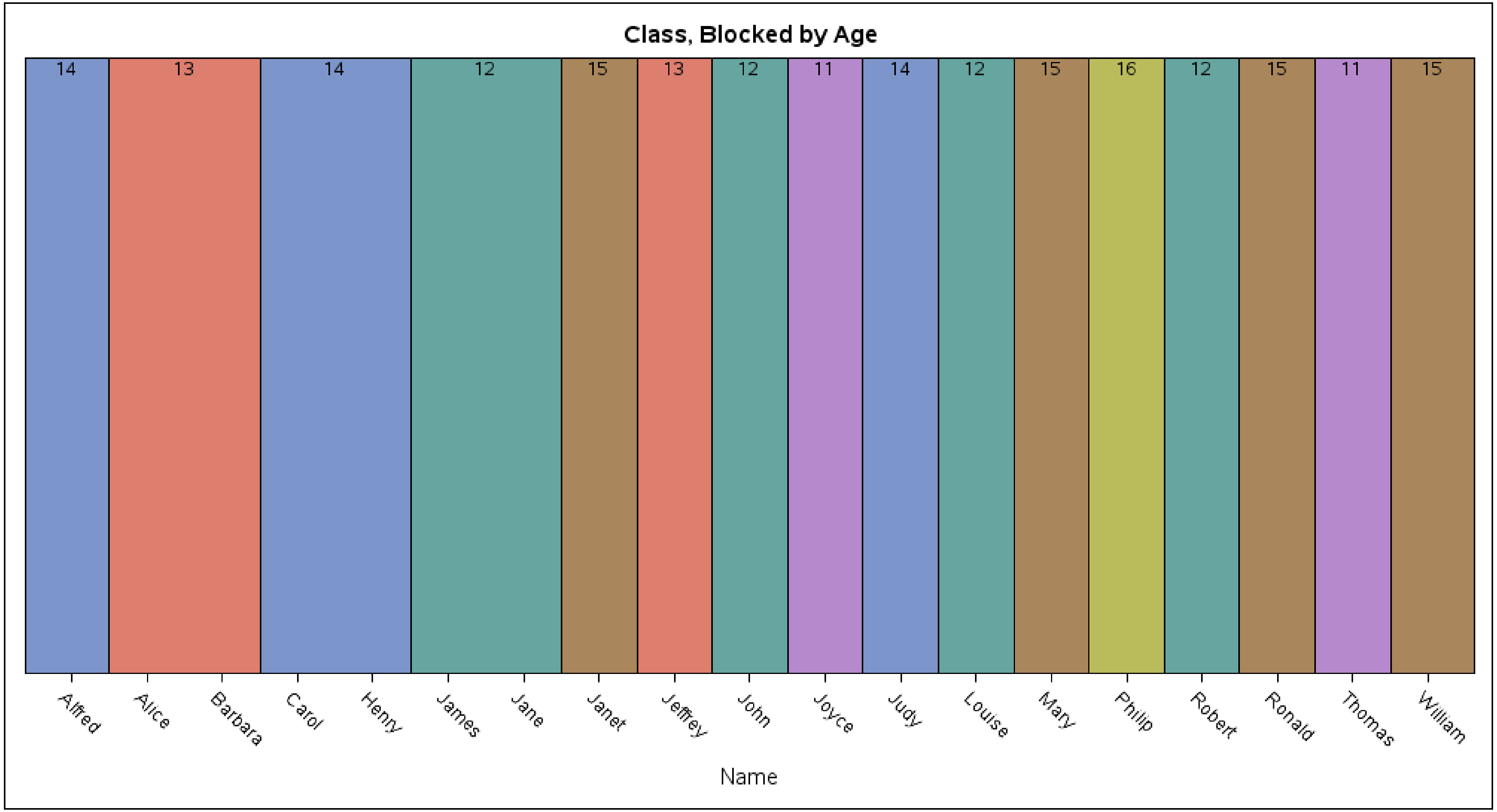
```
proc sql noprint;
create table orsalesum as
select quarter, sum(profit) as profit
from sashelp.orsales group by 1 order by 1;
proc sgplot data=orsalesum;
title "Quarterly Profit";
band x=quarter upper=profit lower=0 /
    fill fillattrs=(color=green transparency=.7);
format profit dollar10.;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) grid;
```


Quarterly Profit
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
1999Q1
1999Q2
1999Q3
1999Q4
2000Q1
2000Q2
2000Q3
2000Q4
2001Q1
2001Q2
2001Q3
2001Q4
2002Q1
2002Q2
2002Q3
2002Q4

BLOCK CHARTS

BLOCK CHARTS: EXERCISE 1

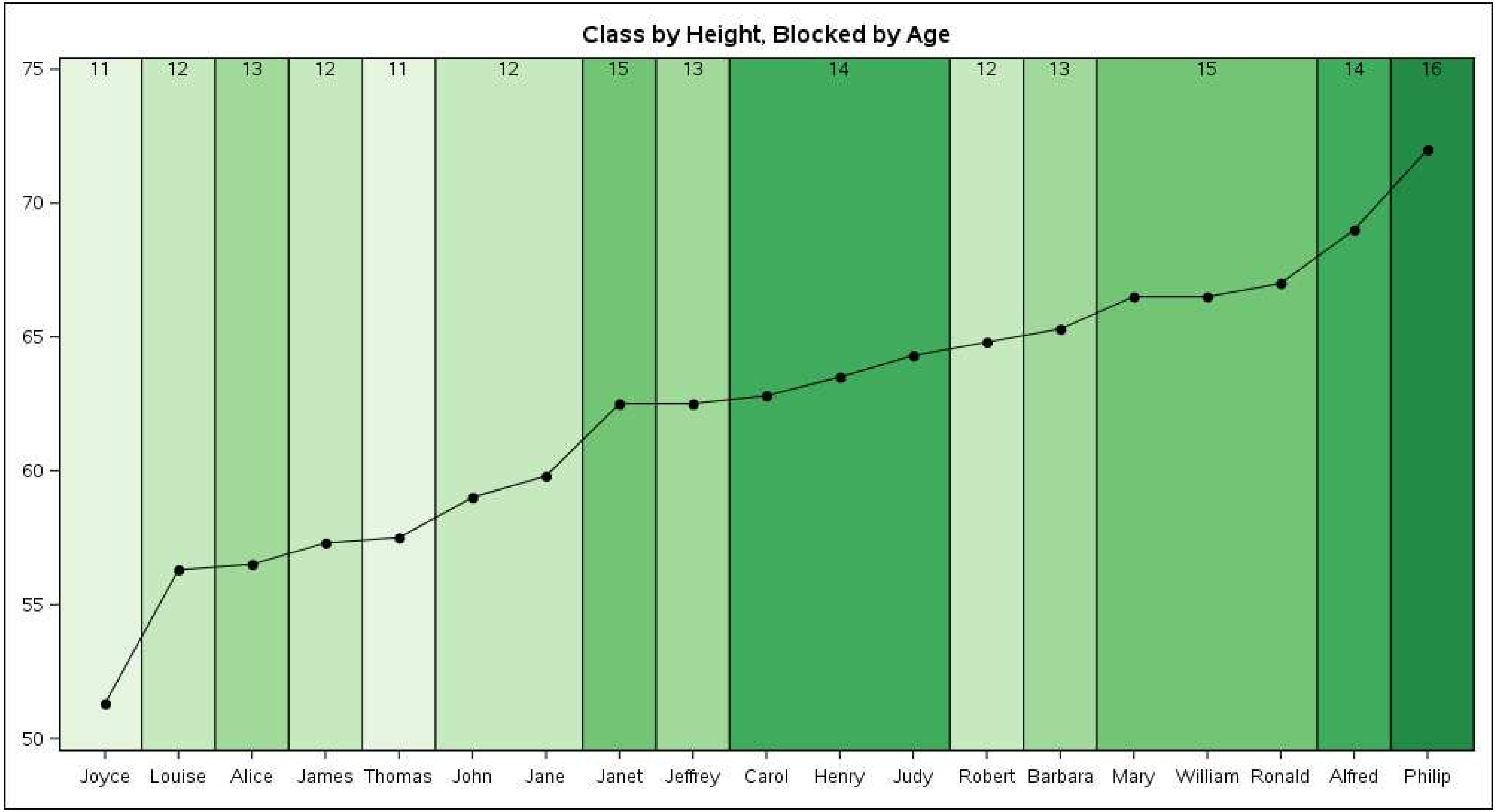
```
proc sgplot data=sashelp.class;
title "Class, Blocked by Age";
block x=name block=age;
```



Class, Blocked by Age
14
13
14
12
15
13
12
11
14
12
15
16
12
15
11
15
Alfred
Alice
Barbara
Carol
Henry
James
Jane
Janet
Jeffrey
John
Joyce
Judy
Louise
Mary
Philip
Robert
Ronald
Thomas
William
Name

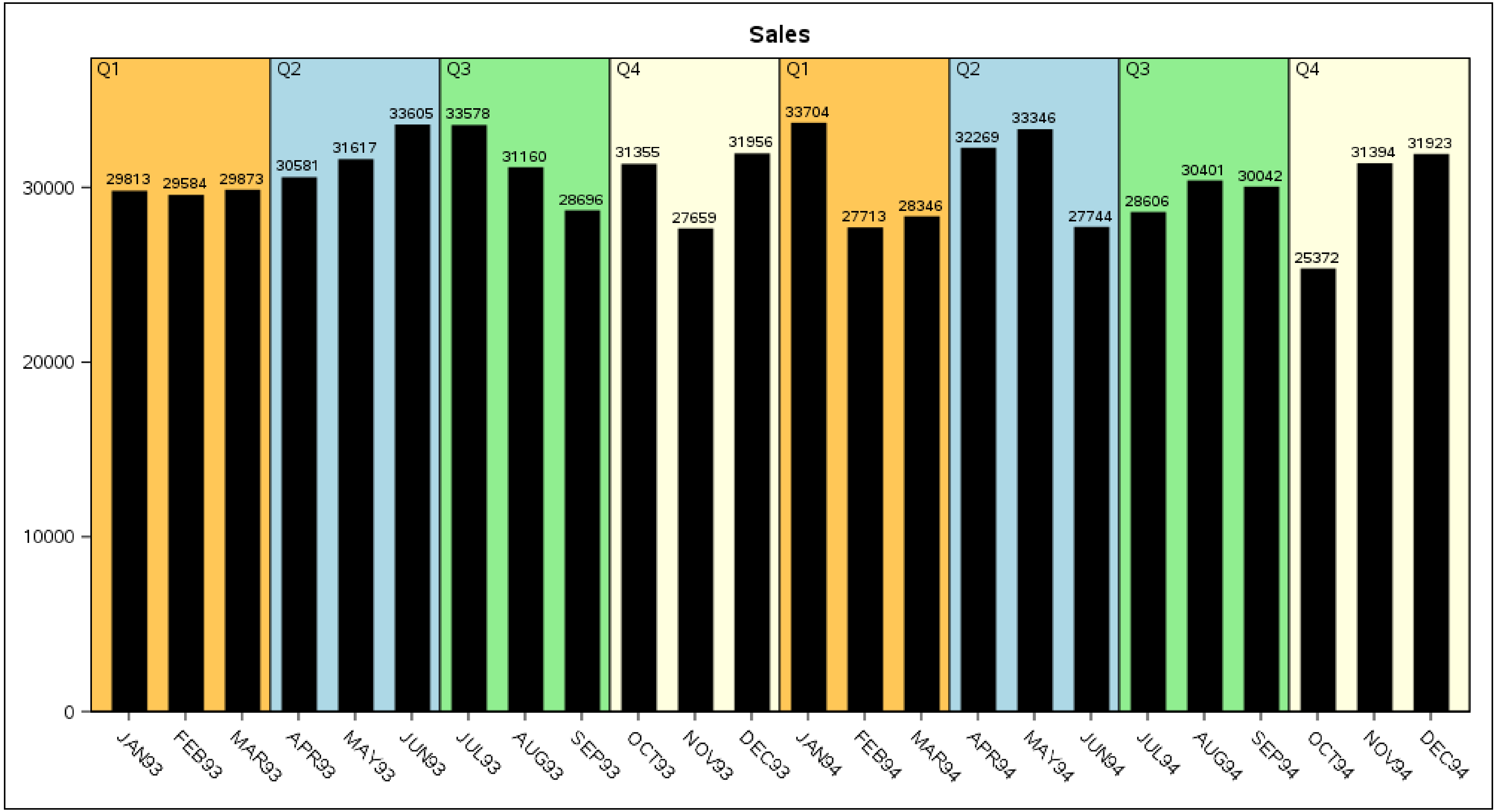
BLOCK CHARTS: EXERCISE 2

```
proc sort data=sashelp.class out=classSort;
by height;

proc sgplot data=classSort;
styleattrs datacolors=(cxe5f5e0 cxc7e9c0 cxa1d99b cx74c476 cx41ab5d cx238b45);
title "Class by Height, Blocked by Age";
block x=name block=age;
series x=name y=height /
      markers markerattrs=(symbol=circlefilled);
xaxis display=(nolabel);
yaxis display=(nolabel) max=75;
```


Class by Height, Blocked by Age
75
70
65
60
55
50
11 12 13 12 11 12 15 13 14 12 13 15 14 16
Joyce Louise Alice James Thomas John Jane Janet Jeffrey Carol Henry Judy Robert Barbara Mary William Ronald Alfred Philip

BLOCK CHARTS: EXERCISE 3

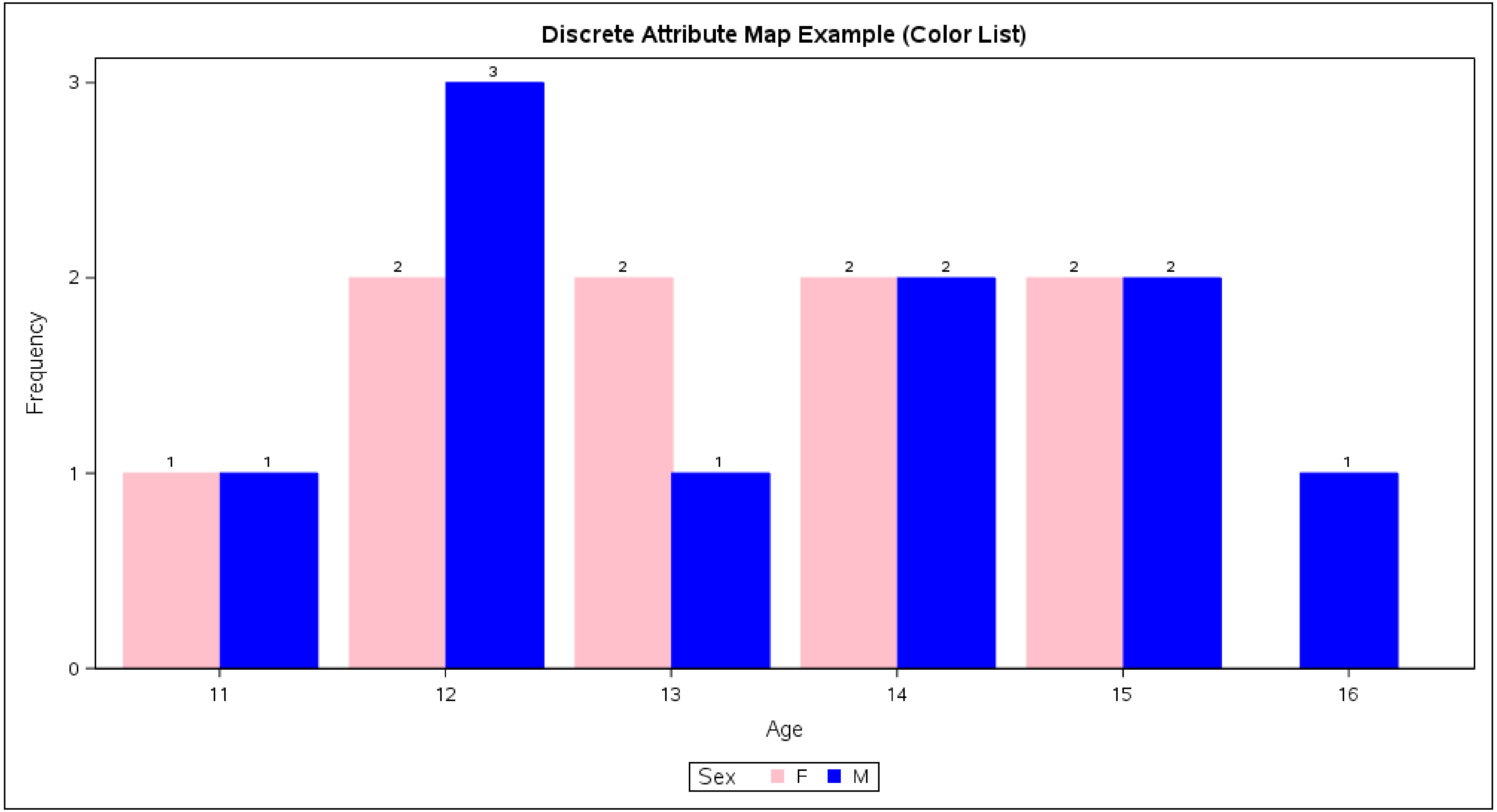
```
proc sql;
create table prdsalemth as
select month, put(month,monyy5.) as monyy, "Q"

put(quarter,1.) as qtr, sum(actual) as actual
from sashelp.prdsale group by 1, 2, 3 order by 1, 2, 3;

proc sgplot data=prdsalemth;
styleattrs datacolors=(lightorange lightblue lightgreen lightyellow);
title "Sales";
block x=monyy block=qtr / valuehalign=left;
vbarparm category=monyy response=actual /
            fillattrs=(color=black) fill barwidth=.6 datalabel;
xaxis display=(nolabel) discreteorder=data;
yaxis display=(nolabel) offsetmax=0.1;
```


Sales
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
29813
29584
29873
30581
31617
33605
33578
31160
28696
31355
27659
31956
33704
27713
28346
32269
33346
27744
28606
30401
30042
25372
31394
31923
30000
20000
10000
0
JAN93
FEB93
MAR93
APR93
MAY93
JUN93
JUL93
AUG93
SEP93
OCT93
NOV93
DEC93
JAN94
FEB94
MAR94
APR94
MAY94
JUN94
JUL94
AUG94
SEP94
OCT94
NOV94
DEC94

