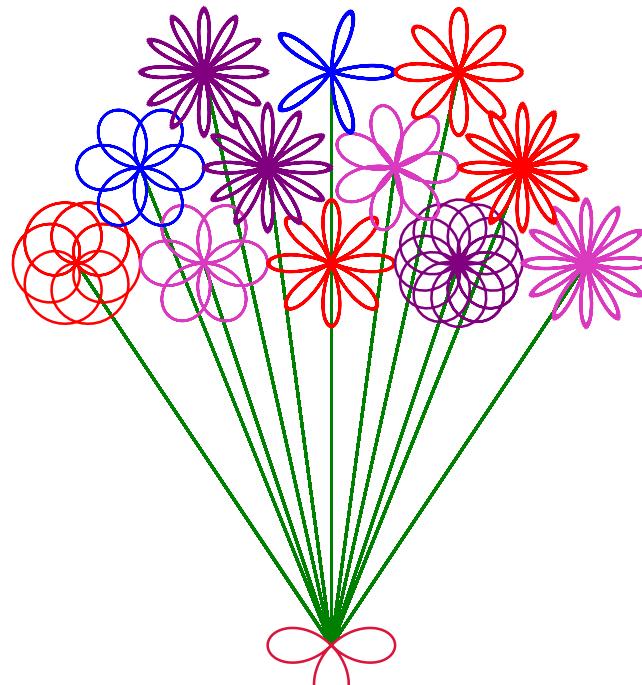


Happy Valentines Day

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

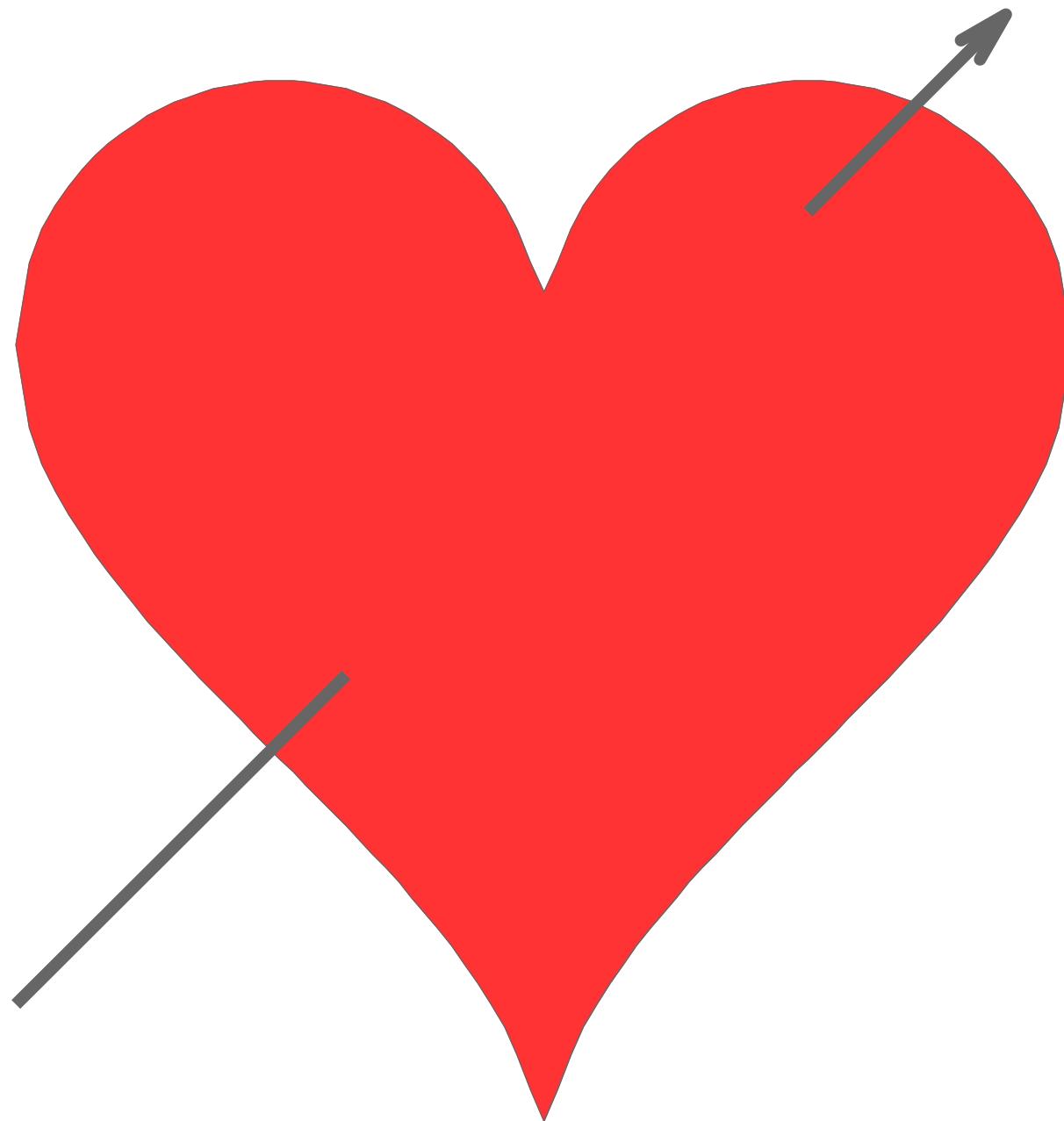
`tut_AddPdfSly.sas`

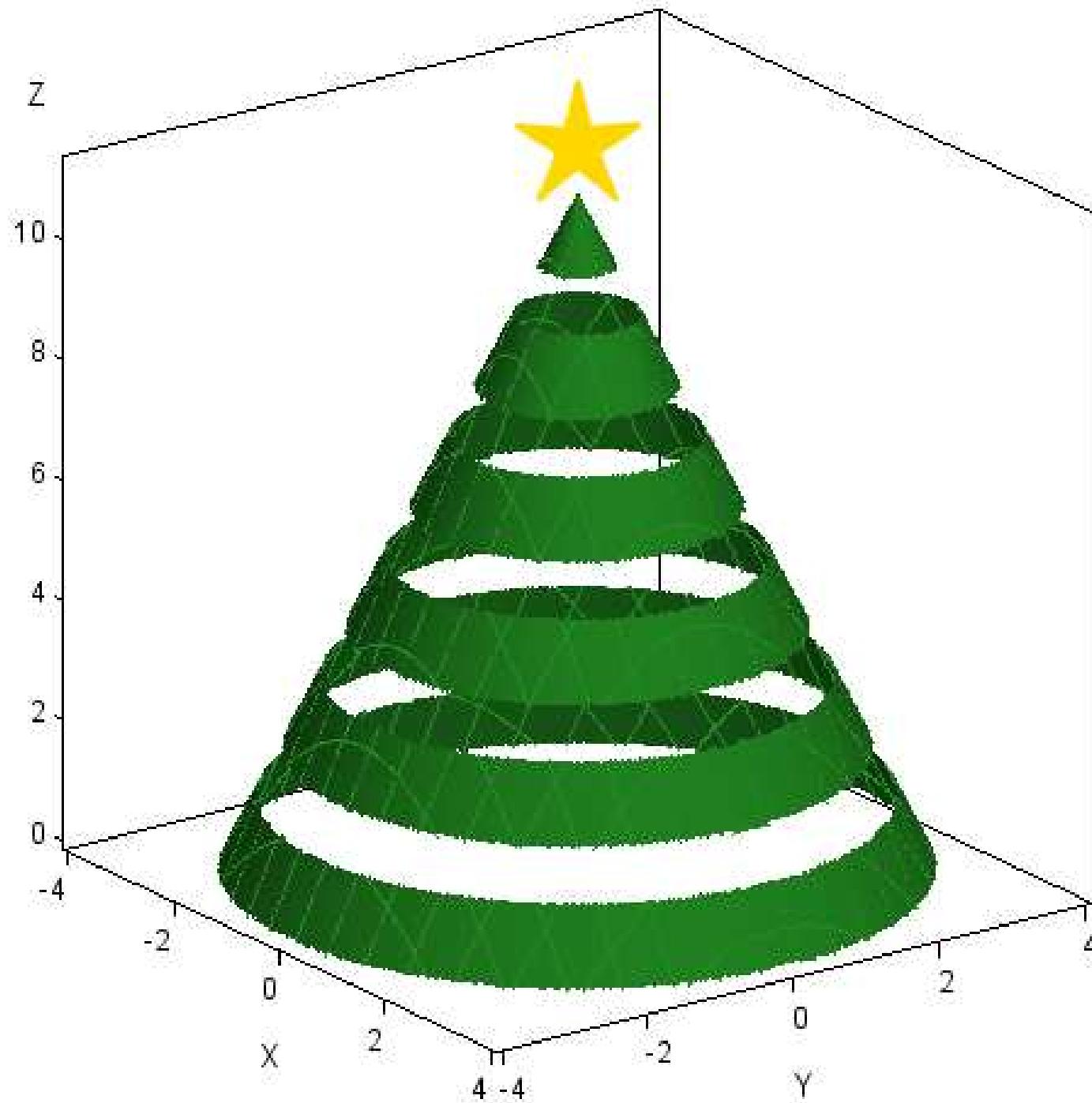
- SAS pdf output

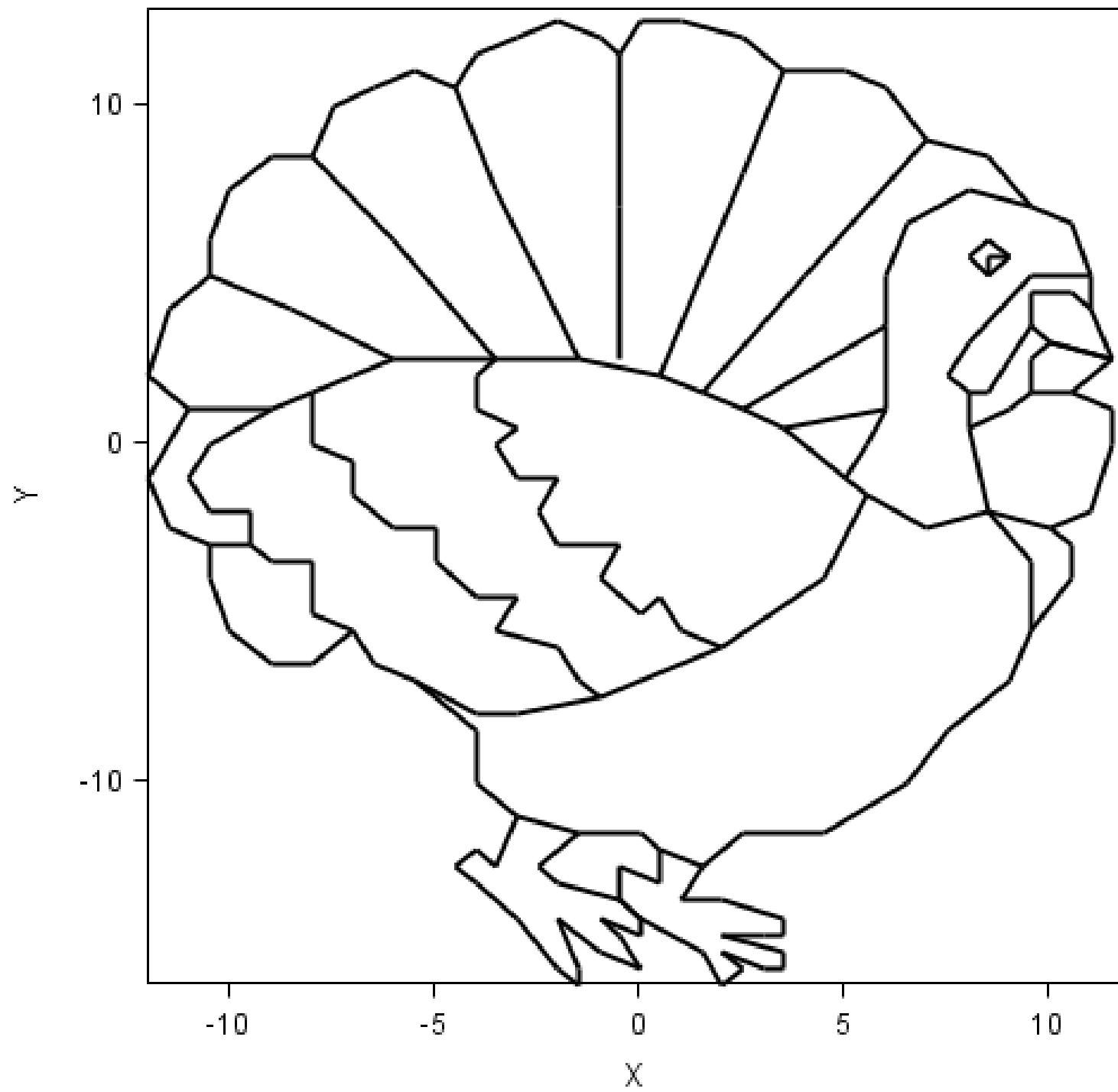
`tut_AddPdfSly.pdf`

Most graphs use sashelp datasets

From Robert Allison Site







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=acos(1-abs(x))-3.14;;
output;;
end;;
run;;
```

Adjustment heart bottom and Arrow

```
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%)

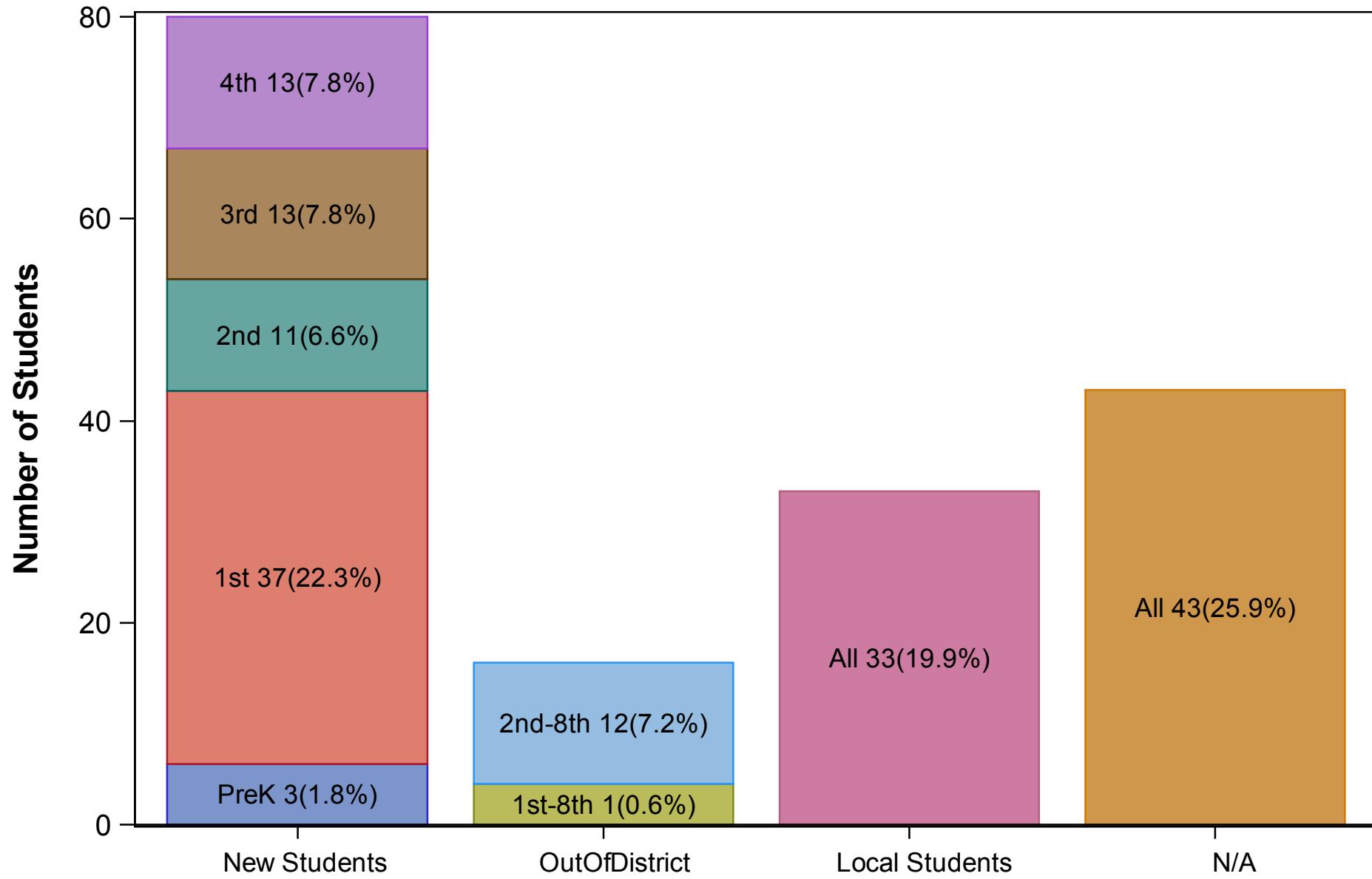
Create bar graph data

```
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)



Multidimensional preference analysis

Comments on Preference Analysis

First two principle components plotted.

Components are orthonormal.

One and two standard deviations from hyperspace mean.

First principle component accounts for more than 70%

Think of the major and minor axis of ellipsoid

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=(labelatrs=(size=15 weight=bold)
    label="Increasing (Deductible + Premium)" shortlabel=XSHORTLAB offsetmin=0.1 offsetmax=0.1 )
  yaxisopts=(labelatrs=(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" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=left valign=top;Layout Gridded;
Entry halign=left "Low Average" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=left valign=bottom;;Layout Gridded;
Entry halign=left "Cheapest" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=right valign=center;;Layout Gridded;
Entry halign=left "Expensive" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=left valign=center;;Layout Gridded;
Entry halign=left "Very Cheap" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=center valign=top;;Layout Gridded;
Entry halign=left "High Average" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=center valign=center;;Layout Gridded;
Entry halign=left "Average Cost" / textatrs=(color=green weight=bold);endlayout;endlayout;
Layout Gridded / Border=false halign=center valign=bottom;;Layout Gridded;
Entry halign=left "Low Average" / textatrs=(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;
```

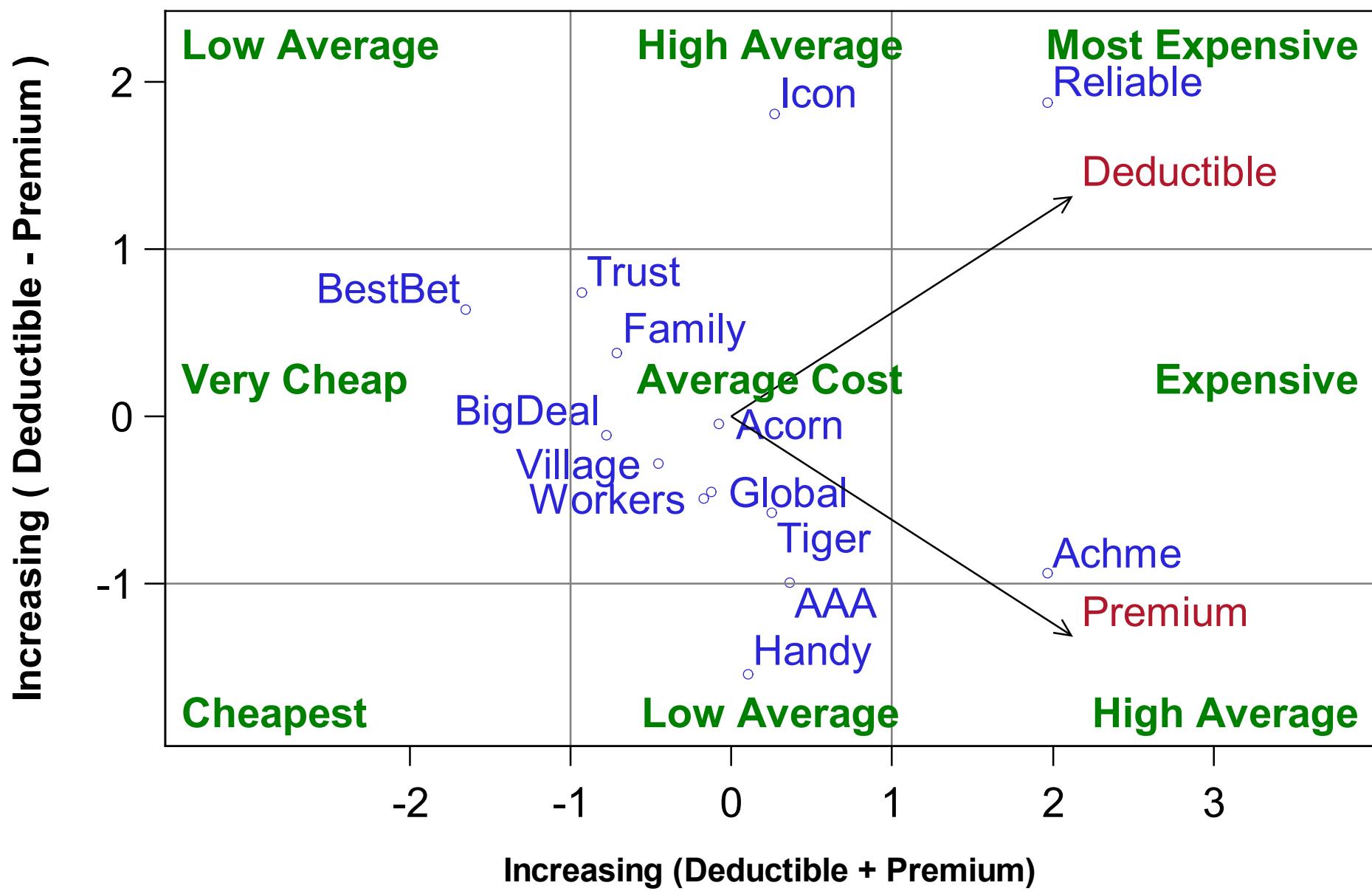
Data for multidimensional car insurance analysis

```
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)



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

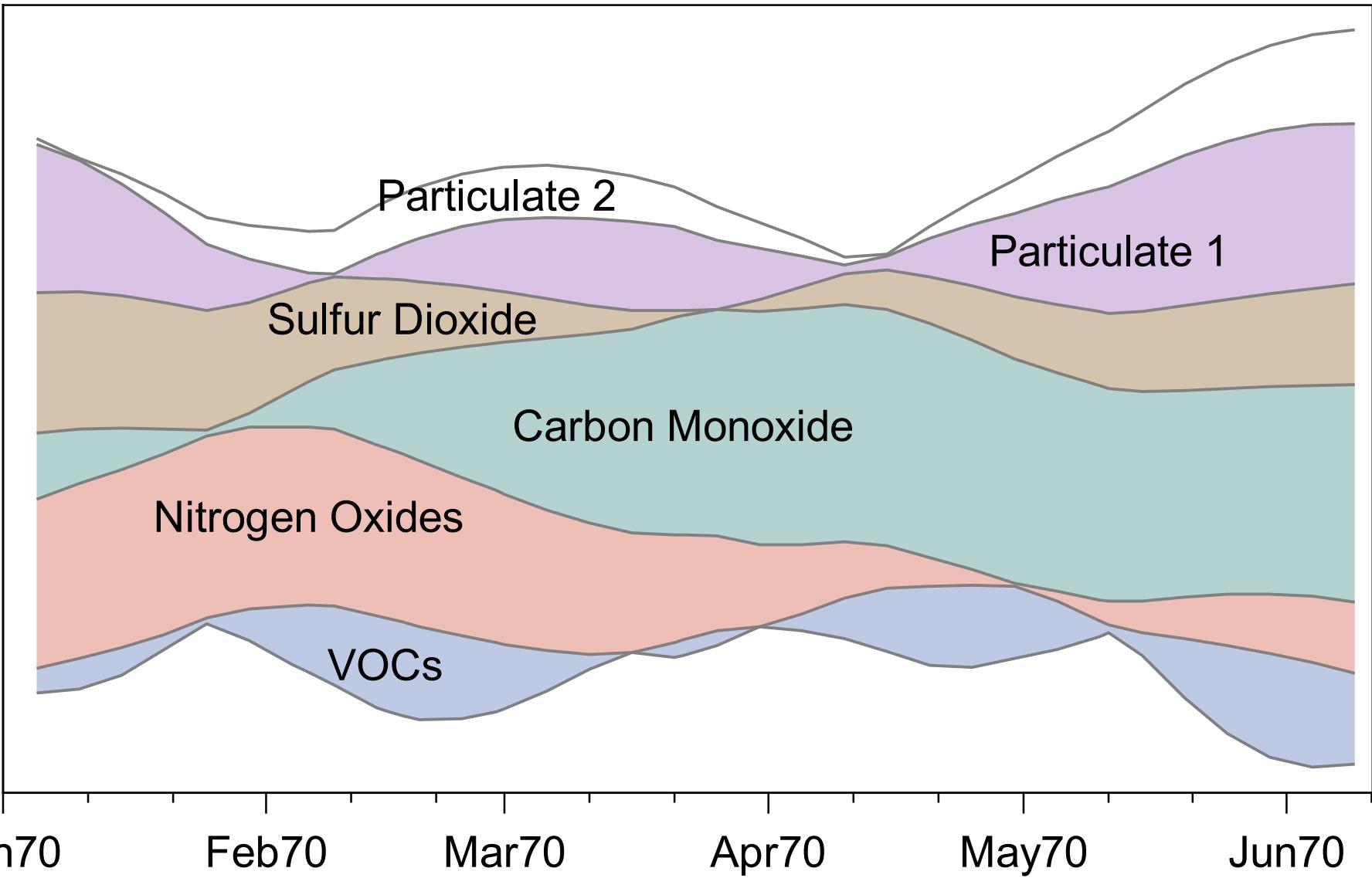
```
proc template;
  define statgraph river;
    dynamic dynTime "time"
      dynLL1 "first lower limit" dynLU1 "first upper limit"
      dynLL2 dynLU2 dynLL3 dynLU3 dynLL4 dynLU4 dynLL5 dynLU5 dynLL6 dynLU6
      dynTitle dynFootNote;
  begingraph / designwidth=7in designheight=4.5in;
    entrytitle 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