ATTRIBUTE MAPS CHARTS

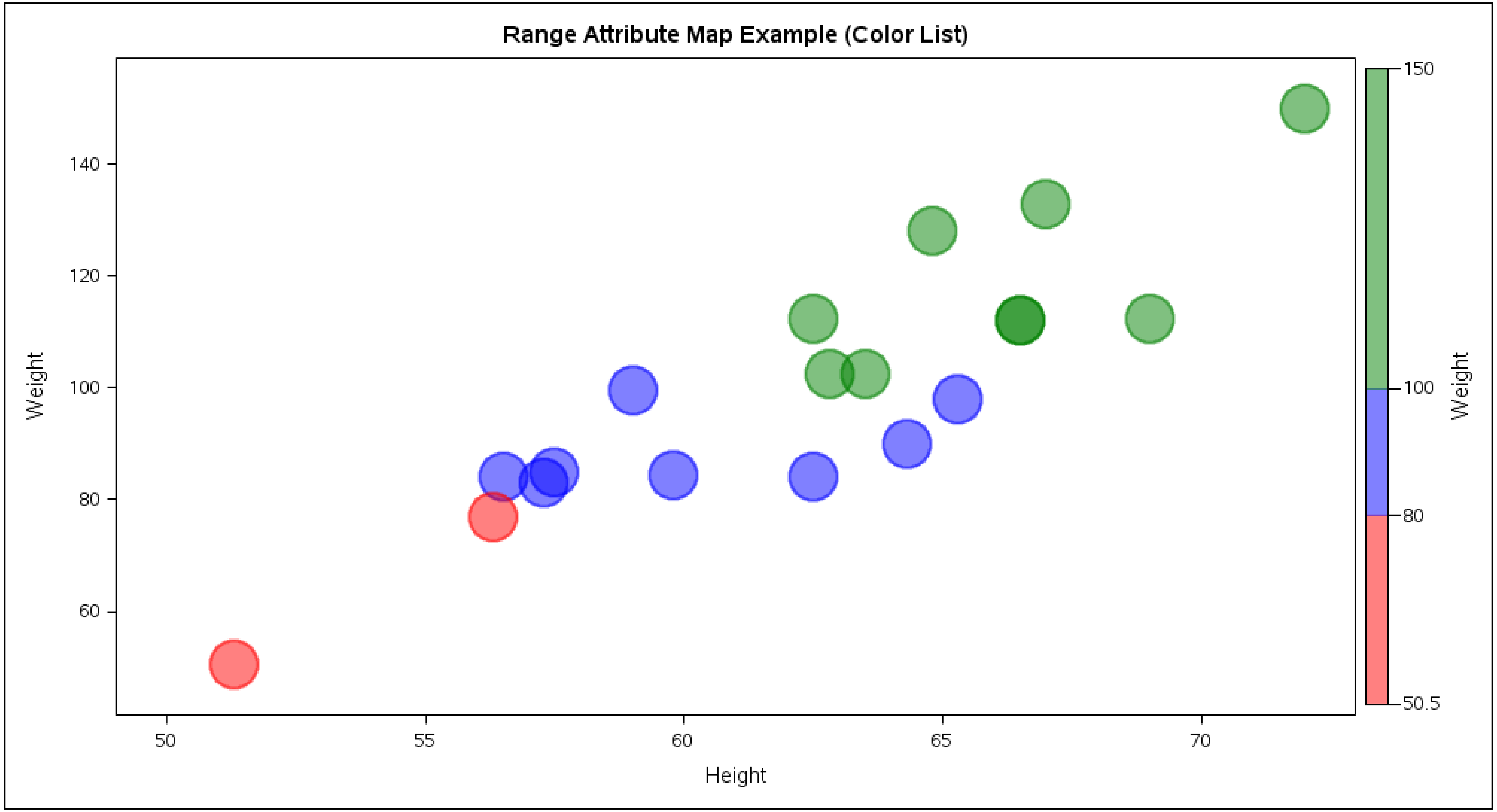
ATTRIBUTE MAPS CHARTS: EXERCISE 1

```
data mapGender;
input (ID value linecolor fillcolor)($);
datalines;
Gender F pink pink
Gender M blue blue
;
proc sgplot data=sashelp.class dattrmap=mapGender;
title "Discrete Attribute Map Example (Color List)";
vbar age / group=sex groupdisplay=cluster attrid=Gender datalabel;
```


Discrete Attribute Map Example (Color List)
Frequency
Age
3
2
1
0
11
12
13
14
15
16
Sex
F
M

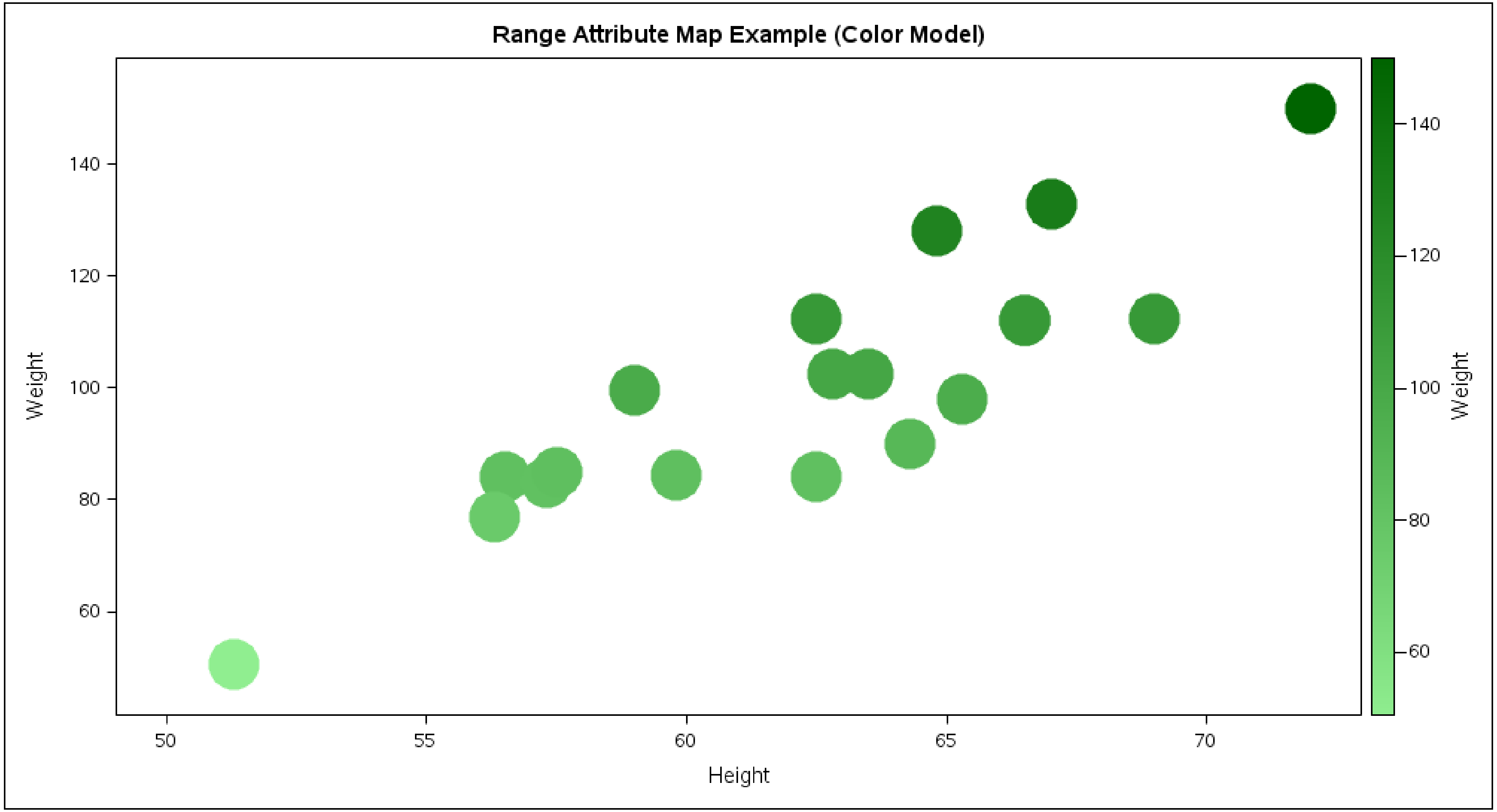
ATTRIBUTE MAPS CHARTS: EXERCISE 2

```
data mapWeight;
input (ID min max color altcolor)($);
datalines;
weight _min_ 80     red    red
weight 80    100    blue   blue
weight 100   _max_  green green
;
proc sgplot data=sashelp.class rattrmap=mapWeight;
title "Range Attribute Map Example (Color List)";
scatter x=height y=weight /
    transparency=.5
    colorresponse=weight rattrid=weight
    markerattrs=(symbol=circlefilled size=24pt);
```


Range Attribute Map Example (Color List)
Weight
140
120
100
80
60
50
55
60
65
70
Height
150
100
80
50.5
Weight

ATTRIBUTE MAPS CHARTS: EXERCISE 3

```
data mapWeight2;
input (ID min max)($) altcolormodel1:$10. altcolormodel2:$10.;
datalines;
weight _min_ _max_ lightgreen darkgreen
;
proc sgplot data=sashelp.class rattrmap=mapWeight2;
title "Range Attribute Map Example (Color Model)";
scatter x=height y=weight /
        colorresponse=weight rattrid=weight
        markerattrs=(symbol=circlefilled size=24pt);
```

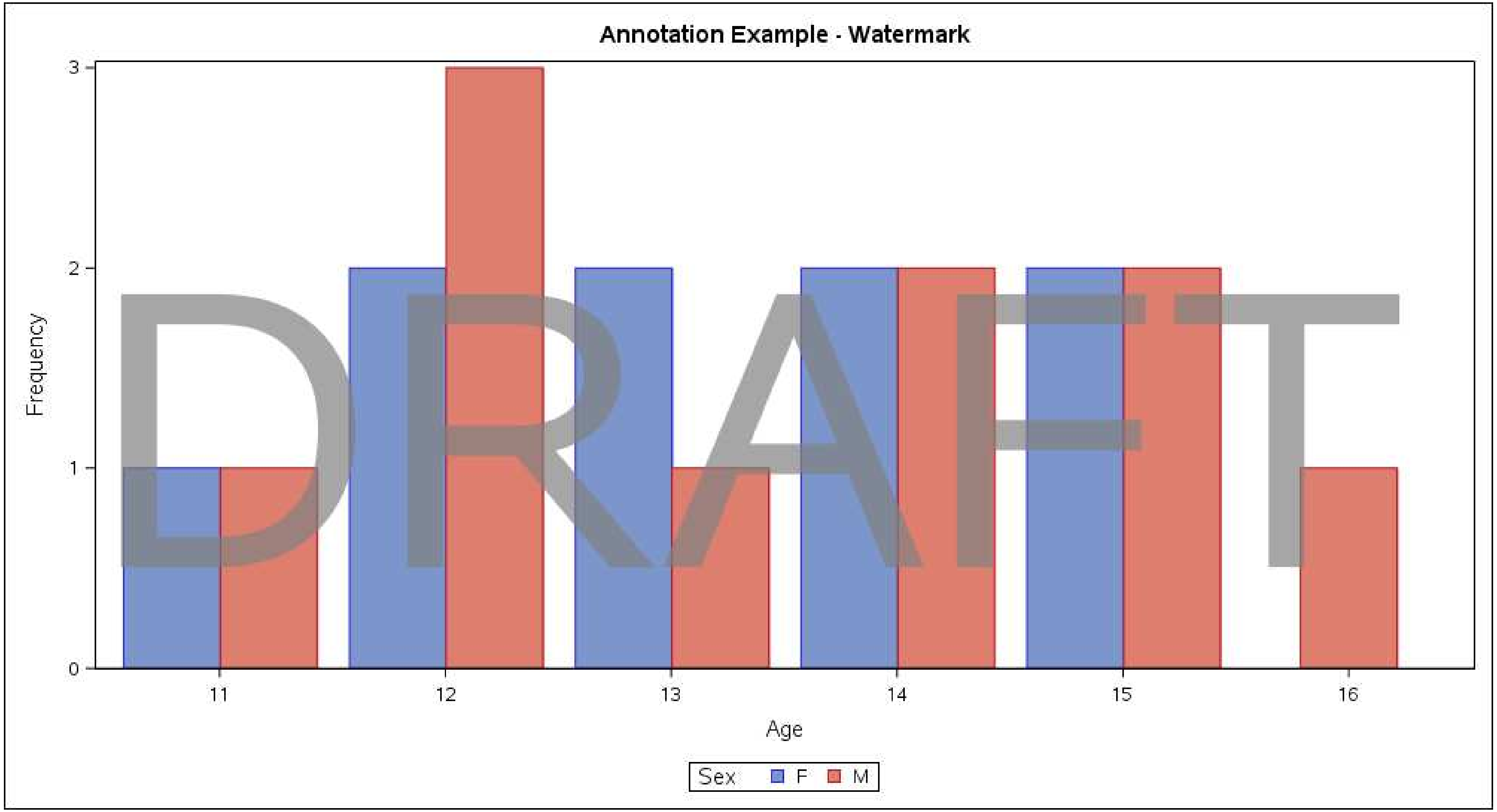


Range Attribute Map Example (Color Model)
Weight
140
120
100
80
60
50
55
60
65
70
Height
140
120
100
80
60
Weight

ANNOTATE CHARTS

ANNOTATE CHARTS: EXERCISE 1

```
data anno;
retain function "text" label "DRAFT" textcolor "gray" justify "center"
      textsize 180 transparency .3 width 200;

proc sgplot data=sashelp.class sganno=anno;
title "Annotation Example - Watermark";
vbar age / group=sex groupdisplay=cluster;
```

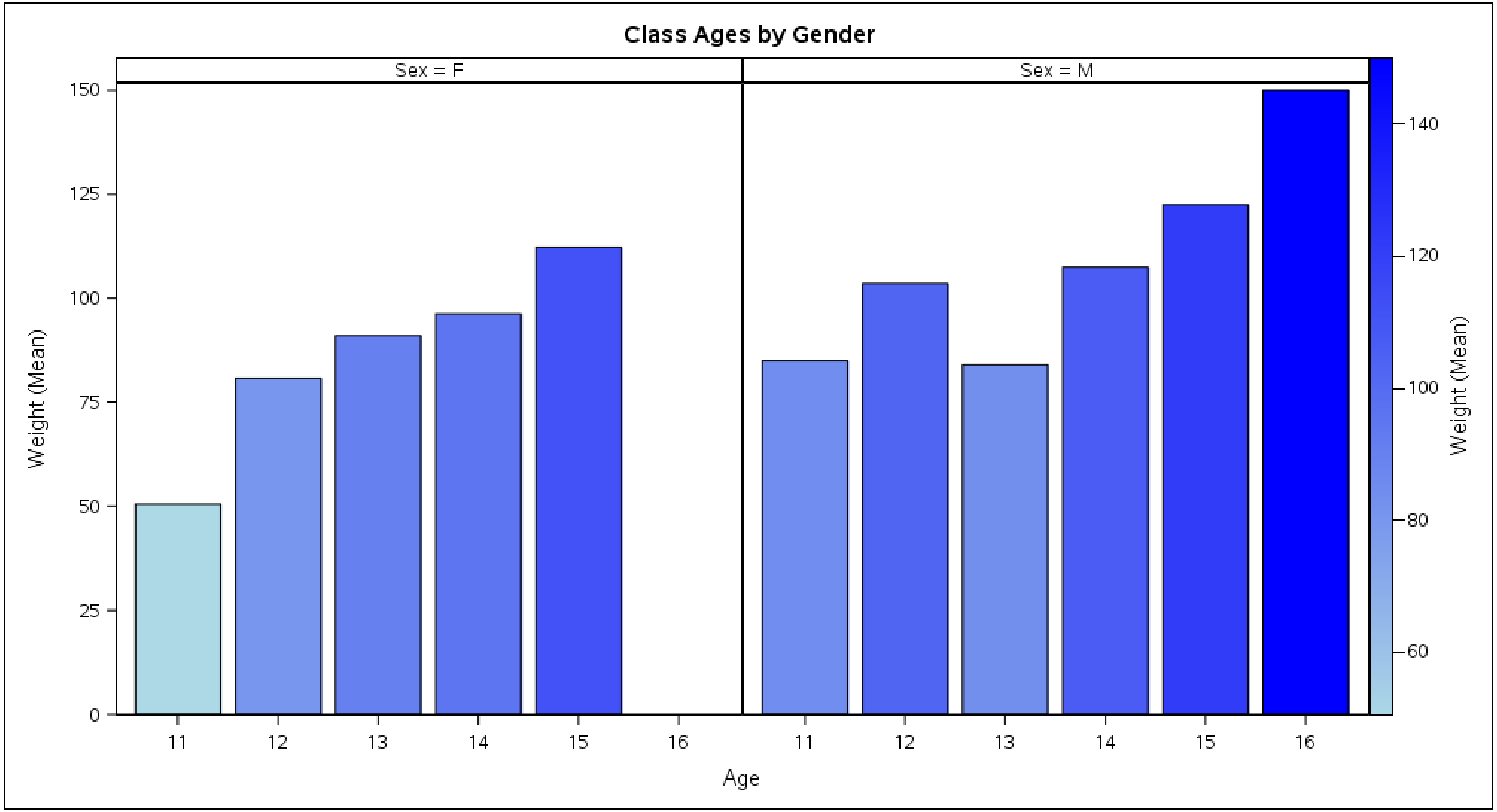


Annotation Example - Watermark
DRAFT
Frequency
3
2
1
0
11
12
13
14
15
16
Age
Sex
F
M

SGPANEL CHARTS

SGPANEL CHARTS: EXERCISE 1

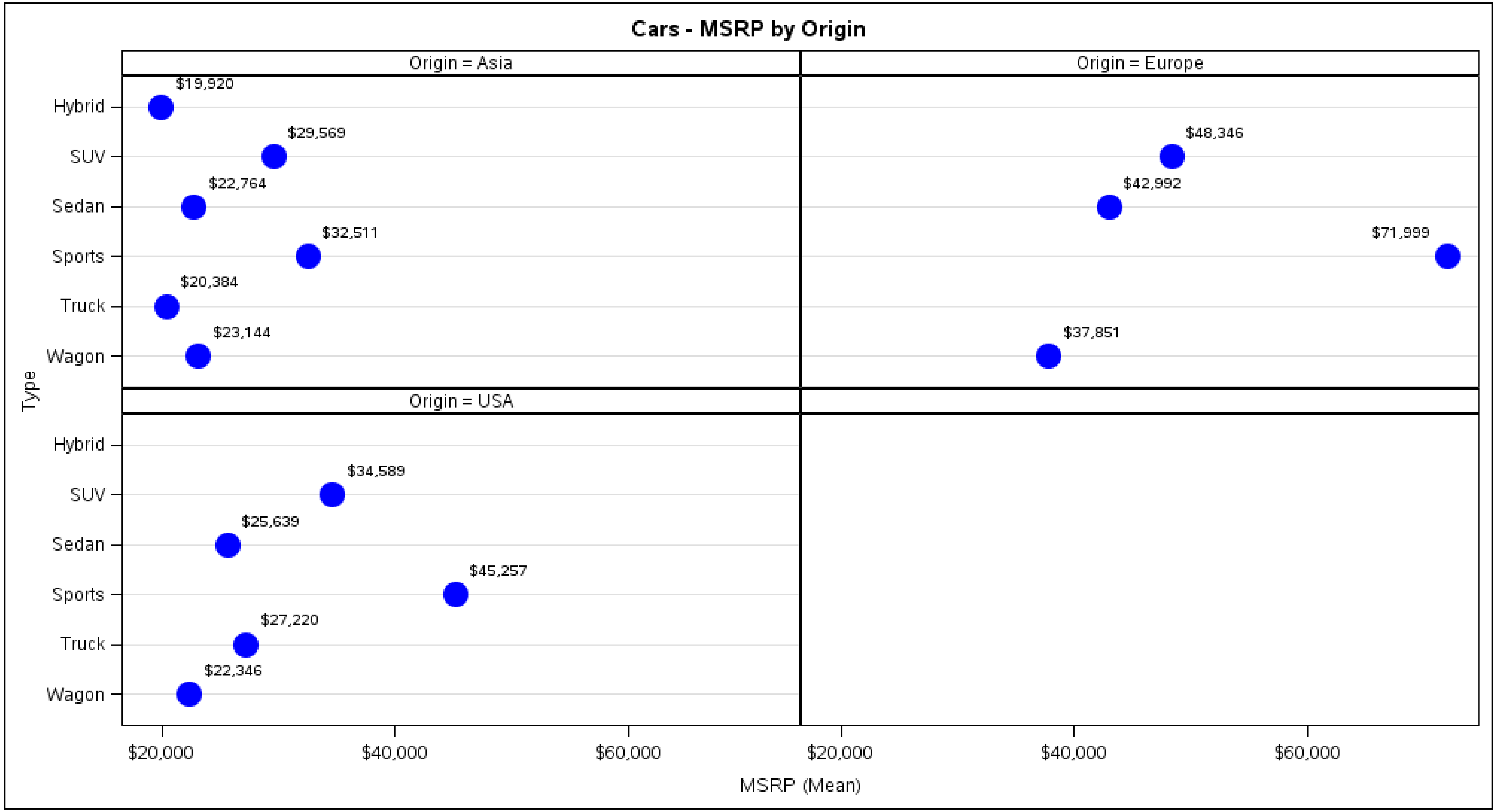
```
proc sgpanel data=sashelp.class;
title "Class Ages by Gender";
panelby sex;
vbar age / colorresponse=weight colormodel=(lightblue blue)
           response=weight stat=mean colorstat=mean;
```



Class Ages by Gender
Sex = F
Sex = M
150
125
100
75
50
25
0
Weight (Mean)
11
12
13
14
15
16
11
12
13
14
15
16
Age
140
120
100
80
60
Weight (Mean)

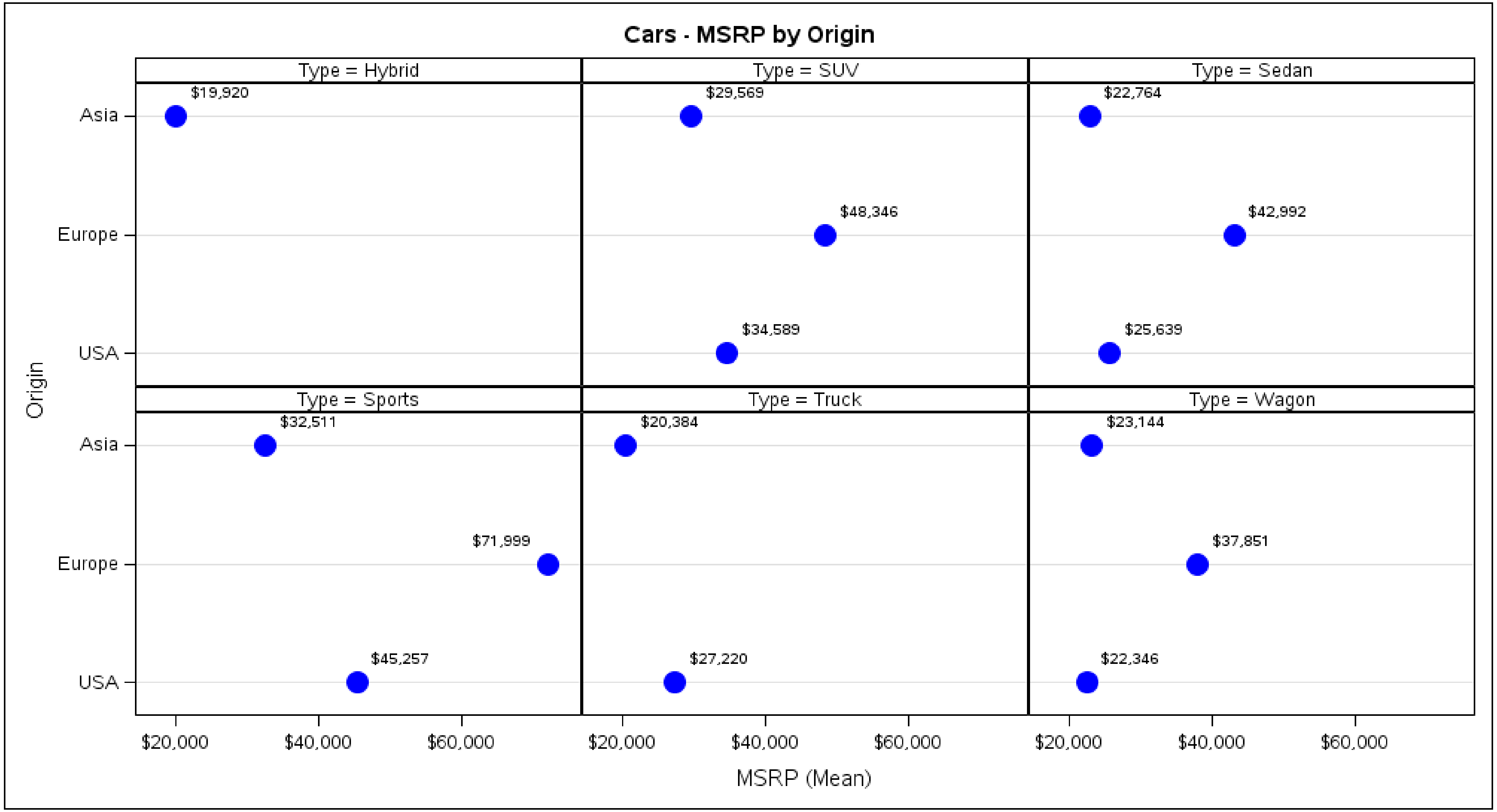
SGPANEL CHARTS: EXERCISE 2

```
proc sgpanel data=sashelp.cars;
title "Cars - MSRP by Origin";
panelby origin;
dot type / response=msrp stat=mean datalabel
          markerattrs=(size=16pt symbol=circlefilled color=blue);
```


Cars - MSRP by Origin
Origin = Asia
Origin = Europe
Origin = USA
Type
Hybrid
SUV
Sedan
Sports
Truck
Wagon
$19,920
$29,569
$22,764
$32,511
$20,384
$23,144
$48,346
$42,992
$71,999
$37,851
$34,589
$25,639
$45,257
$27,220
$22,346
$20,000
$40,000
$60,000
MSRP (Mean)

SGPANEL CHARTS: EXERCISE 3

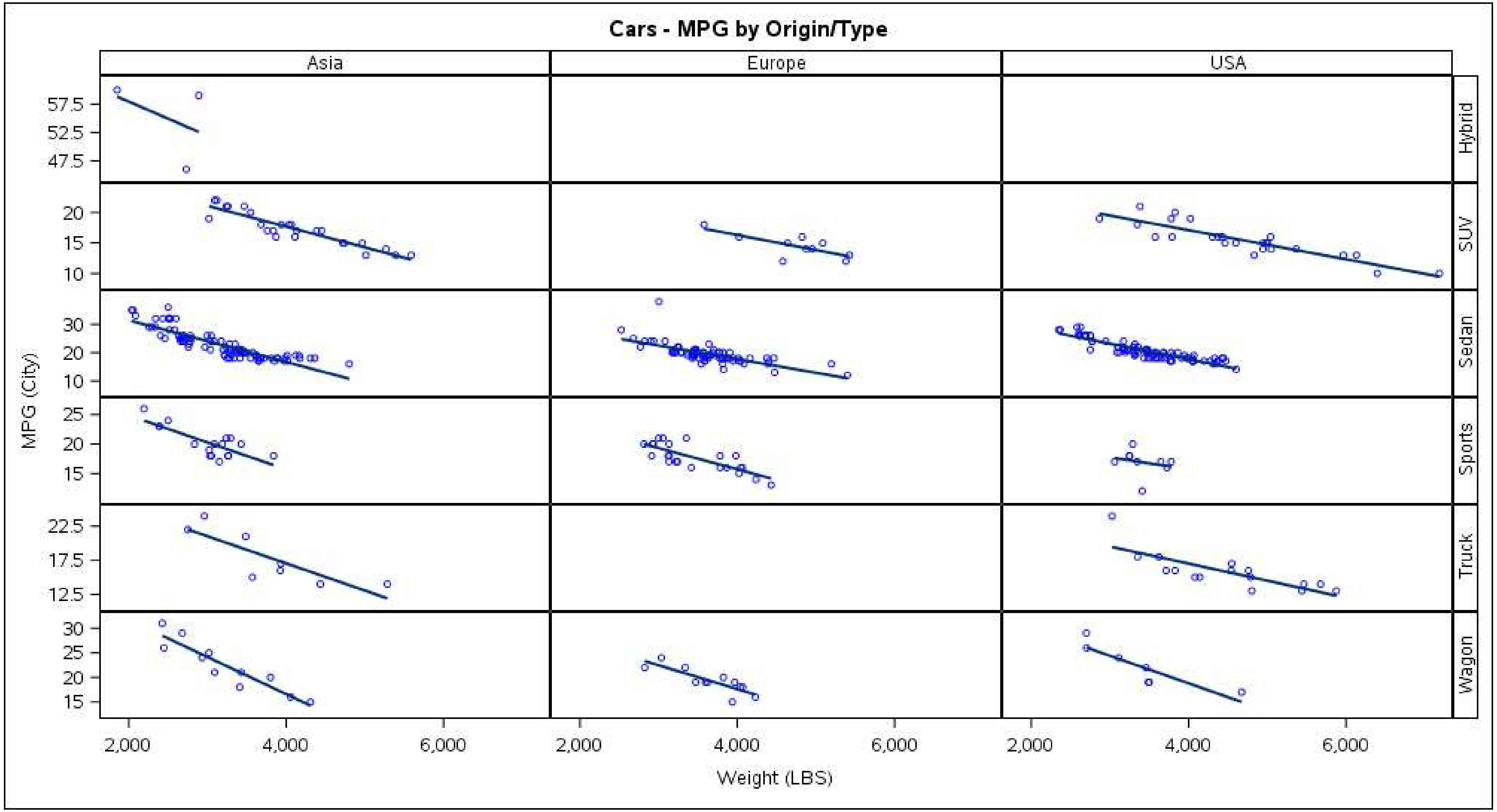
```
proc sgpanel data=sashelp.cars;
title "Cars - MSRP by Origin";
panelby type;
dot origin / response=msrp stat=mean datalabel
             markerattrs=(size=16pt symbol=circlefilled color=blue);
```



Cars - MSRP by Origin
Type = Hybrid
Type = SUV
Type = Sedan
Type = Sports
Type = Truck
Type = Wagon
$19,920
$29,569
$48,346
$34,589
$22,764
$42,992
$25,639
$32,511
$71,999
$45,257
$20,384
$27,220
$23,144
$37,851
$22,346
Asia
Europe
USA
Origin
$20,000
$40,000
$60,000
MSRP (Mean)

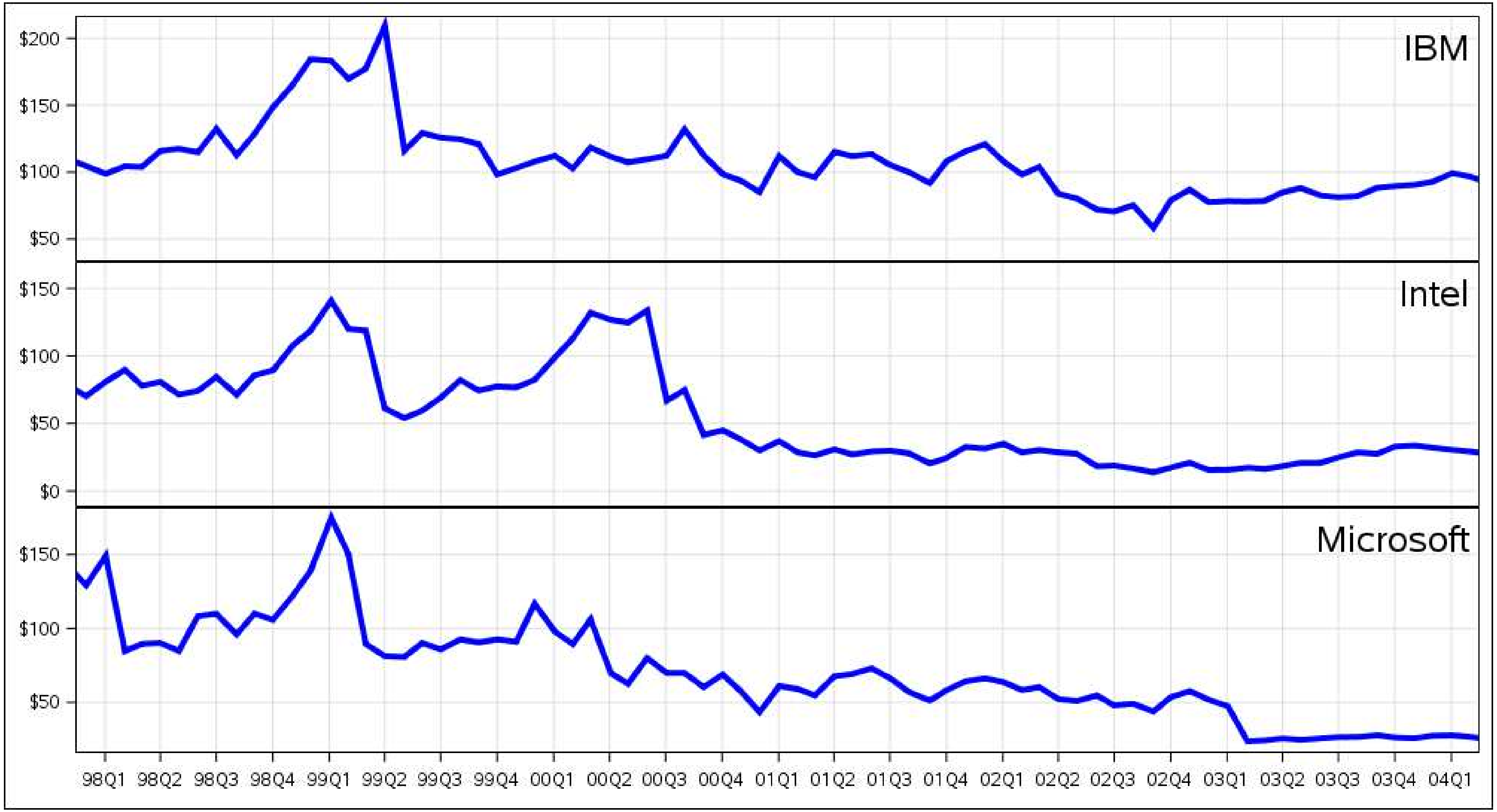
SGPANEL CHARTS: EXERCISE 4

```
proc sgpanel data=sashelp.cars noautolegend;
title "Cars - MPG by Origin/Type";
panelby origin type /
            layout=lattice novarname uniscale=column onepanel;
reg y=mpg_city x=weight / markerattrs=(color=blue);
format weight comma8.;
```


Cars - MPG by Origin/Type
Asia
Europe
USA
Hybrid
SUV
Sedan
Sports
Truck
Wagon
MPG (City)
Weight (LBS)
2,000
4,000
6,000
57.5
52.5
47.5
22.5
17.5
12.5
30
25
20
15
10

SGPANEL CHARTS: EXERCISE 5

```
proc sgpanel data= sashelp.stocks;
title "Stock Closing Prices by Quarter (1998-2003)";
panelby stock / rows=3 novarname uniscale=column noheader;
title;
inset stock / nolabel  textattrs=(size=18pt);
series x=date y=close / lineattrs=(thickness=3pt) lineattrs=(color=blue);
colaxis values=('01jan1998'd to '01jan2004'd by quarter)
       min='01jan1998'd max='01jan2004'd
       display=(nolabel) grid valuesformat=yyq4.;
rowaxis display=(nolabel) grid;
```

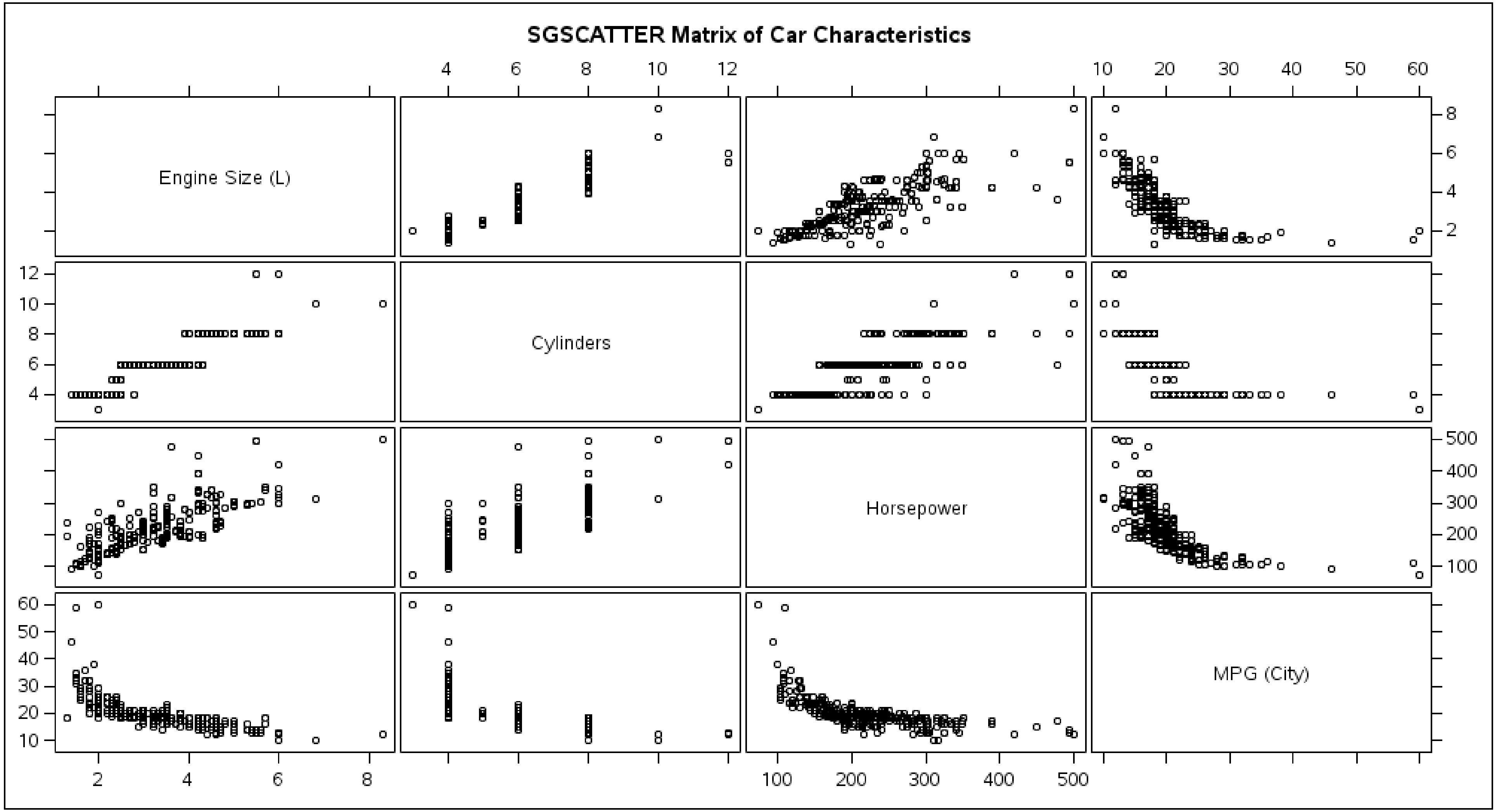


IBM
Intel
Microsoft
$200
$150
$100
$50
$150
$100
$50
$0
$150
$100
$50
98Q1 98Q2 98Q3 98Q4 99Q1 99Q2 99Q3 99Q4 00Q1 00Q2 00Q3 00Q4 01Q1 01Q2 01Q3 01Q4 02Q1 02Q2 02Q3 02Q4 03Q1 03Q2 03Q3 03Q4 04Q1