(Simulated data) Stacked Graphs. Byron & Wattenberg. IEEE InfoVis 2008

Time series model of asthma

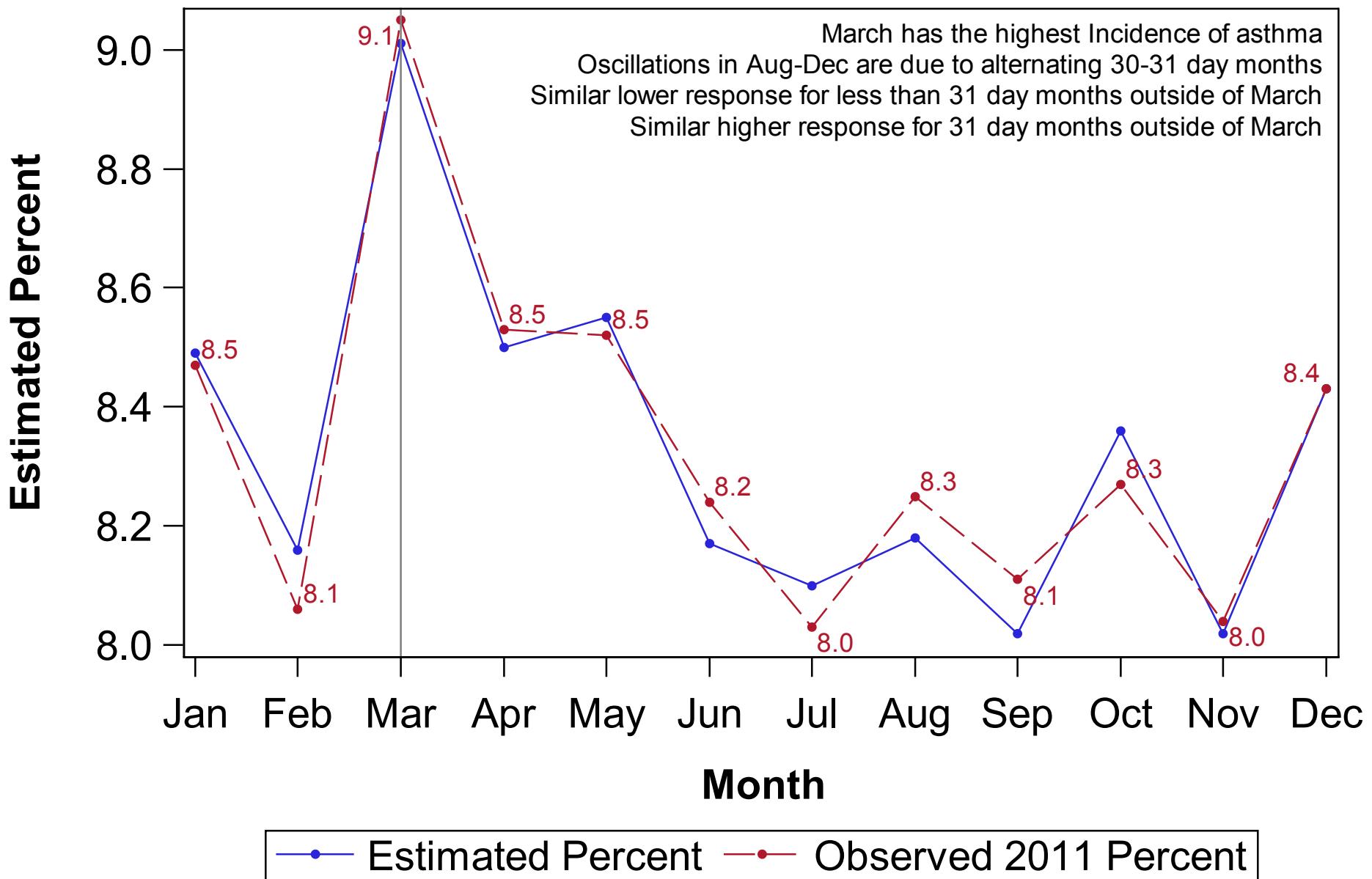
Asthma time series data

```
%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



Fourier time series model of asthma

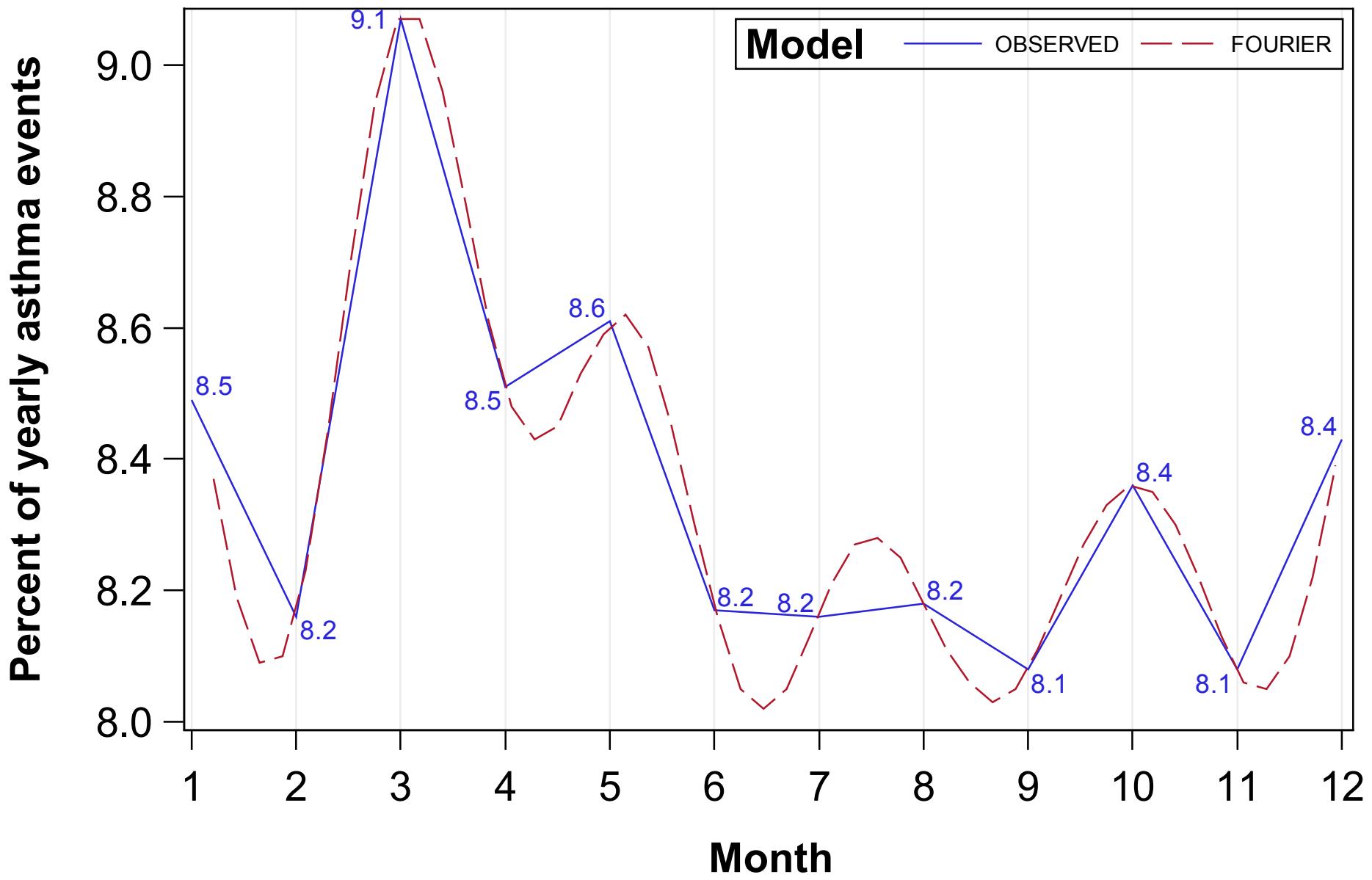
Data for Fourier model to compare with timeseries model