SGSCATTER CHARTS

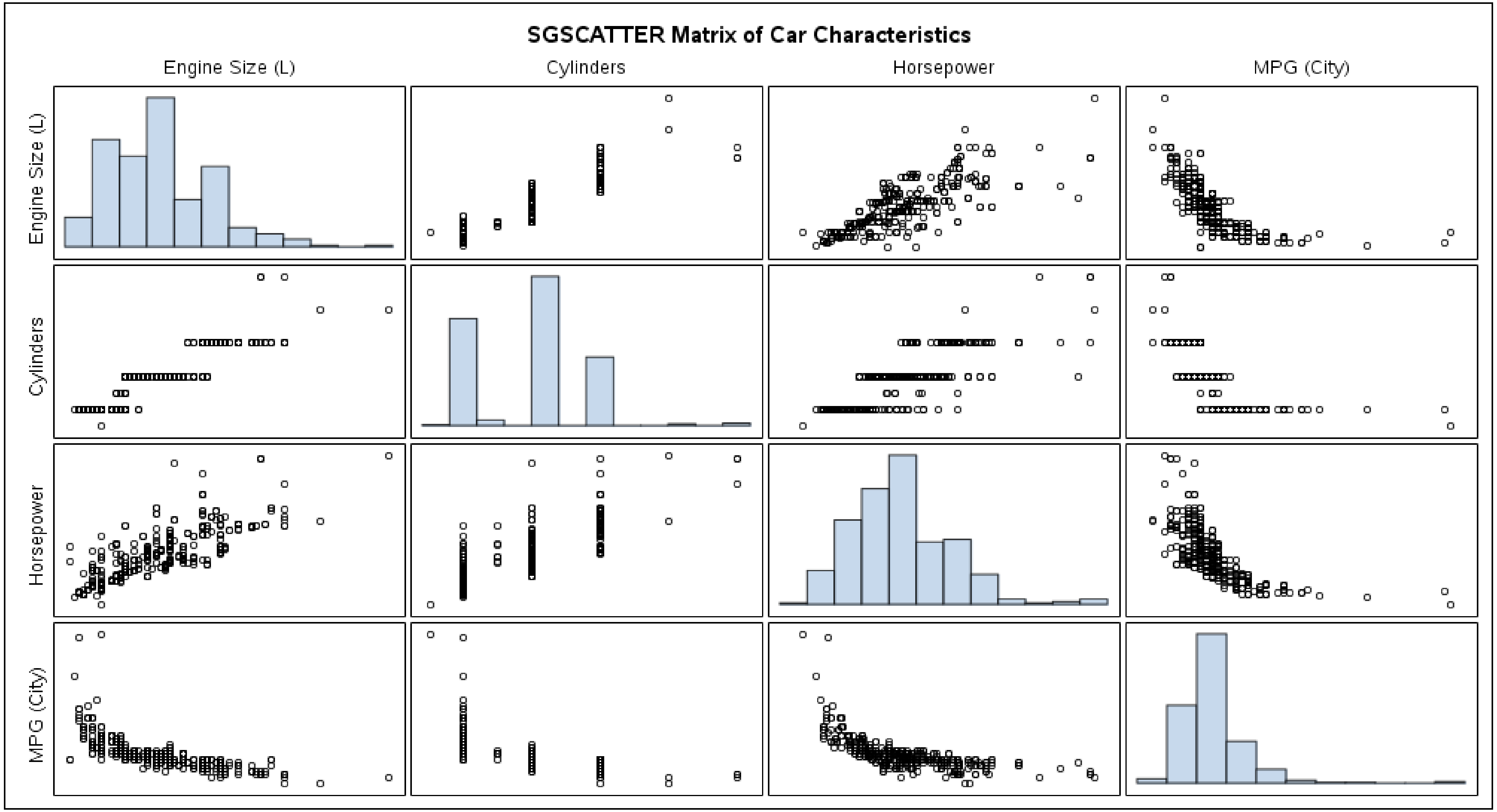
SGSCATTER CHARTS: EXERCISE 1

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Matrix of Car Characteristics";
matrix enginesize cylinders horsepower mpg_city;
```


SGSCATTER Matrix of Car Characteristics
Engine Size (L)
Cylinders
Horsepower
MPG (City)
4
6
8
10
12
10
20
30
40
50
60
8
6
4
2
12
10
8
6
4
500
400
300
200
100
60
50
40
30
20
10
2
4
6
8
100
200
300
400
500

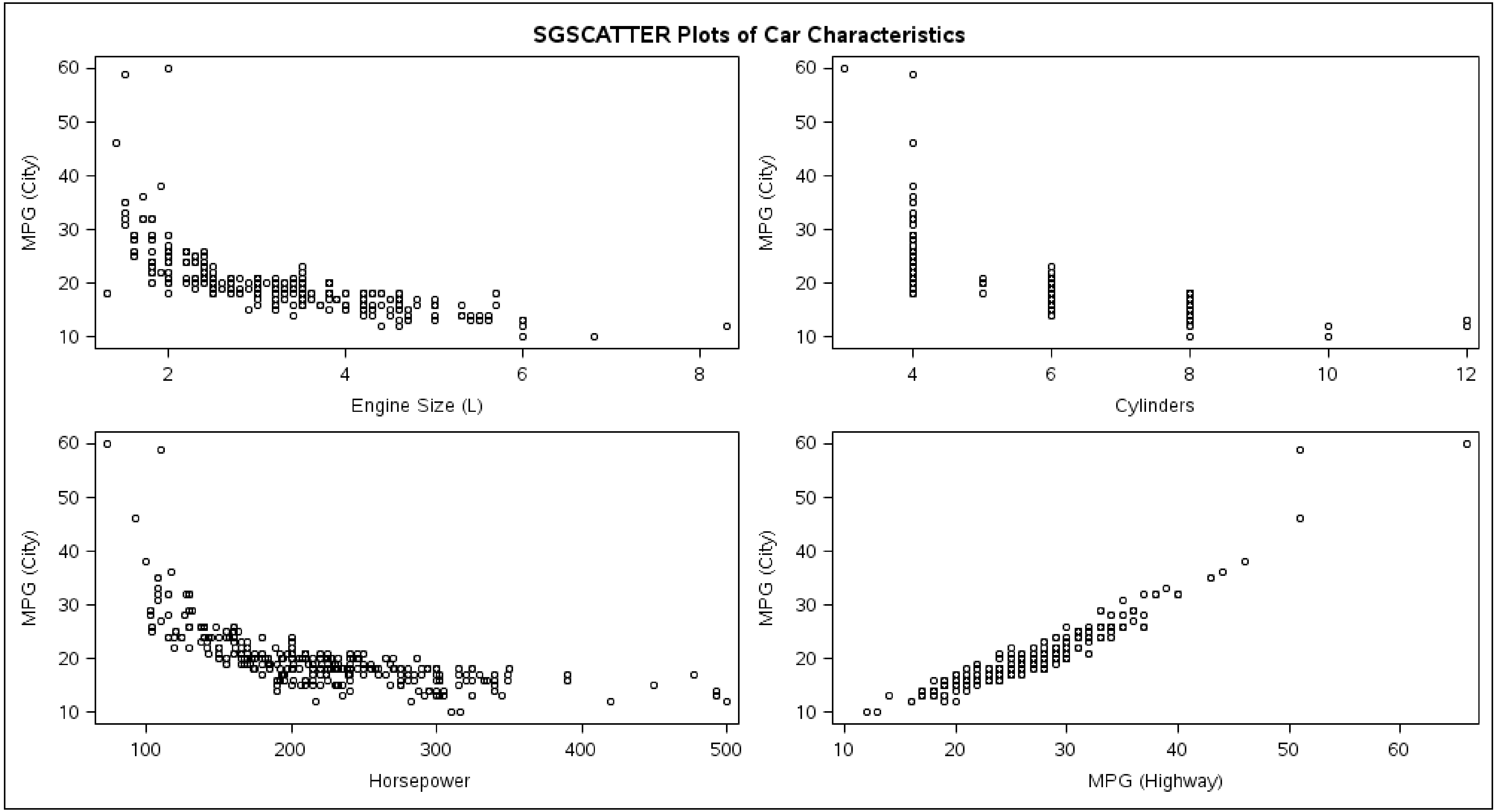
SGSCATTER CHARTS: EXERCISE 2

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Matrix of Car Characteristics";
matrix enginesize cylinders horsepower mpg_city /
     diagonal=(histogram) transparency=.2;
```


SGSCATTER Matrix of Car Characteristics
Engine Size (L)
Cylinders
Horsepower
MPG (City)

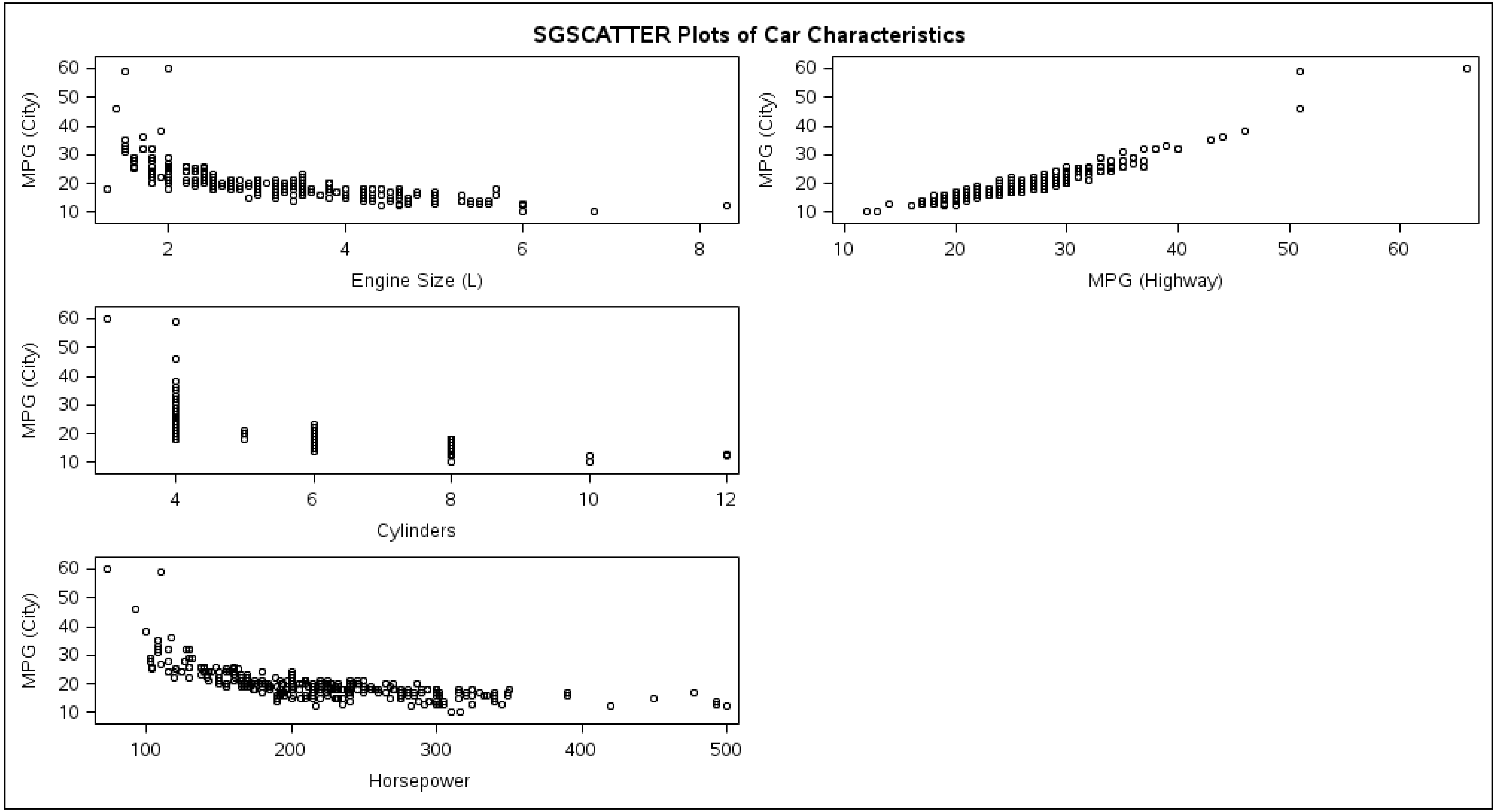
SGSCATTER CHARTS: EXERCISE 3

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Plots of Car Characteristics";
plot mpg_city*(enginesize cylinders horsepower mpg_highway);
```


SGSCATTER Plots of Car Characteristics
MPG (City)
Engine Size (L)
Cylinders
Horsepower
MPG (Highway)
60
50
40
30
20
10
2
4
6
8
10
12
100
200
300
400
500

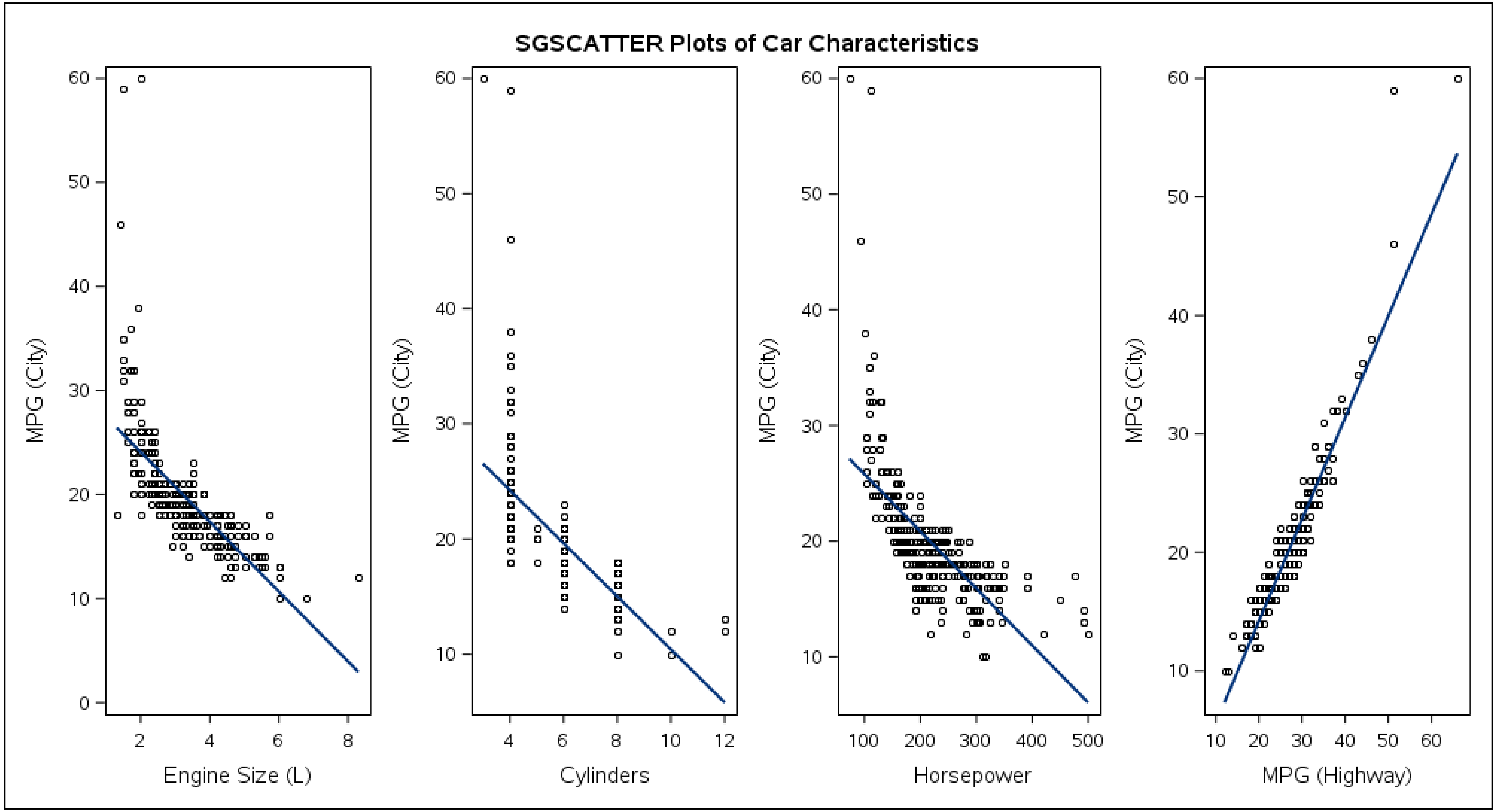
SGSCATTER CHARTS: EXERCISE 4

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Plots of Car Characteristics";
plot mpg_city* (enginesize cylinders horsepower mpg_highway) / rows=3;
```


SGSCATTER Plots of Car Characteristics
MPG (City)
Engine Size (L)
MPG (Highway)
Cylinders
Horsepower
60
50
40
30
20
10
2
4
6
8
10
20
30
40
50
60
12
100
200
300
400
500

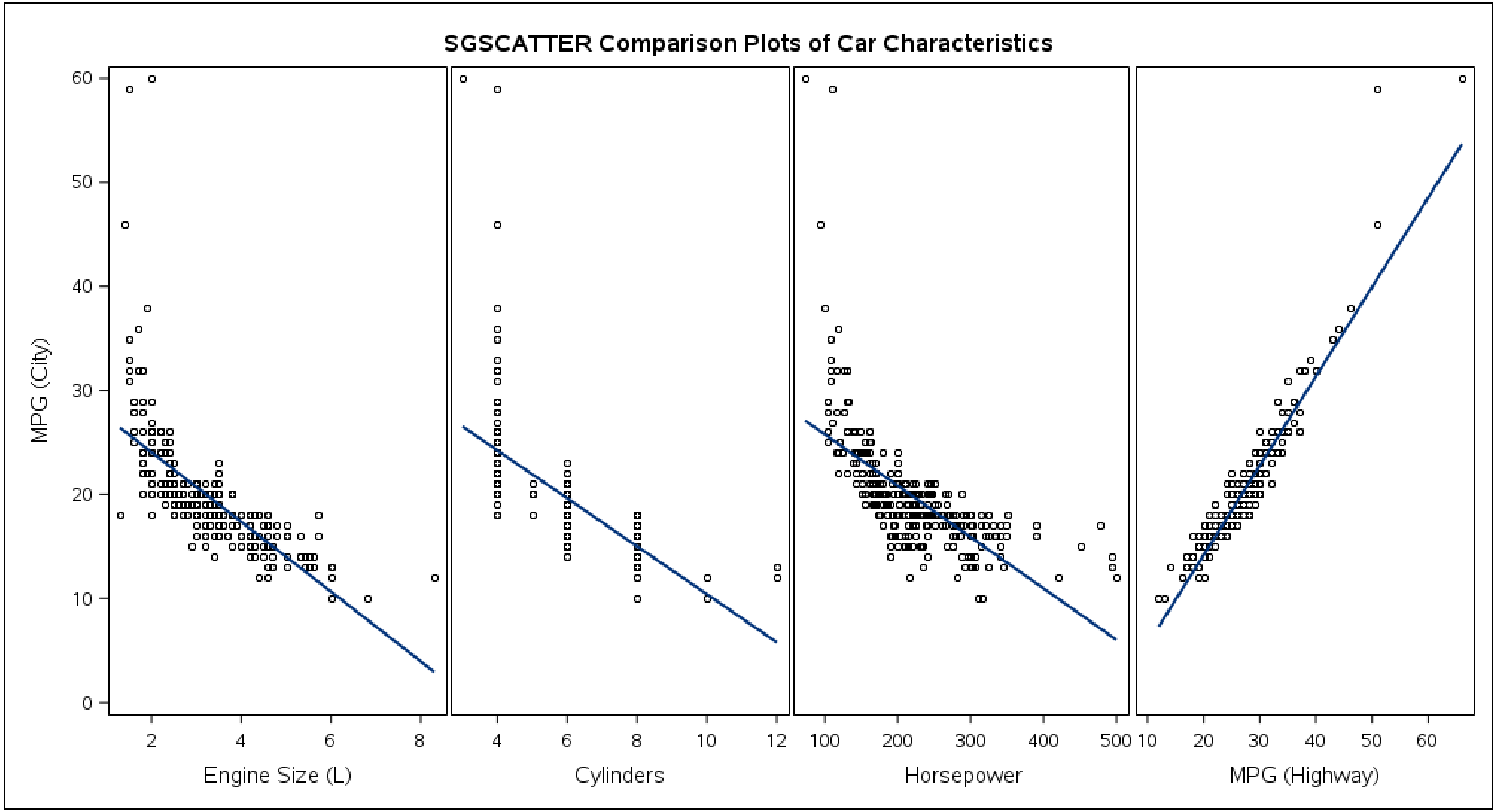
SGSCATTER CHARTS: EXERCISE 5

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Plots of Car Characteristics";
plot mpg_city* (enginesize cylinders horsepower mpg_highway) / columns=4 reg;
```


SGSCATTER Plots of Car Characteristics
MPG (City)
Engine Size (L)
Cylinders
Horsepower
MPG (Highway)
0
10
20
30
40
50
60
2
4
6
8
10
12
100
200
300
400
500

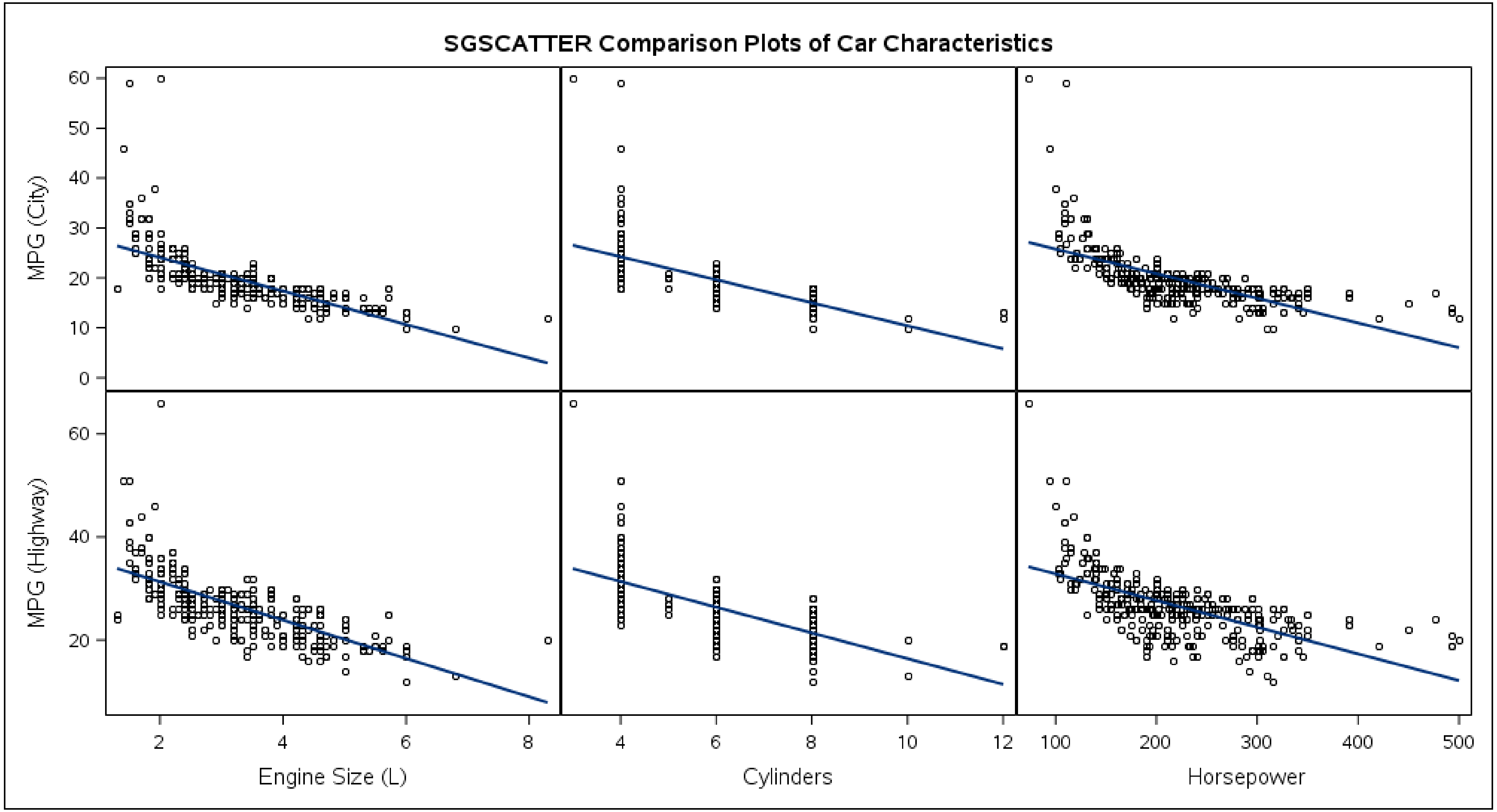
SGSCATTER CHARTS: EXERCISE 6

```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Comparison Plots of Car Characteristics";
compare x=(enginesize cylinders horsepower mpg_highway) y=(mpg_city) / reg;
```


SGSCATTER Comparison Plots of Car Characteristics
MPG (City)
60
50
40
30
20
10
0
2
4
6
8
Engine Size (L)
4
6
8
10
12
Cylinders
100
200
300
400
500
Horsepower
10
20
30
40
50
60
MPG (Highway)

SGSCATTER CHARTS: EXERCISE 7

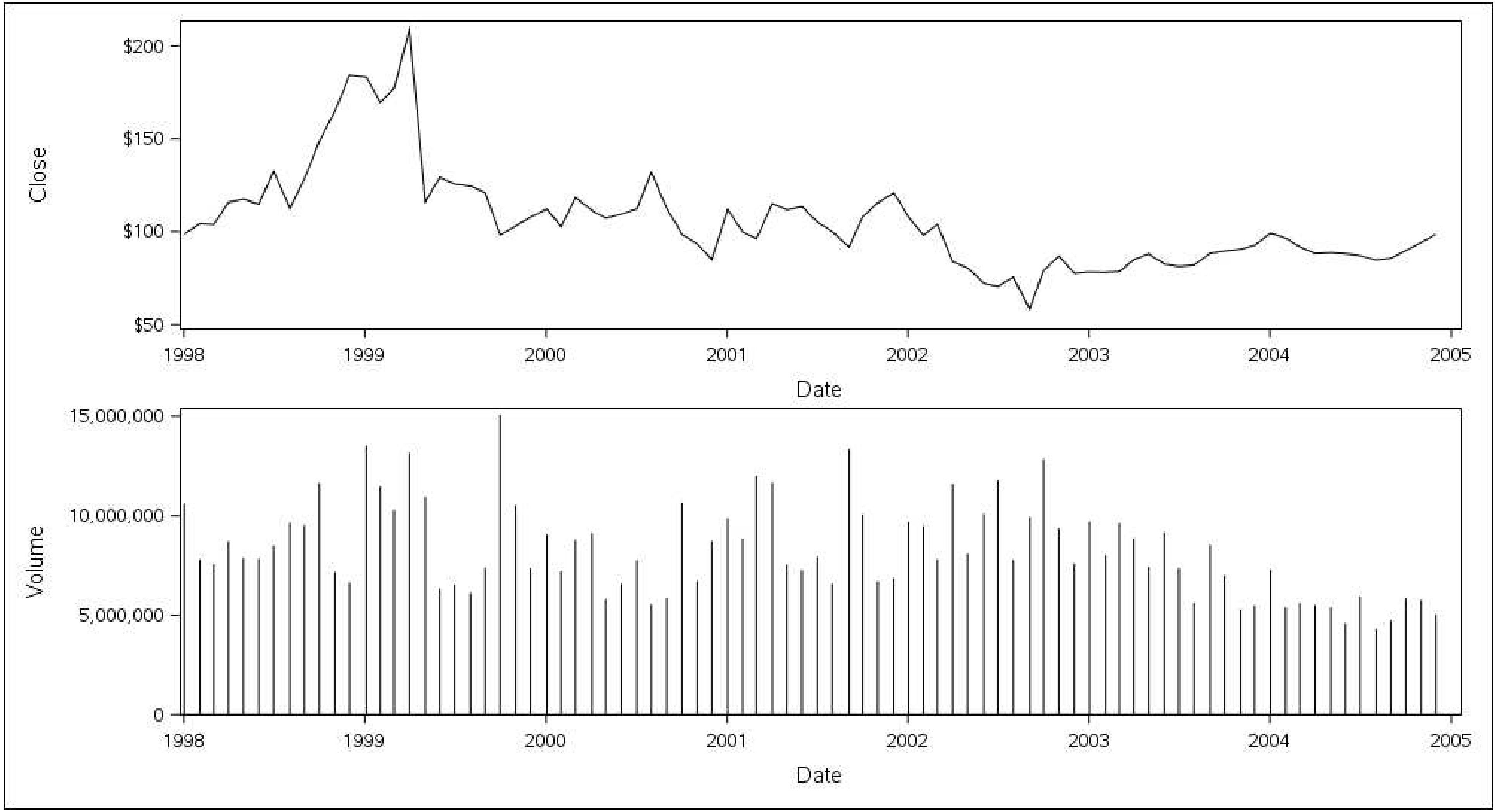
```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Comparison Plots of Car Characteristics";
compare x=(enginesize cylinders horsepower) y=(mpg_city mpg_highway) / reg;
```


SGSCATTER Comparison Plots of Car Characteristics
MPG (City)
MPG (Highway)
Engine Size (L)
Cylinders
Horsepower
0
10
20
30
40
50
60
20
40
60
2
4
6
8
4
6
8
10
12
100
200
300
400
500

GTL CHARTS

GTL CHARTS: EXERCISE 1

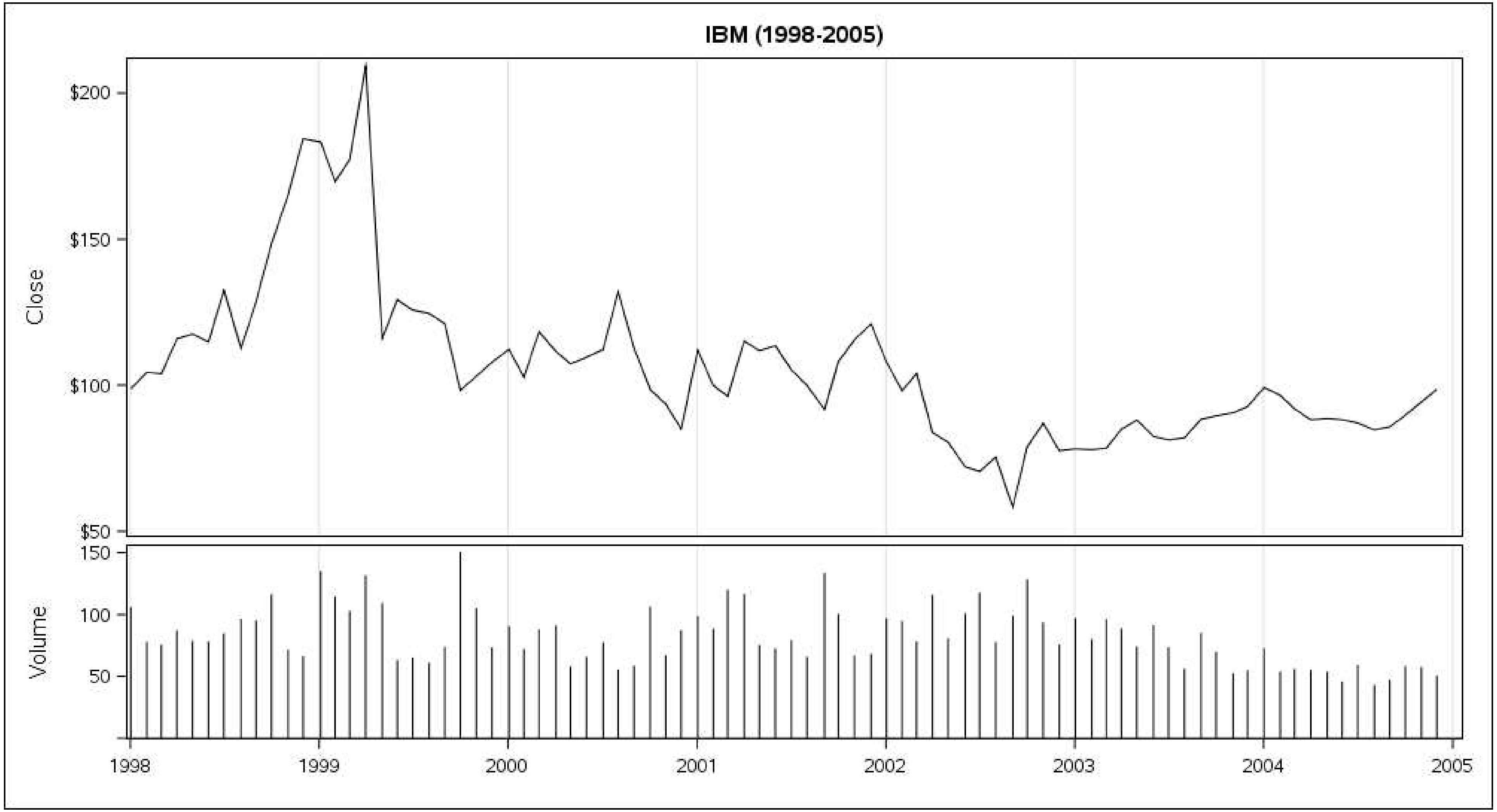
```
proc template;
define statgraph gtlStock;
begingraph;
layout lattice;
seriesplot x=date y=close;
needleplot x=date y=volume;
endlayout;
endgraph;
end;

proc sgrender data=sashelp.stocks template=gtlStock;
title height=10pt "IBM Closing Stock Prices and Volume (1998-2005)";
where stock="IBM" and '01jan1998'd<=date<'01jan2005'd;
```



Close
$200
$150
$100
$50
1998
1999
2000
2001
2002
2003
2004
2005
Date
Volume
15,000,000
10,000,000
5,000,000
0
1998
1999
2000
2001
2002
2003
2004
2005
Date

GTL CHARTS: EXERCISE 2

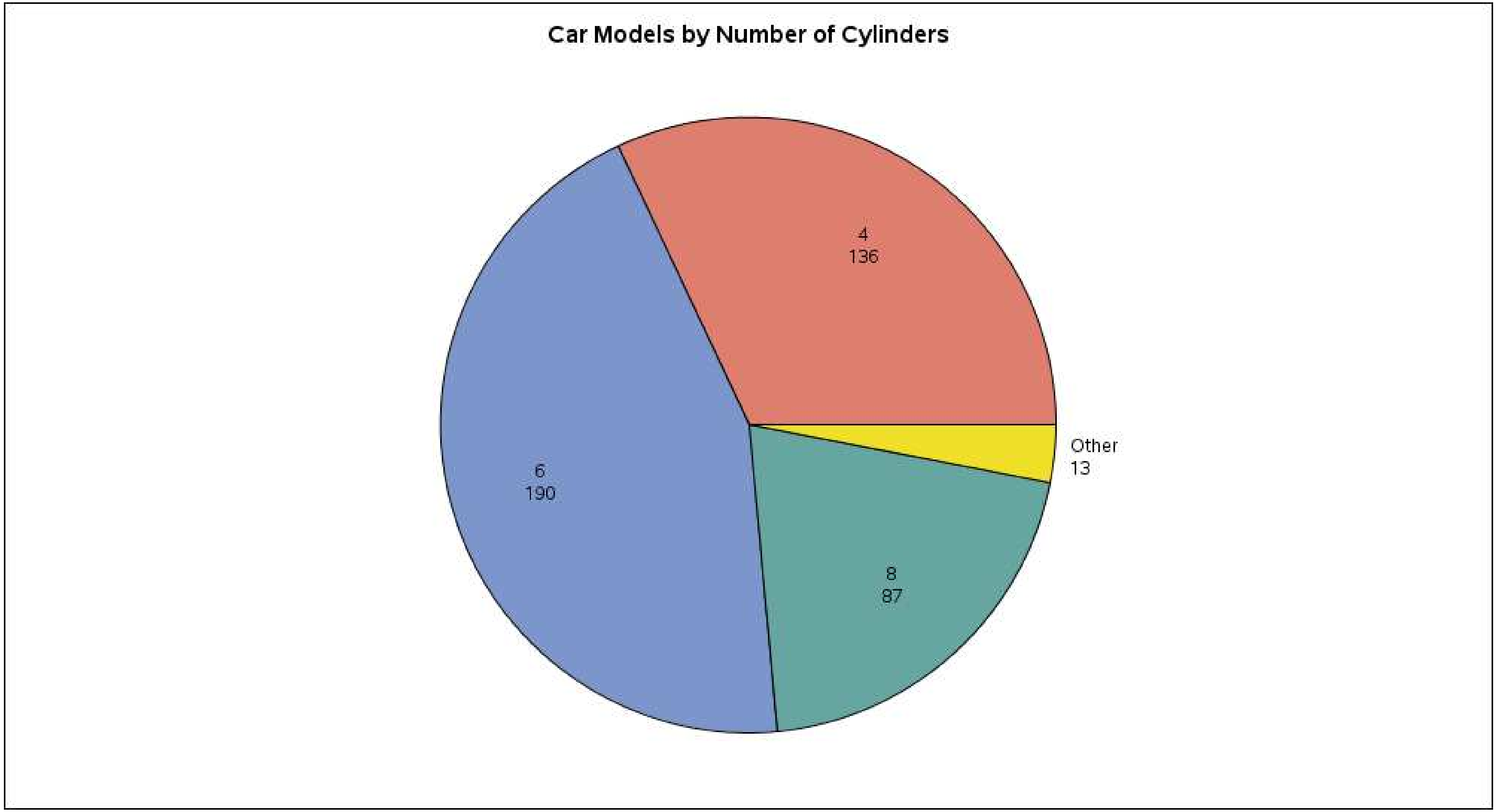
```
proc format;
picture million low-high='0000' (mult=.00001);

proc template;
define statgraph gtlStock;
begingraph;
entrytitle "IBM (1998-2005)";
layout lattice / columndatarange=union rowweights=(.7 .3);
seriesplot x=date y=close;
needleplot x=date y=volume;
columnaxes;
columnaxis / griddisplay=on display=(line ticks tickvalues);
endcolumnaxes;
endlayout;
endgraph;
end;

proc sgrender data=sashelp.stocks template=gtlStock;
where stock="IBM" and '01jan1998'd<=date<'01jan2005'd;
format volume million.;
```


IBM (1998-2005)
$200
$150
$100
$50
Close
150
100
50
Volume
1998
1999
2000
2001
2002
2003
2004
2005

PIE CHARTS

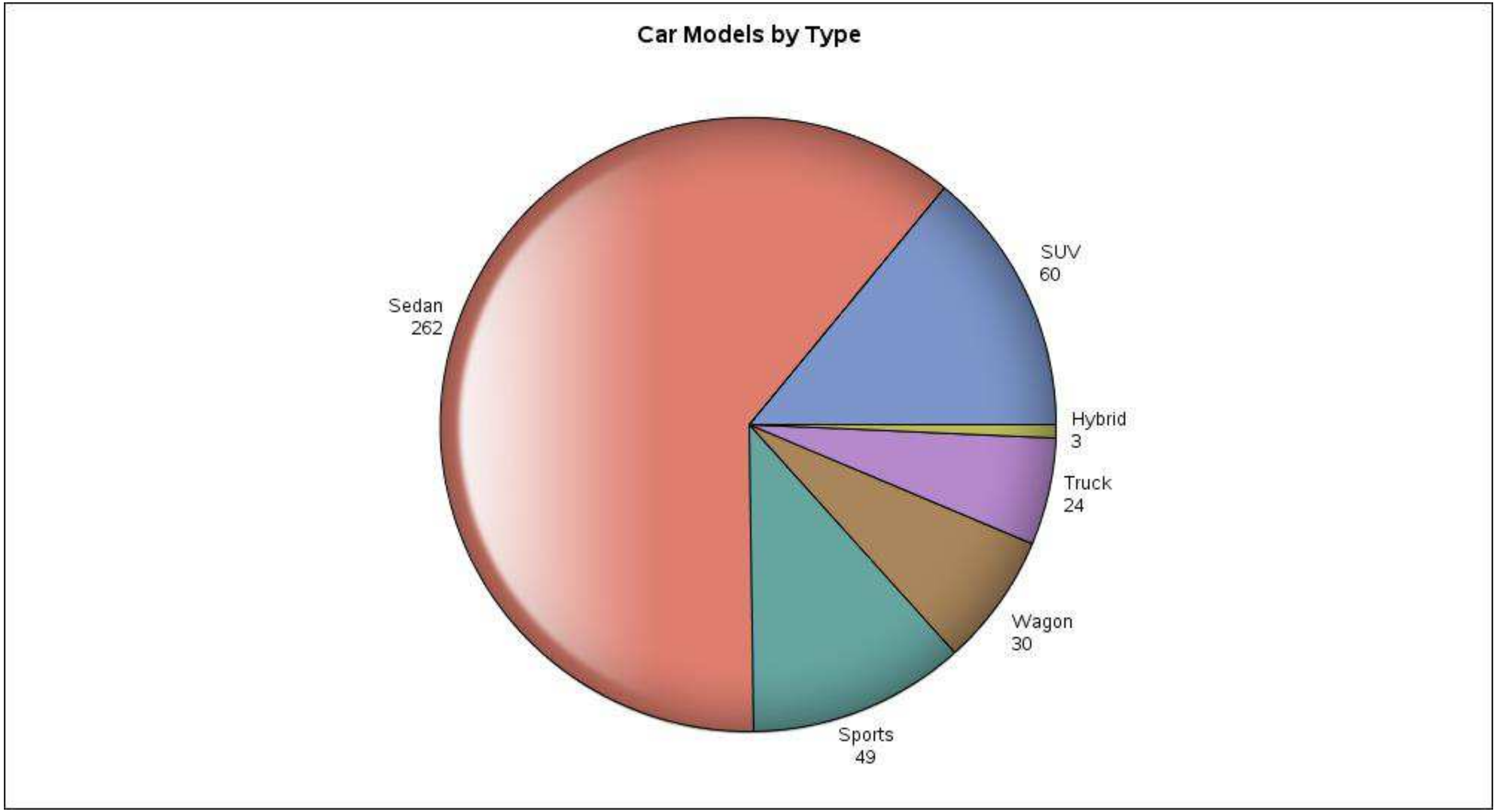
PIE CHARTS: EXERCISE 1