```
%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(5.00,5.00,"OBSERVED",8.61,8.61);&_ins Values(5.15,5.15,"FOURIER",8.62,.);
&_ins Values(5.37,5.37,"FOURIER",8.57,.);&_ins Values(5.59,5.59,"FOURIER",8.45,.);
&_ins Values(5.81,5.81,"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 datalabelatrs=(size=12)
grouplc=model name="Models";
xaxis values=(1 to 12 by 1) grid;
keylegend / location = inside
           position=TopRight valueatrs=(size=10);
run;quit;
```

Fourier Series Model of Asthma

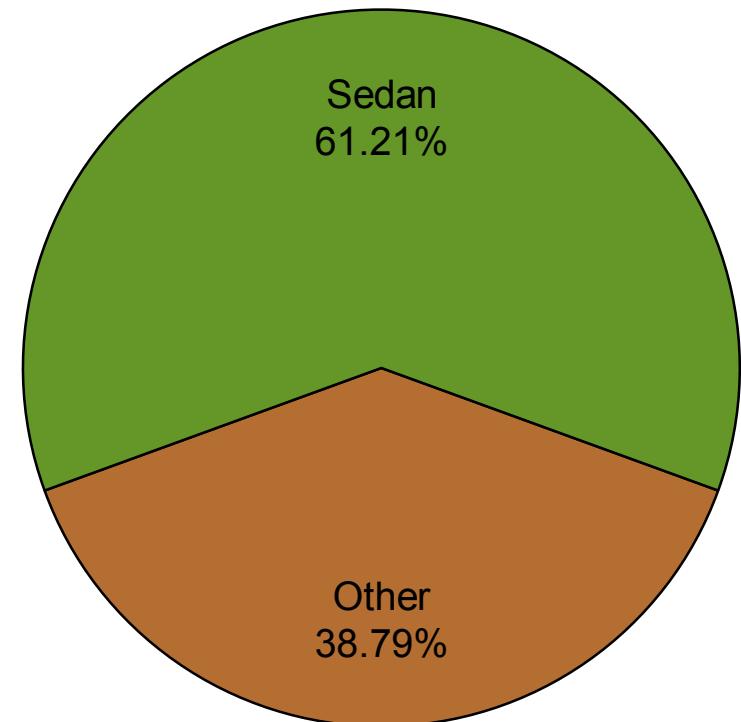
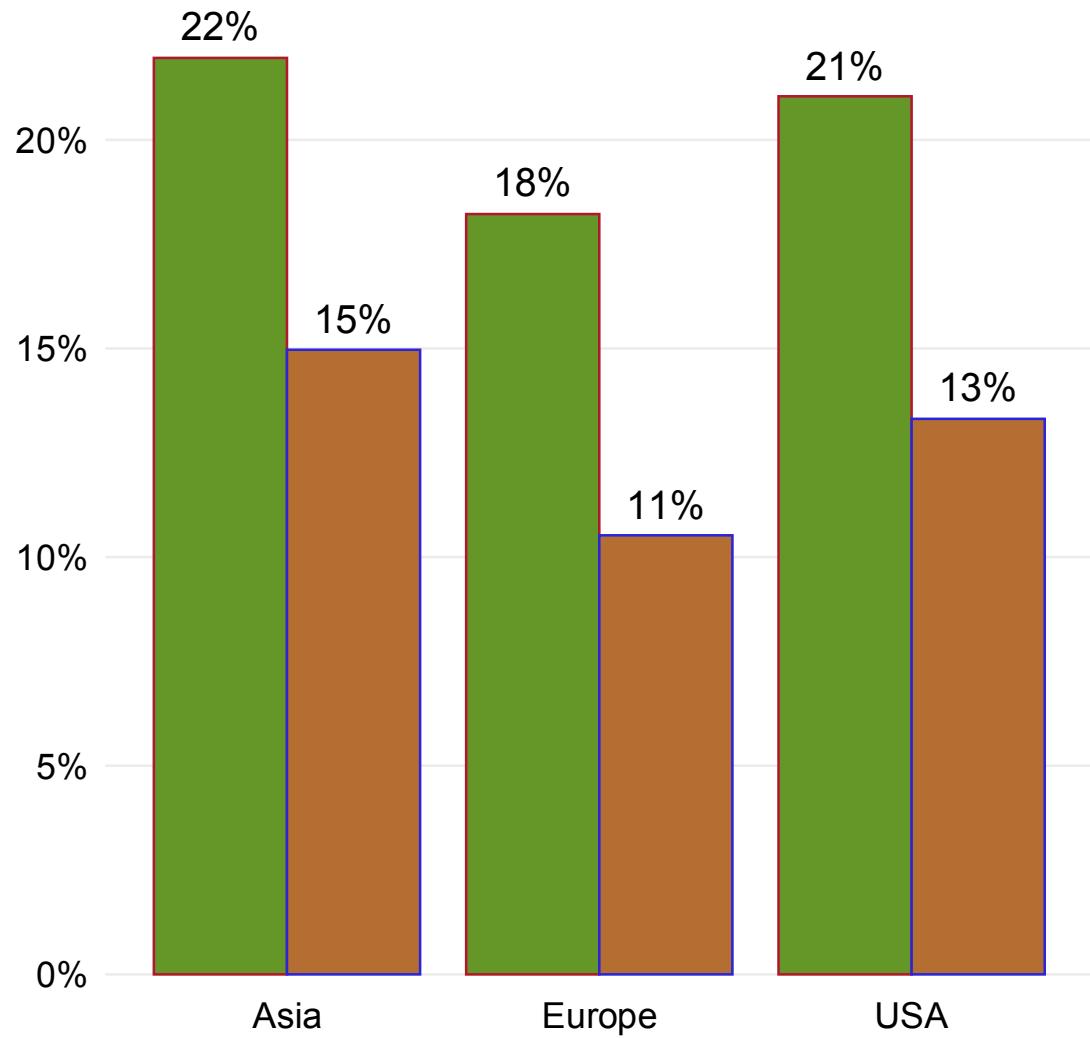


SAS Template Pie Chart and Barchart together -see SLY220

```
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

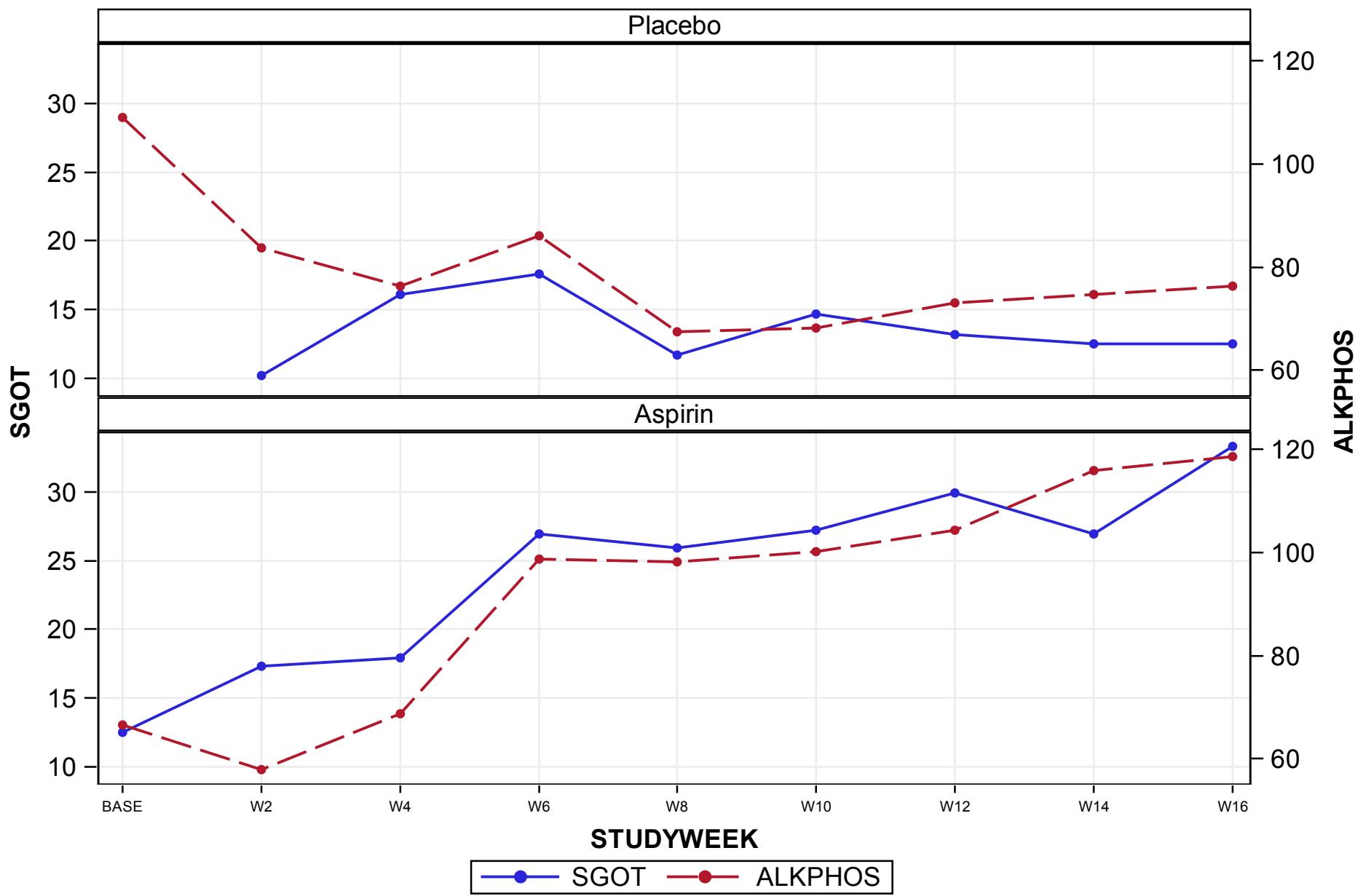
Sedan Other



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=(tickvalueatrs=(size=7) griddisplay=on)
columns=1 headerLabelDisplay=Value cellheightmin=50;
layout prototype / cycleattrs=true;
SeriesPlot X=studyweek Y=sgot / primary=true display=(markers)
markeratrs=(size=9px symbol=circlefilled)
lineatrs=(thickness=2px) NAME="s1";
SeriesPlot X=studyweek Y=ALKPHOS / yaxis=y2 display=(markers)
markeratrs=(size=9px symbol=circlefilled)
lineatrs=(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