```
proc template;
define statgraph pie;
begingraph;
entrytitle "Car Models by Number of Cylinders";
layout region;
piechart category=cylinders;
endlayout;
endgraph;
end;

proc sgrender data=sashelp.cars template=pie;
```


Car Models by Number of Cylinders
4
136
6
190
8
87
Other
13

PIE CHARTS: EXERCISE 2

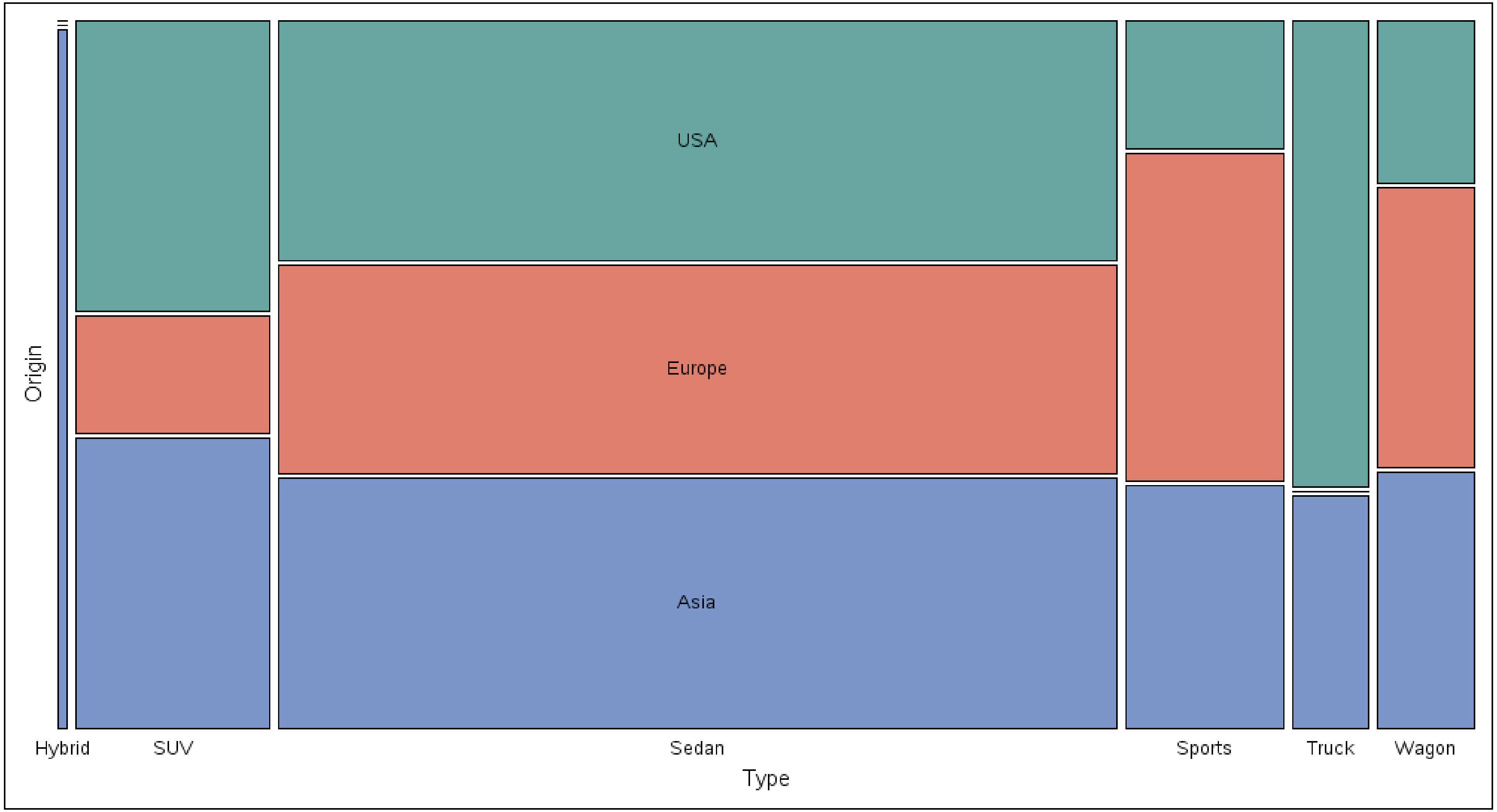
```
proc template;
define statgraph pie;
begingraph;
entrytitle "Car Models by Type";
layout region;
piechart category=type /
        dataskin=gloss
        datalabellocation=outside;
endlayout;
endgraph;
end;

proc sgrender data=sashelp.cars template=pie;
```


Car Models by Type
SUV
60
Sedan
262
Hybrid
3
Truck
24
Wagon
30
Sports
49

MOSAIC CHARTS

MOSAIC CHARTS: EXERCISE 1

```
proc summary data=sashelp.cars nway;
class origin type;
var mpg_highway;
output out=mileage mean=avgMpg N=count / noinherit;

proc template;
define statgraph mosaicPlotParm;
begingraph;
layout region;
mosaicPlotParm category=(type origin) count=count / colorgroup=origin;
endlayout;
endgraph;
end;
proc sgrender data=mileage template=mosaicPlotParm;
title "Mosaic Plot of Car Origin/Type/MPG";
```

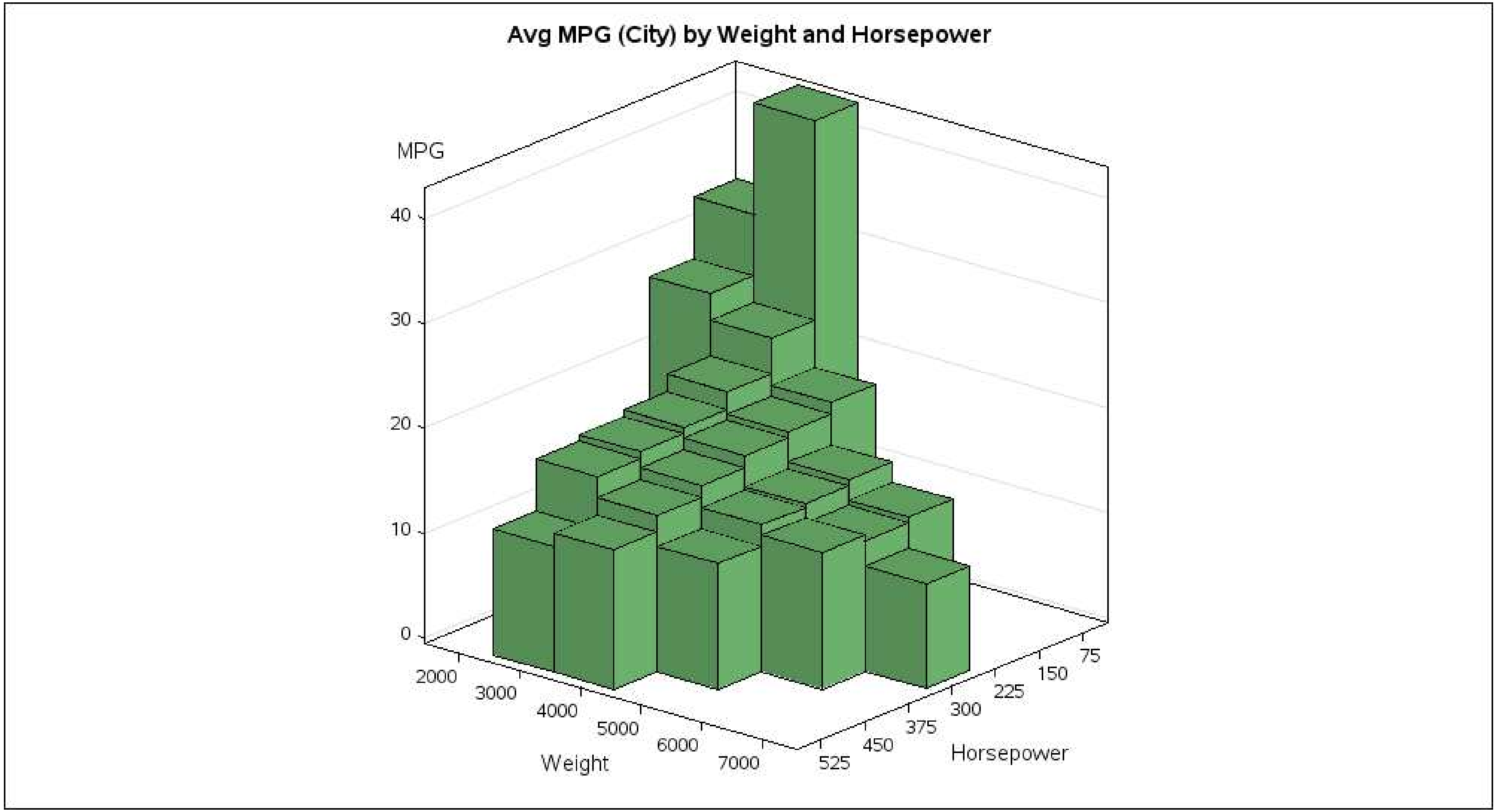


USA
Europe
Asia
Origin
Hybrid
SUV
Sedan
Sports
Truck
Wagon
Type

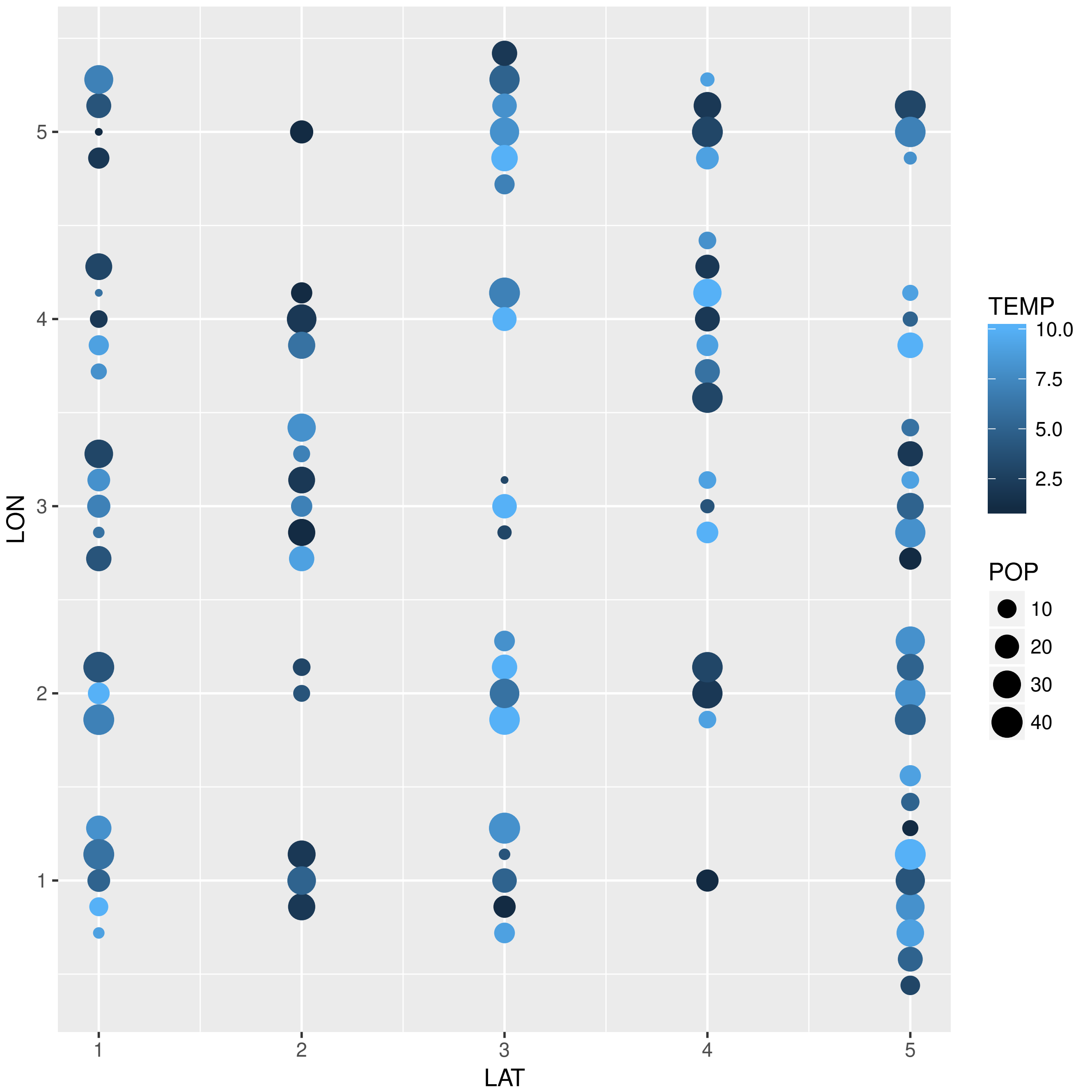
3D HISTOGRAM CHARTS

3D HISTOGRAM CHARTS: EXERCISE 1

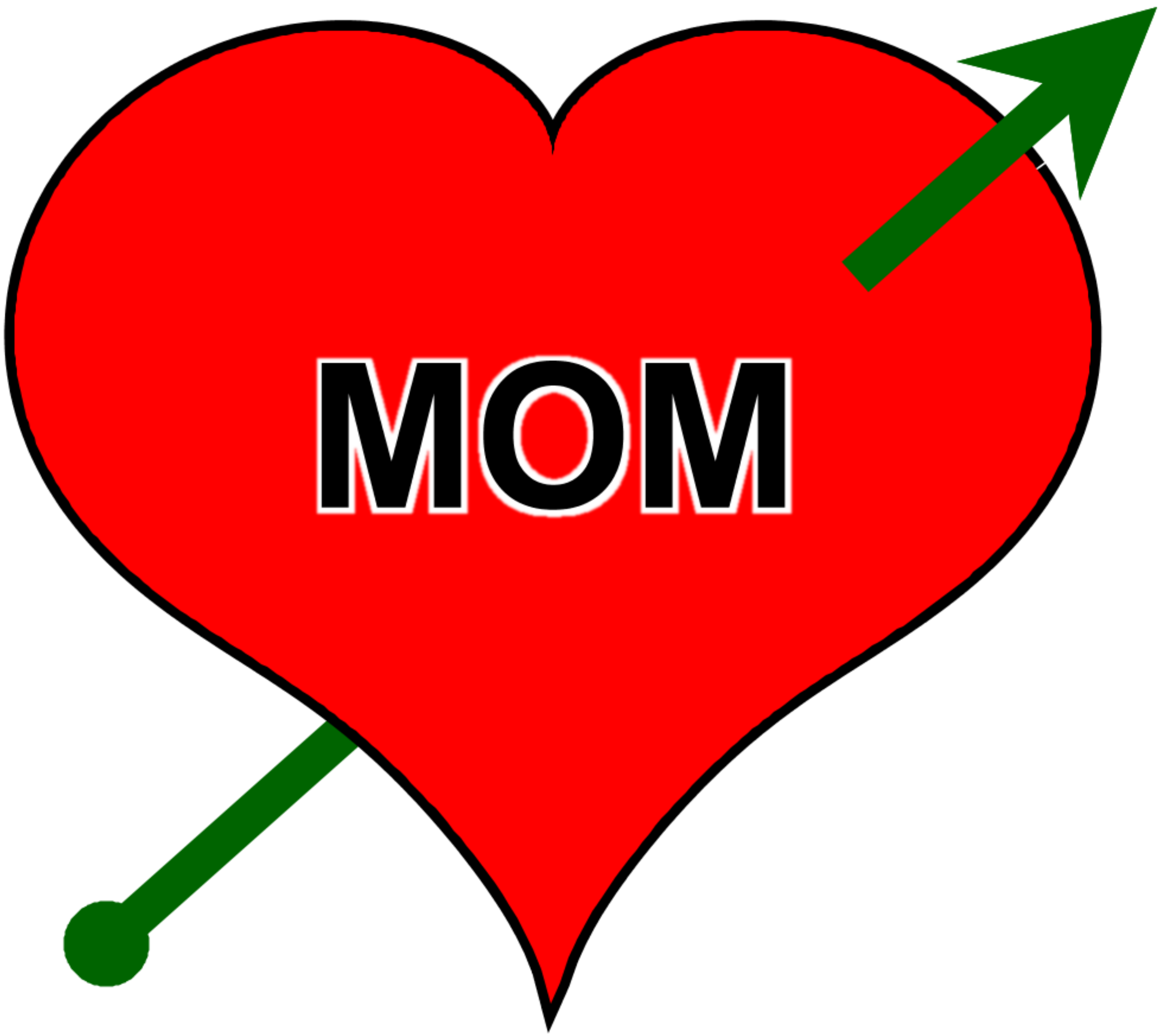
```
proc sql noprint;
create table carSum as
select round(horsepower,75) as Horsepower,
      round(weight,1000) as Weight,
      avg(mpg_city) as MPG
from sashelp.cars group by 1, 2 order by 1, 2;

proc template;
define statgraph gtl3D;
begingraph;
entrytitle "Avg MPG (City) by Weight and Horsepower";
layout overlay3d / cube=false zaxisopts=(griddisplay=on) rotate=130;
bihistogram3dparm y=weight x=horsepower z=mpg /
               fillattrs=(color=lightgreen) display=all;
endlayout;
endgraph;
end;

proc sgrender data=carSum template=gtl3D;
```


Avg MPG (City) by Weight and Horsepower
MPG
40
30
20
10
0
2000
3000
4000
5000
6000
7000
Weight
525
450
375
300
225
150
75
Horsepower

```
* uses WPS proc R substitute IML/R or pure R;
options validvarname=upcase;
libname sd1 "d:/sd1";
data sd1.have(drop=i);
call streaminit(123);
do i=1 to 100;
lat =int(5*(rand("Uniform")))+1;
lon =int(5*(rand("Uniform")))+1;
temp =int(10*(rand("Uniform")))+1;
pop =int(40*(rand("Uniform")))+1;
output;
end;
run;quit;
%utl_submit_wps64('
libname sd1 "d:/sd1";
options set=R_HOME "C:/Program Files/R/R-3.3.1";
libname wrk "%sysfunc(pathname(work))";
proc r;
submit;
source("C:/Program Files/R/R-3.3.1/etc/Rprofile.site", echo=T);
library(haven);
library(ggbeeswarm);
have<-read_sas("d:/sd1/have.sas7bdat");
head(have);
pdf("d:/pdf/beeswarm.pdf");
ggplot(aes(x=LON, y=LAT, col=TEMP, size=POP),  data = have)+
geom_beeswarm(priority="random",cex=3.5, groupOnX=T)+coord_flip();
endsubmit;
run;quit;
');
```


LON
LAT
TEMP
10.0
7.5
5.0
2.5
POP
10
20
30
40
1
2
3
4
5
1
2
3
4
5

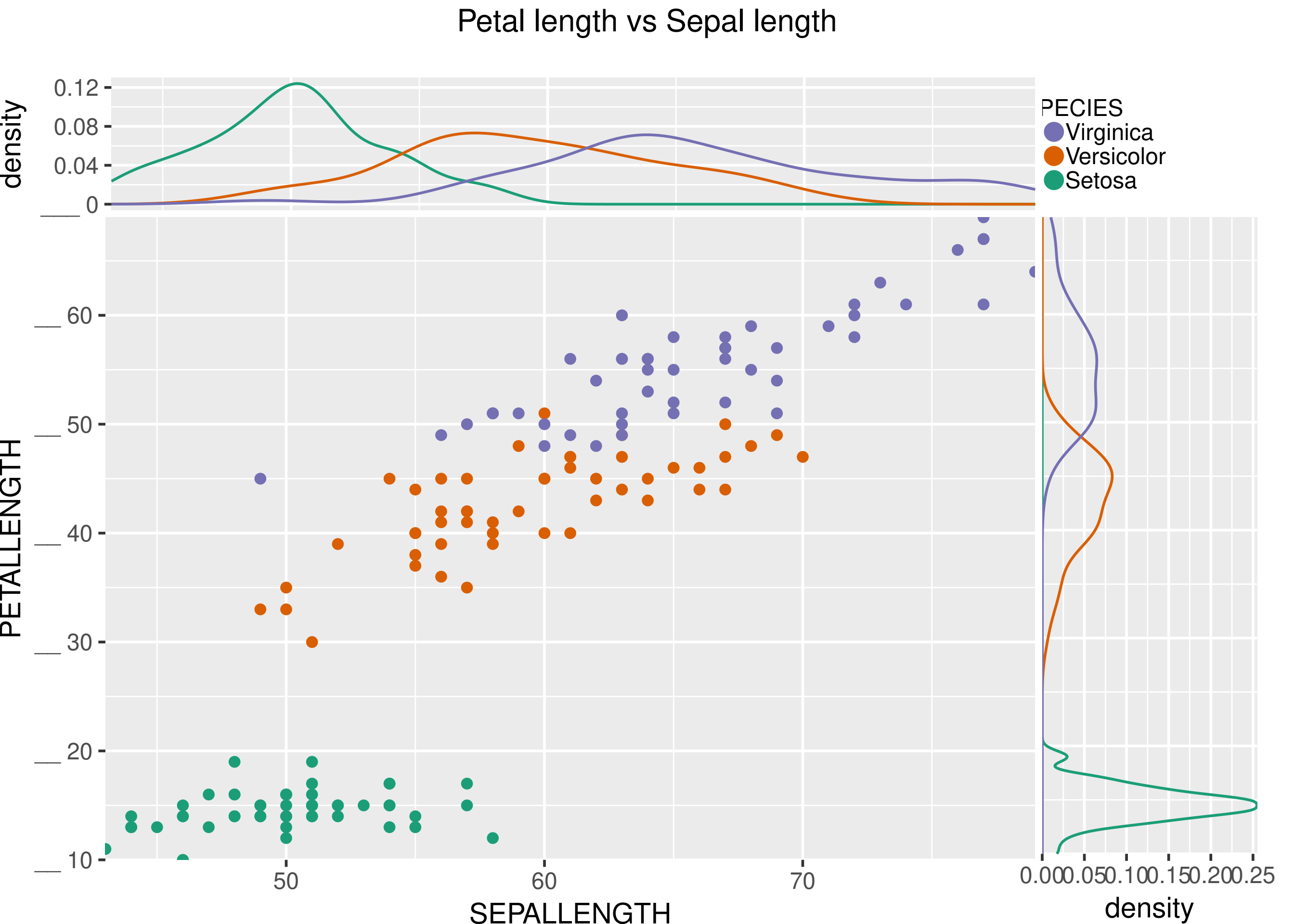
```
data Heart;
do t = 0 to 2*constant("pi") by 0.01;
r=sin(t)*sqrt(abs(cos(t)))/(sin(t)+7/5)-2*sin(t)+2;
x = r*cos(t);
y = r*sin(t);
id=1;
output;
end;
x=.; y=.;
xMarker=-1.85; yMarker=-3.6; output; xmarker=.; ymarker=.;* Arrow;
xArrowO=-1.85; yArrowO=-3.6; xArrow=2.5; yArrow=.75;
output; xArrowO=.; yArrowO=.; xArrow=.; yArrow=.;
xArrowO2=1.25; yArrowO2=-.5; xArrow2=2.5; yArrow2=.75;
output; xArrowO2=.; yArrowO2=.; xArrow2=.; yArrow2=.;
xText=0; yText=-1.25; Text='MOM'; output; * Text;
proc sgplot data=Heart aspect=1 nowall noautolegend noborder;
vector x=xArrow y=yArrow /
xorigin=xArrowO yorigin=yArrowO
lineattrs=(color=darkgreen thickness=10pt) arrowheadshape=barbed;
scatter x=xMarker y=yMarker /
markerattrs=(symbol=circlefilled size=20pt color=darkgreen);
series x=x y=y / lineattrs=(color=black thickness=5pt);
polygon x=x y=y id=id / fill fillattrs=(color=red);
vector x=xArrow2 y=yArrow2 /
xorigin=xArrowO2 yorigin=yArrowO2
lineattrs=(color=darkgreen thickness=10pt) arrowheadshape=barbed;
text x=xText y=yText text=Text / backlight=1 strip
textattrs=(color=black size=72pt weight=bold);
xaxis display=none min=-2.4 max=2.5 offsetmax=.001 offsetmin=.001;
yaxis display=none min=-4.2 max=1.3 offsetmax=.001 offsetmin=.001;
run;quit;
```


MOM

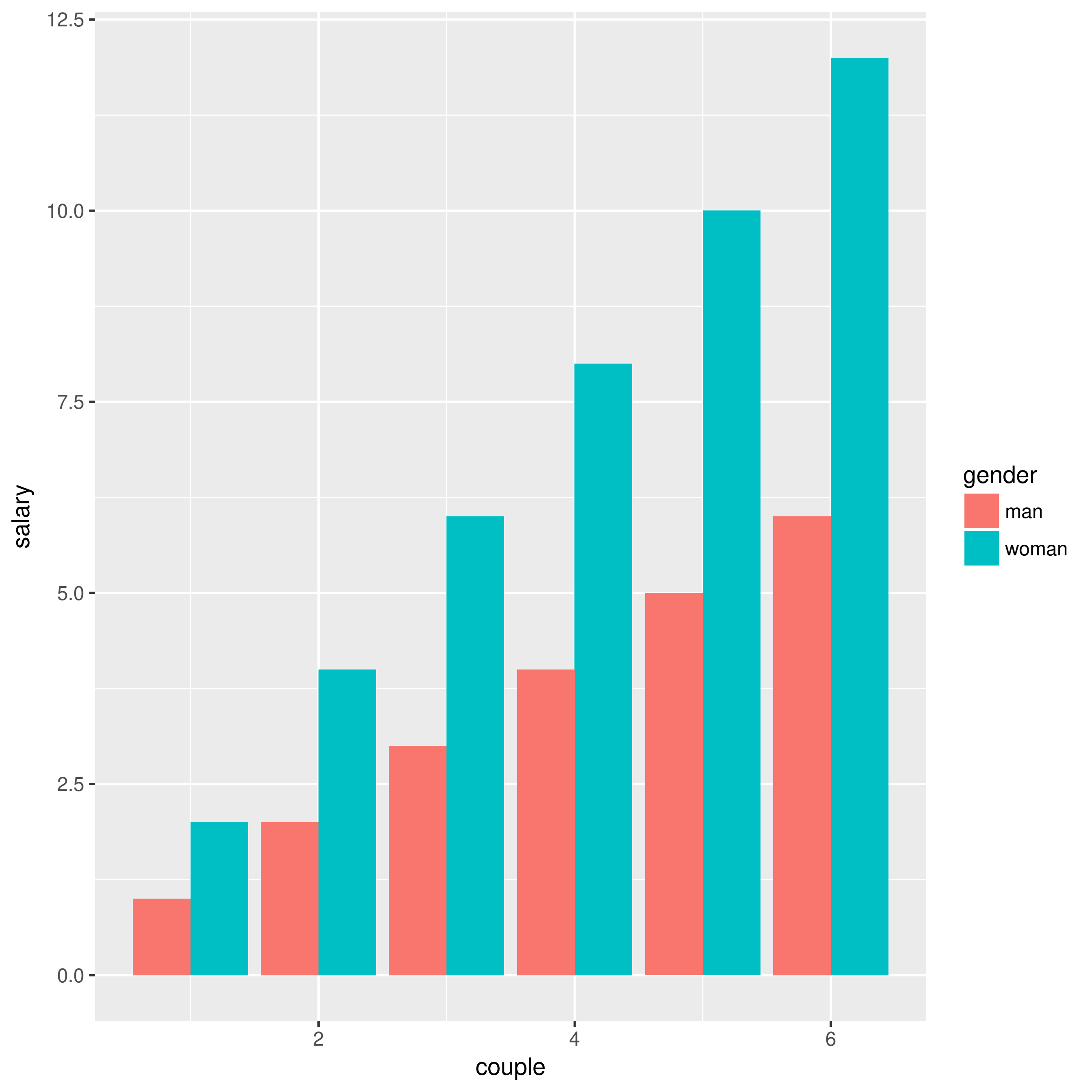
```
data;                /* Memorial Day image */
if _n_=1 then        /* Generate marker points for grass */
do x1=-200 to 500 by 5;
do y1=-200 to 500 by 5;
rnum=ranuni(1);  /* Random # for color assignment */
output;
end;
end;
x1=.; y1=.;
input x y @@;         /* Polygon points for cross rectangles */
polygon=ceil(_N_/4);
output;
cards;
118 400 182 400 182 -35 118 -35
0   285 300 285 300 220 0   220
;
run;quit;
ods graphics on / height=5in width=5in;  /* Generate image */
ods pdf file="d:/pdf/&pgm._004b.pdf";
proc sgplot aspect=1 noautolegend noborder pad=0 nowall ;
xaxis display=none offsetmin=0 offsetmax=0;
yaxis display=none offsetmin=0 offsetmax=0;
scatter x=x1 y=y1 / colormodel=(lightgreen green darkgreen)
colorresponse=rnum markerattrs=(symbol=circlefilled);
polygon x=x y=y id=polygon / fill fillattrs=(color=white)
outline lineattrs=(color=black thickness=3pt);
polygon x=x y=y id=polygon / fill
fillattrs=(color=white) nooutline;
inset "MEMORIAL DAY 2017" / position=bottom
textattrs=(color=white weight=bold size=28pt);
run;quit;
ods pdf close;
ods graphics off;
```


MEMORIAL DAY 2017

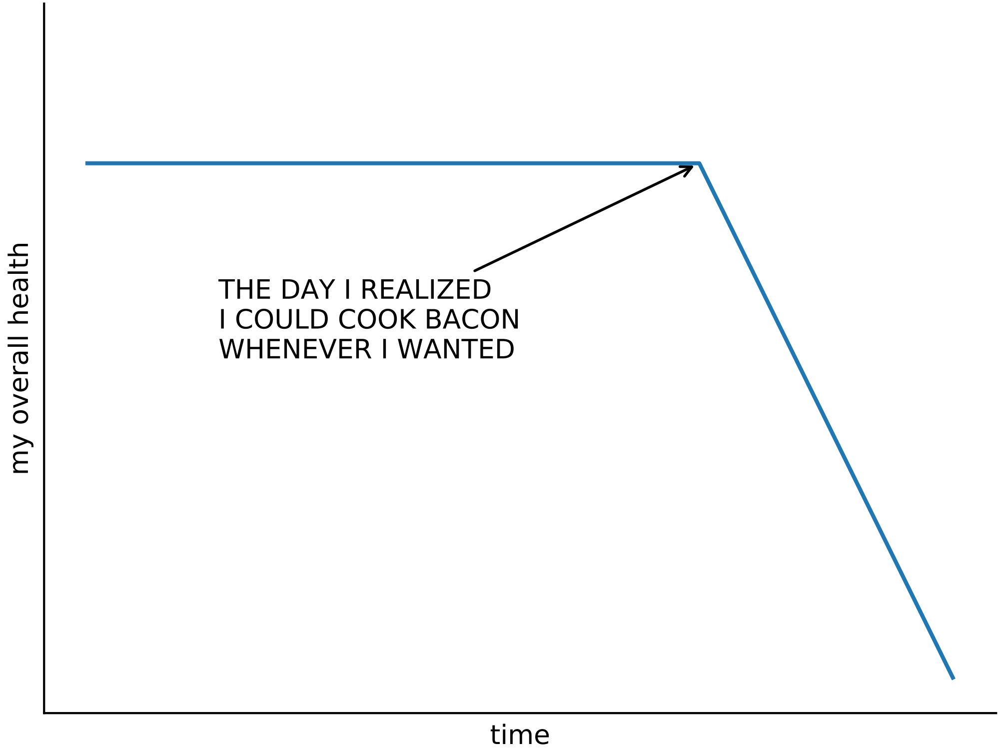
```
options validvarname=upcase;
libname sd1 "d:/sd1";
data sd1.iris;
set sashelp.iris;
run;quit;
%utl_submit_wps64('
libname sd1 "d:/sd1";
options set=R_HOME "C:/Program Files/R/R-3.3.2";
libname wrk "%sysfunc(pathname(work))";
libname hlp "C:\Program Files\SASHome\SASFoundation\9.4\core\sashelp";
proc r;
submit;
source("c:/Program Files/R/R-3.3.2/etc/Rprofile.site",echo=T);
library(haven);
library(WVPlots);
have<-read_sas("d:/sd1/iris.sas7bdat");
have;
pdf("d:/pdf/&pgm._005b.pdf",7,5);
ScatterHistC(have, "SEPALLENGTH", "PETALLENGTH", "SPECIES",
title = "Petal length vs Sepal length");
endsubmit;
run;quit;
');
```


Petal length vs Sepal length
density
0.12
0.08
0.04
0
PECIES
Virginica
Versicolor
Setosa
PETALLENGTH
60
50
40
30
20
10
50
60
70
SEPALLENGTH
0.000.050.100.150.200.25
density

```
%utl_submit_r64('
source("c:/Program Files/R/R-3.3.1/etc/Rprofile.site",echo=T);
library(ggplot2);
xx <- data.frame (gender = c(rep("man", 6), rep("woman", 6)),
couple = c(1:6, 1:6),
salary = c(1:6, seq (2, 12, 2)));
pdf("d:/pdf/&pgm._006b.pdf");
xx <- xx[sample (1:nrow(xx)), ];
ggplot(xx,aes(x=couple,y=salary,fill=gender))+geom_bar(stat="identity",position="dodge");
');
```

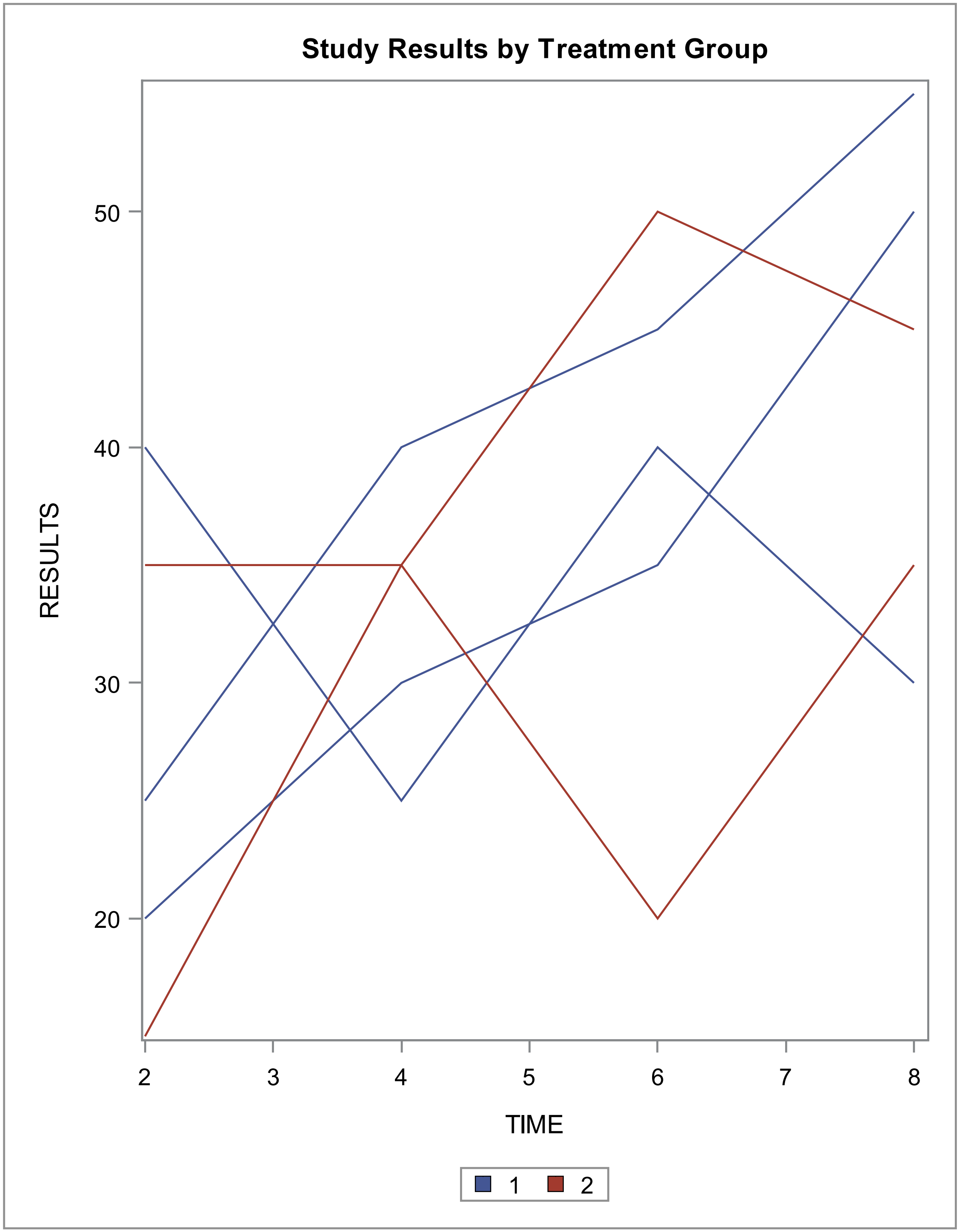

12.5
10.0
7.5
5.0
2.5
0.0
salary
2
4
6
couple
gender
man
woman