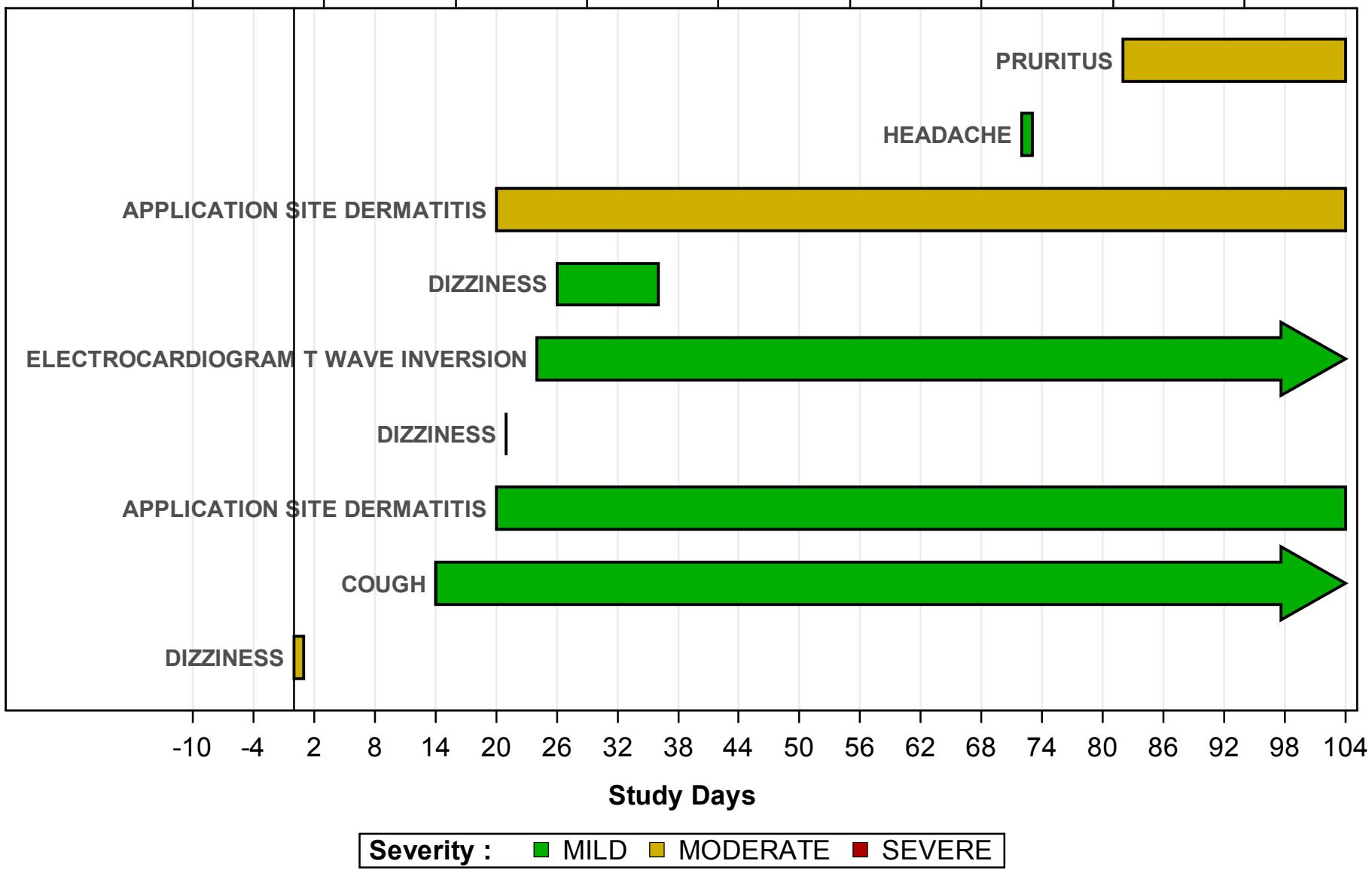


Adverse action patient profile see attached SLY240.sas for datand code

```
title "Adverse Events for Patient Id = xx-xxx-xxxx";
proc sgplot data=ae2 nocycleattrs dattrmap=attrmap;
highlow y=aeseq low=stday high=enday / group=aelev 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

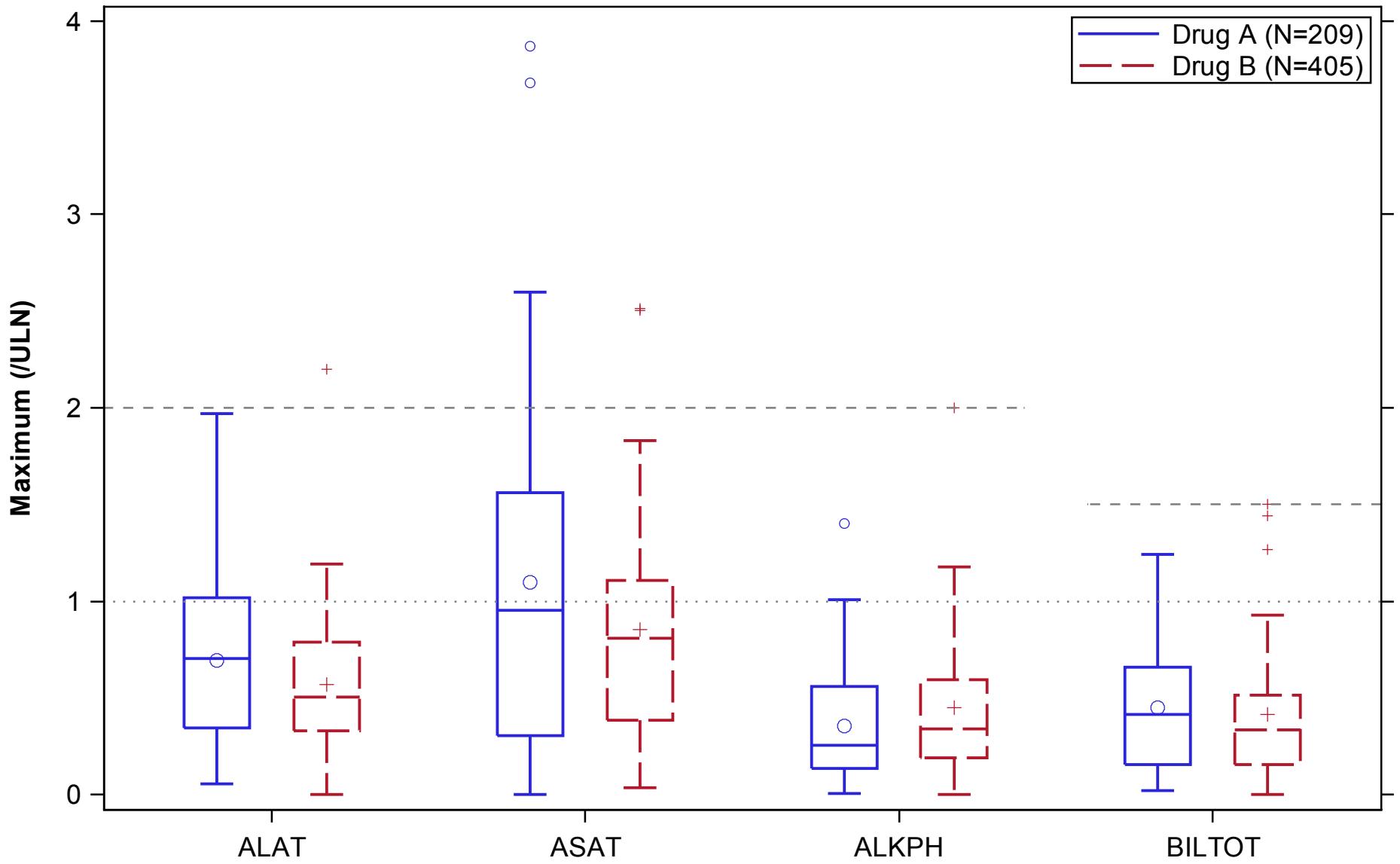
24Feb13 09Mar13 22Mar13 04Apr13 17Apr13 30Apr13 13May13 26May13 08Jun13



Maximum Liver Function Test Values by Treatment SLY250.sas

```
proc template;
define statgraph LFT_MaxByTrt;
dynamic _footnote _thick;
begingroup;
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;
```

Maximum Liver Function Test Values by Treatment



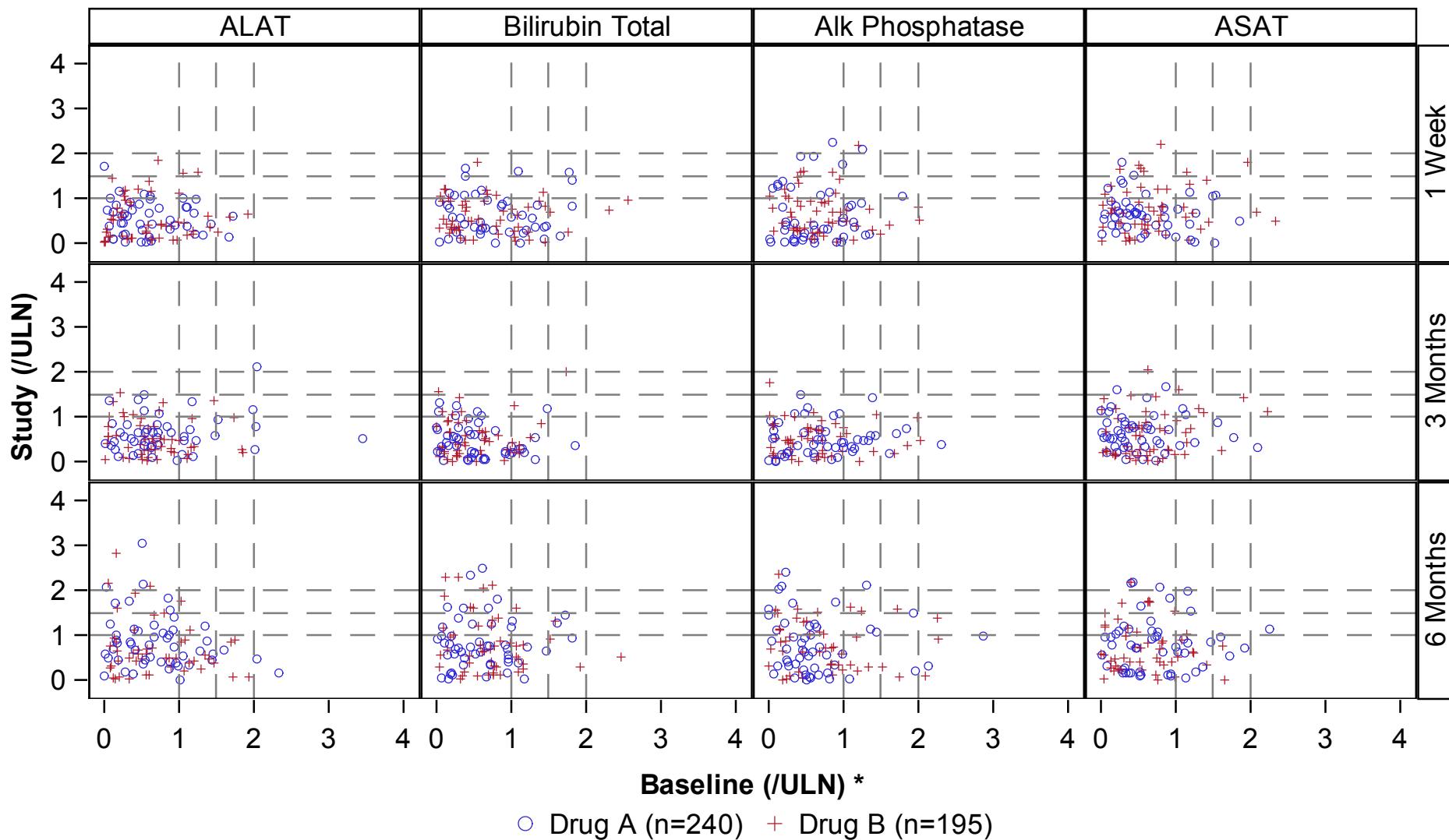
For ALAT, ASAT and ALKPH, the Clinical Concern Level is 2 ULN;
For BILTOT, the CCL is 1.5 ULN: where ULN is Upper Level Normal Range

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;
```