```
%utl_submit_py64('
from matplotlib import pyplot as plt;
import numpy as np;
plt.xkcd();
fig = plt.figure();
ax = fig.add_subplot(1, 1, 1);
ax.spines["right"].set_color("none");
ax.spines["top"].set_color("none") ;
plt.xticks([]);
plt.yticks([]);
ax.set_ylim([-30, 10]);
data = np.ones(100);
data[70:] -= np.arange(30);
plt.annotate(
"THE DAY I REALIZED\nI COULD COOK BACON\nWHENEVER I WANTED",
xy=(70, 1), arrowprops=dict(arrowstyle="->"), xytext=(15, -10));
plt.plot(data);
plt.xlabel("time");
plt.ylabel("my overall health");
fig.savefig("d:/png/simple1.png");
');
```

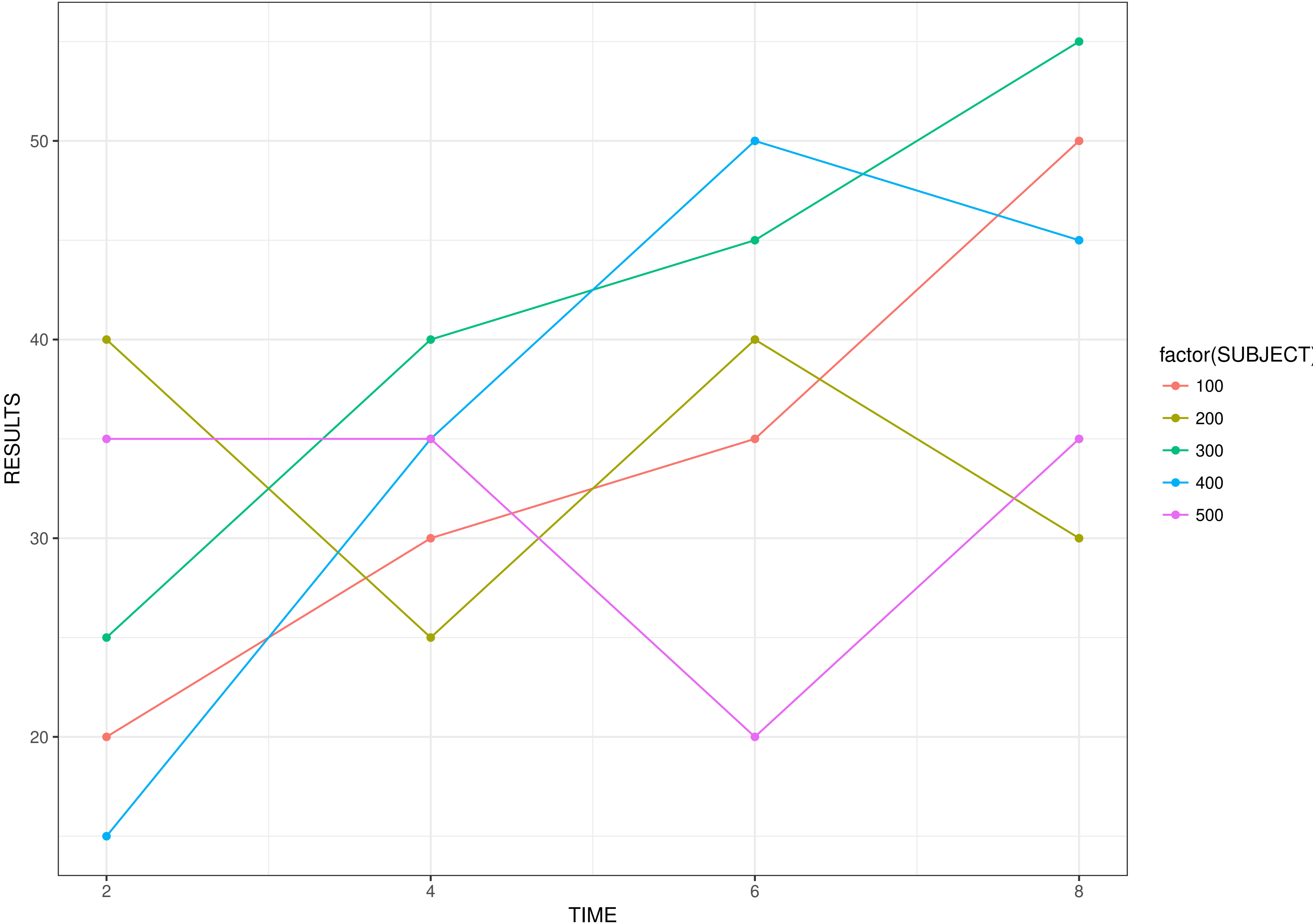

my overall health
THE DAY I REALIZED
I COULD COOK BACON
WHENEVER I WANTED
time

```
data stars(keep=x y);   * Generate x/y points for 50 stars ;
do r=1 to 9;            * 9 rows of stars ;
y=1-r*0.0538;
do x=0.0633*(1+mod(r-1,2)) to 11*0.0633 by 2*0.0633;
* Odd rows have 6 stars, even have 5 (offset by 1) ;
output;
end;
end;
run;quit;
data stripes(keep=spolygon sx sy);       * Generate x/y points for 7 ;
do stripe=1 to 13 by 2;                  * Need seven rectangles (polygons) ;
spolygon+1;                            * Rectangle counter ;
sx=0;    sy=stripe*0.0769;     output; * Upper left x/y point ;
sx=1.92; sy=stripe*0.0769;     output; * Upper right x/y point ;
sx=1.92; sy=(stripe-1)*0.0769; output; * Lower right x/y point ;
sx=0;    sy=(stripe-1)*0.0769; output; * Lower left x/y point ;
end;
run;quit;
data canton(keep=cpolygon cx cy); * Generate x/y points (blue rectangle) ;
cpolygon+1;                        * Rectangle counter ;
cx=0;    cy=1;         output;      * Upper left x/y point ;
cx=0.76; cy=1;         output;      * Upper right x/y point ;
cx=0.76; cy=1-0.5385; output;      * Lower right x/y point ;
cx=0;    cy=1-0.5385; output;      * Lower left x/y point ;
data flag;                  * Combine 3 datasets used to plot U.S. flag  1 ;
set stars stripes canton;
run;quit;
ods listing  gpath="d:/pdf";
ods graphics on / reset=index border=off imagefmt=gif
antialias height=5in width=9.5in reset=index imagename="ym_pdf_008b";
proc sgplot data=flag noautolegend noborder pad=0;
symbolchar name=uniStar char='2605'x;    * Unicode value for 5-pointed star ;
xaxis display=none offsetmin=0 offsetmax=0 values=(0 1.9);
yaxis display=none offsetmin=0 offsetmax=0 values=(.005 1);
* Stripes ("Old Glory Red");
polygon x=sx y=sy id=spolygon / fill fillattrs=(color=CXB22234) nooutline;
* Canton ("Old Glory Blue");
polygon x=cx y=cy id=cpolygon / fill fillattrs=(color=CX3C3B6E) nooutline;
* Stars (White);
scatter x=x y=y / markerattrs=(symbol=unistar color=CXFFFFFF size=38pt);
run;quit;
ods graphics off;
```

```
options validvarname=upcase;
libname sd1 "d:/sd1";
filename ft15f001 temp;
data sd1.have;
infile ft15f001;
input trt_group time subject results @@;
parmcards;
1 2 100 20 1 4 100 30 1 6 100 35 1 8 100 50
1 2 200 40 1 4 200 25 1 6 200 40 1 8 200 30
1 2 300 25 1 4 300 40 1 6 300 45 1 8 300 55
2 2 400 15 2 4 400 35 2 6 400 50 2 8 400 45
2 2 500 35 2 4 500 35 2 6 500 20 2 8 500 35
;
run;quit;
*SAS;
options orientation=portrait;
ods graphics on / height=9in width=7in;
ods pdf file="d:/pdf/&pgm._009a.pdf";
proc sgplot data=sd1.have;
title "Study Results by Treatment Group";
series x=time y=results/ group=subject
grouplc=trt_group name="grouping";
keylegend "grouping" / type=linecolor;
run;quit;
ods pdf close;
*PDS;
%utl_submit_wps64('
options set=R_HOME "C:/Program Files/R/R-3.3.2";
libname wrk sas7bdat "%sysfunc(pathname(work))";
proc r;
submit;
source("c:/Program Files/R/R-3.3.2/etc/Rprofile.site",echo=T);
library(ggplot2);
library(haven);
have<-read_sas("d:/sd1/have.sas7bdat");
have;
pdf("d:/pdf/spaghetti_wps.pdf");
ggplot(have, aes(x=TIME, y=RESULTS, color=factor(SUBJECT))) +
geom_line() + geom_point() +
theme_bw();
endsubmit;
run;quit;
');
```



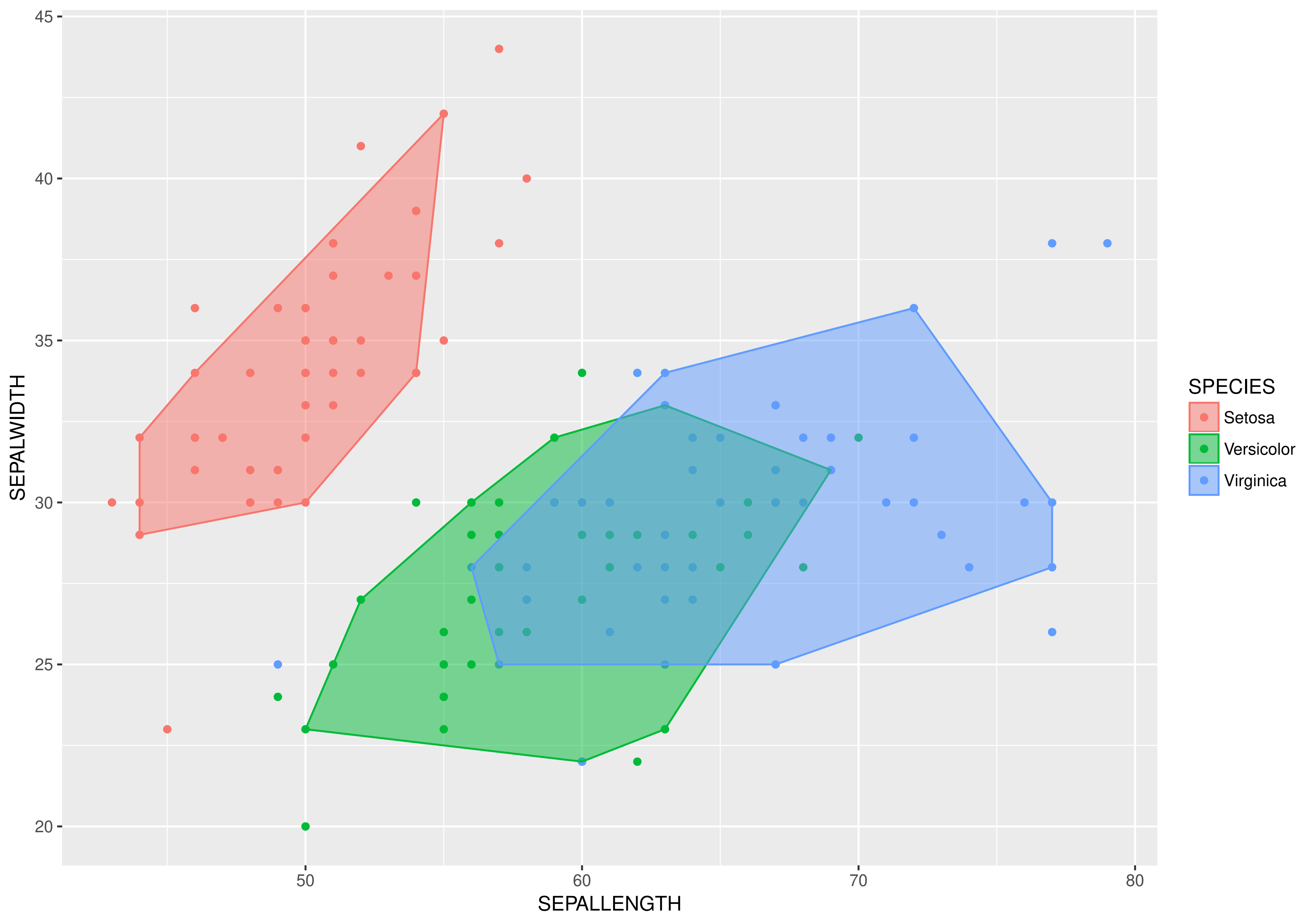
Study Results by Treatment Group
RESULTS
20
30
40
50
2
3
4
5
6
7
8
TIME
1
2



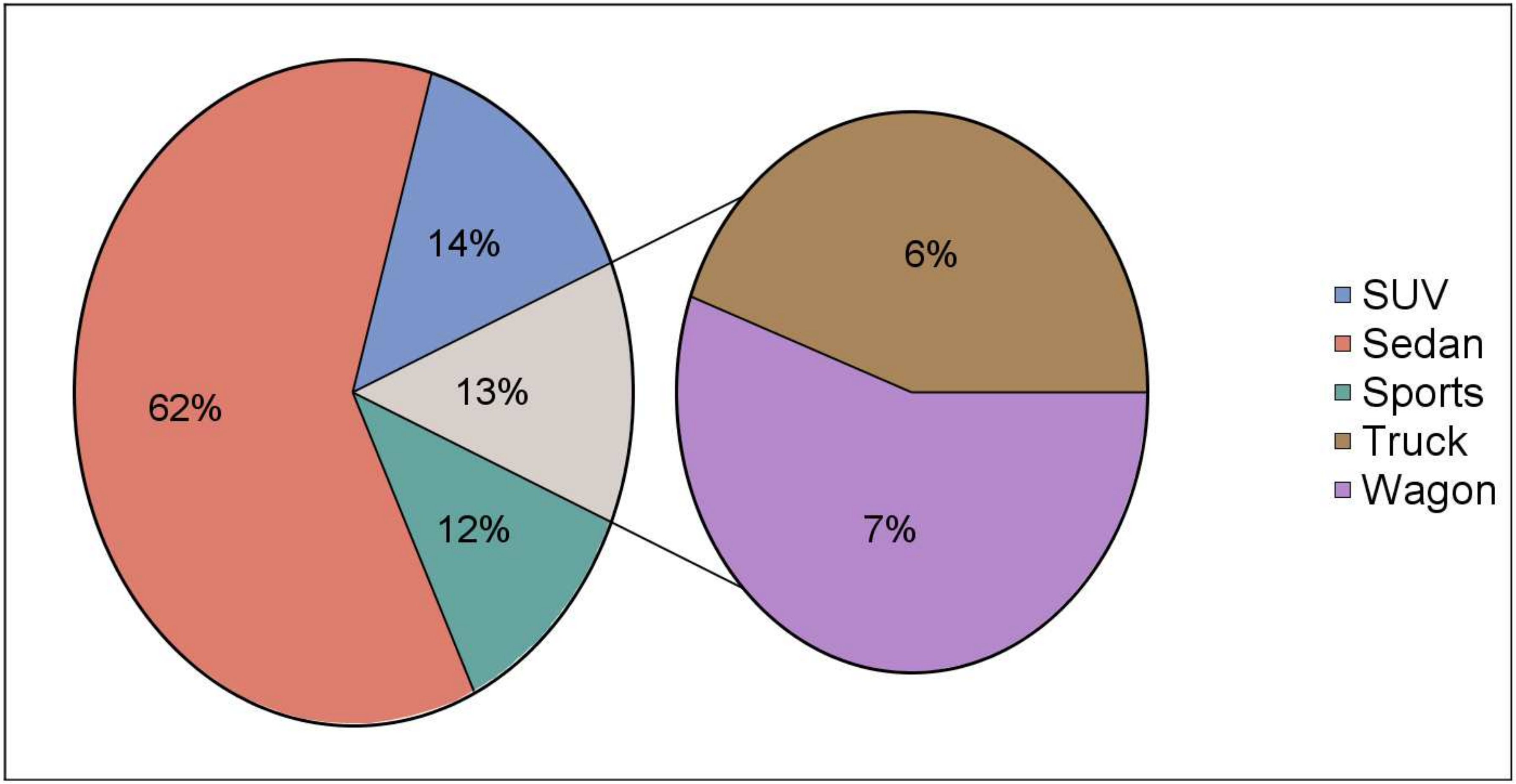
RESULTS
TIME
50
40
30
20
2
4
6
8
factor(SUBJECT)
100
200
300
400
500

```
options validvarname=upcase;
libname sd1 "d:/sd1";
data sd1.have(drop=rec z);;
call streaminit(5731);
do rec=1 to 10000;
x=rand('normal',10,4);
y = 1.5*x + rand('normal',0,8);
z=  10*(x+y);;
output;
end;
run;quit;
%utl_submit_r64('
source("c:/Program Files/R/R-3.3.2/etc/Rprofile.site",echo=T);
library(haven);
library(MASS);
have<-read_sas("d:/sd1/have.sas7bdat");
head(have);
library(RColorBrewer);
library(KernSmooth);
pdf("d:/pdf/&pgm._010b.pdf",10,8);
attach(have);
g=11;
my.cols <- rev(brewer.pal(g, "RdYlBu"));
z <- kde2d(X, Y, n=50);
plot(X, Y, xlab="X", ylab="Y", pch=19, cex=.3, col = "gray60");
contour(z, drawlabels=FALSE, nlevels=g, col=my.cols, add=TRUE, lwd = 2);
abline(h=mean(Y), v=mean(X), lwd=2, col = "black");
legend("topleft", paste("r=", round(cor(X, Y),2)), bty="n");
prob <- c(.99, .95, .90, .8, .5, .1, 0.05);
dx <- diff(z$x[1:2]);
dy <- diff(z$y[1:2]);
sz <- sort(z$z);
c1 <- cumsum(sz) * dx * dy;
levels <- sapply(prob, function(x) {
approx(c1, sz, xout = 1 - x)$y });
plot(X,Y, col = "gray80", pch = 19, cex = 0.3);
contour(z, levels= round (levels,7), add=T, col = "red");
smoothScatter(X, Y, nrpoints=3000, colramp=colorRampPalette(my.cols), pch=19, cex=.3, col = "gre
');
```

```
options validvarname=upcase;
libname sd1 "d:/sd1";
data sd1.iris;
retain sepallength sepalwidth species;
set sashelp.iris
(keep=species sepallength sepalwidth);
run;quit;
%utl_submit_wps64('
options set=R_HOME "C:/Program Files/R/R-3.3.2";
libname sd1 sas7bdat "d:/sd1";
* Largest convex hulls that can contain 95% of the points;
proc r;
submit;
source("c:/Program Files/R/R-3.3.2/etc/Rprofile.site",echo=T);
library(plyr);
library(ggplot2);
library(colorspace);
library(haven);
iris<-read_sas("d:/sd1/iris.sas7bdat");
iris$SPECIES<-as.factor(iris$SPECIES);
str(iris);
alph=0.05;
find_bag = function(x,alpha=alph) {
n=nrow(x);
propinside=1;
target=1-alpha;
x2=x;
while (propinside>target) {
propinside=nrow(x2)/n;
hull=chull(x2);
x2old=x2;
x2=x2[-hull,];
};
x2old[chull(x2old),] };
bags <- ddply(iris, "SPECIES", find_bag, alpha=alph);
plot <- ggplot(data = iris, aes(x = SEPALLENGTH,
y = SEPALWIDTH, colour=SPECIES, fill = SPECIES)) +
geom_point() +
geom_polygon(data = bags, alpha = 0.5) +
labs(x = "SEPALLENGTH", y = "SEPALWIDTH");
pdf("&pgm._012b.pdf",10,7);
plot;
endsubmit;
```



45
40
35
30
25
20
50
60
70
80
SEPALWIDTH
SEPALLENGTH
SPECIES
Setosa
Versicolor
Virginica


14%
62%
13%
12%
6%
7%
SUV
Sedan
Sports
Truck
Wagon

```
data have;
input (uni1 uni2 uni3 uni4) ( $16.);
cards;
^{unicode 2764} ^{unicode 263A} ^{unicode 2605} ^{unicode 2602}
^{unicode 2744} ^{unicode 262E} ^{unicode 2604} ^{unicode 22C8}
^{unicode 272B} ^{unicode 262F} ^{unicode 2600} ^{unicode 25D0}
^{unicode 2601} ^{unicode 2606} ^{unicode 22C6} ^{unicode 2302}
^{unicode 265E} ^{unicode 263C} ^{unicode 2605} ^{unicode 2606}
^{unicode 2639} ^{unicode 2603} ^{unicode 2318} ^{unicode 21F3}
;
run;quit;
options orientation=landscape;
ods pdf file="d:/pdf/ymr_pdf_015b.pdf" ;
ods escapechar='^';
proc report data=have style(column)={font_size=36 cellwidth=1in just=center};
title;
col uni1-uni4;
define uni1 / display "" ;
define uni2 / display "" ;
define uni3 / display "" ;
define uni4 / display "" ;
run;quit;
ods pdf close;
```

♥	☺	★	☂
❄	☮	☄	⋈
✫	☯	☀	◐
☁	☆	★	⌂