LFT Safety Panel, Baseline vs. Study



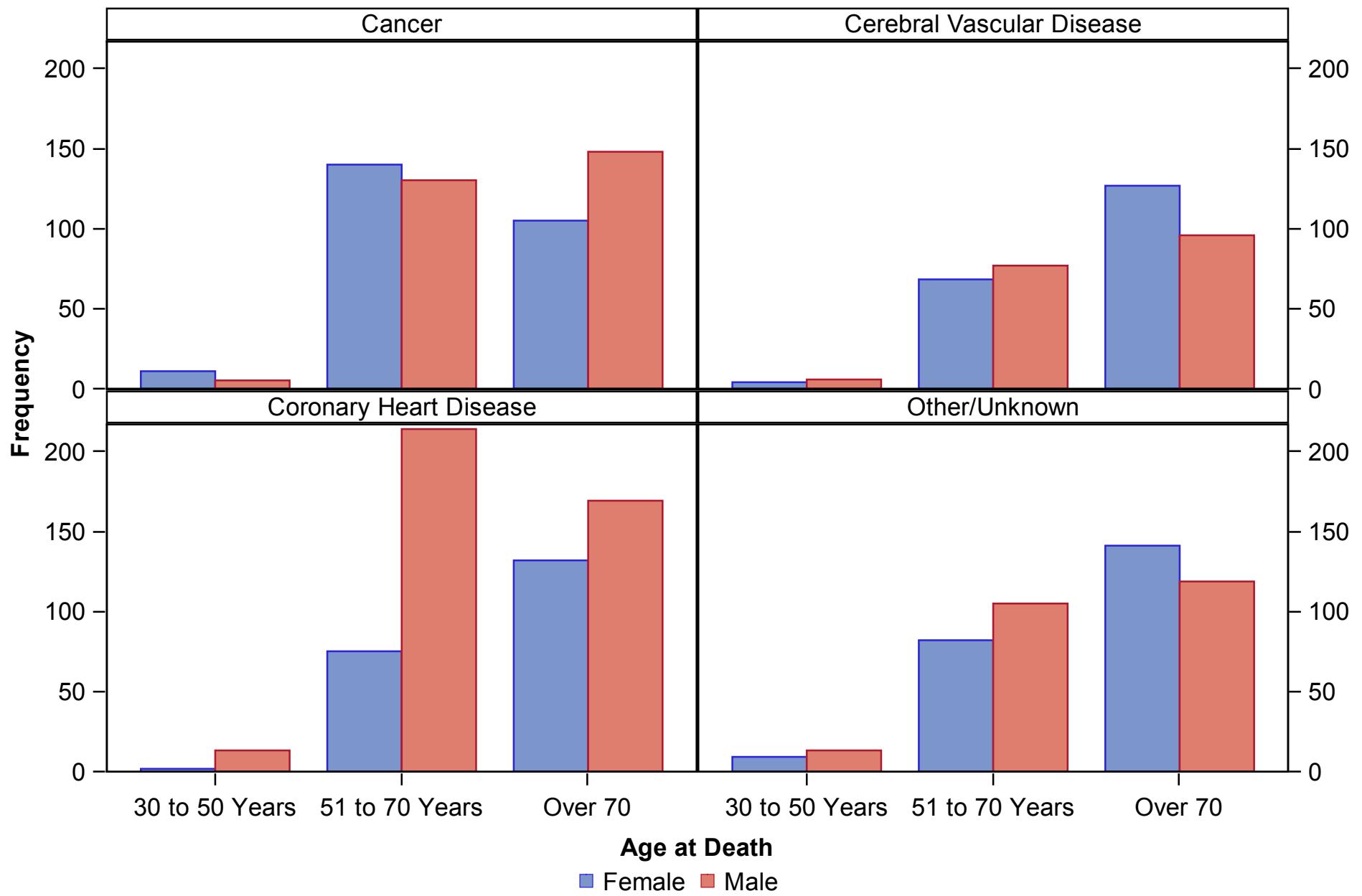
* For ALAT, ASAT and Alkaline Phosphatase, the Clinical Concern Level is 2 ULN;
For Bilirubin Total, the CCL is 1.5 ULN: where ULN is the Upper Level of Normal

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;
```

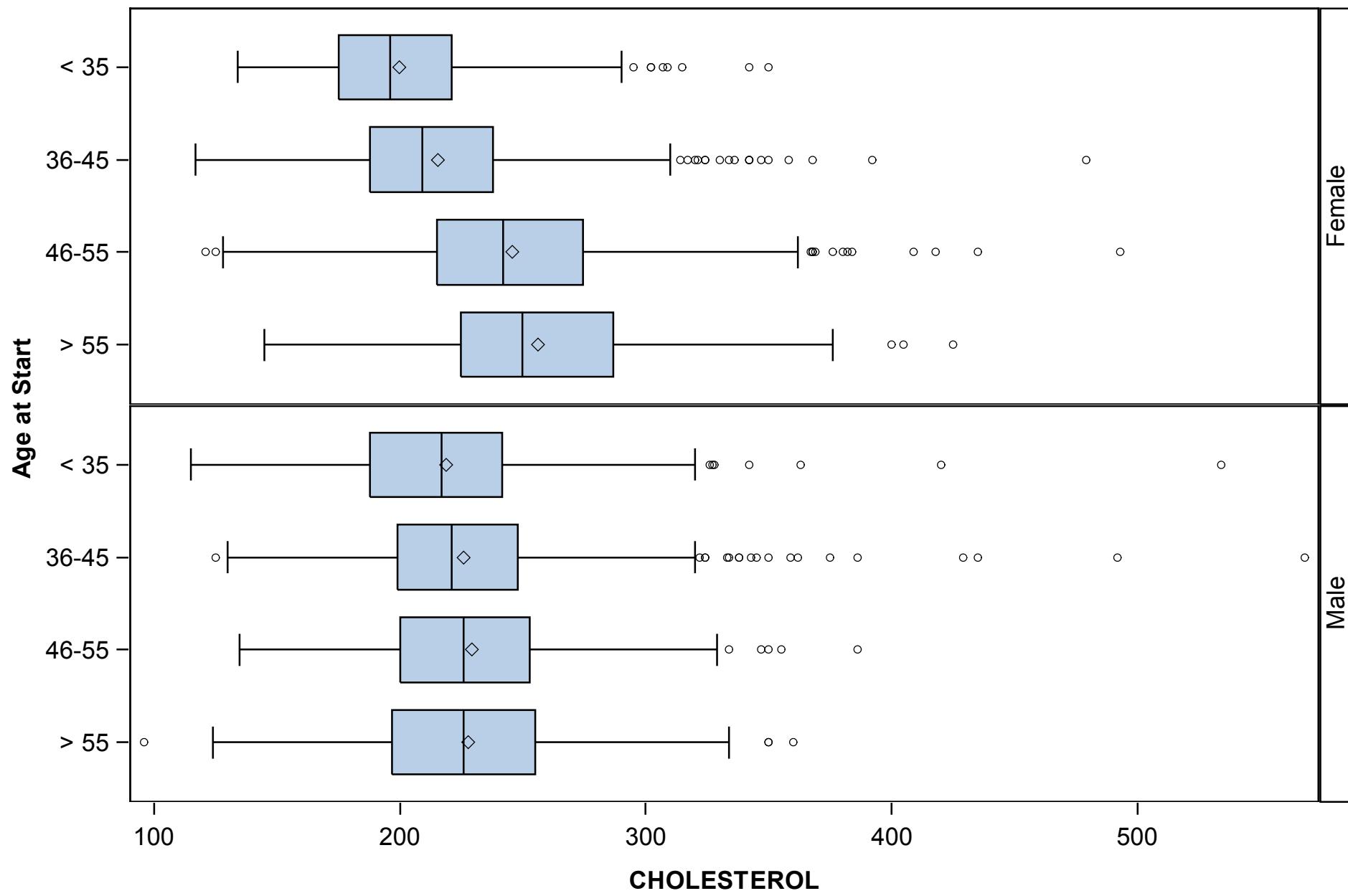
Heart Related Deaths



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" = cxaaf9f;
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;
```

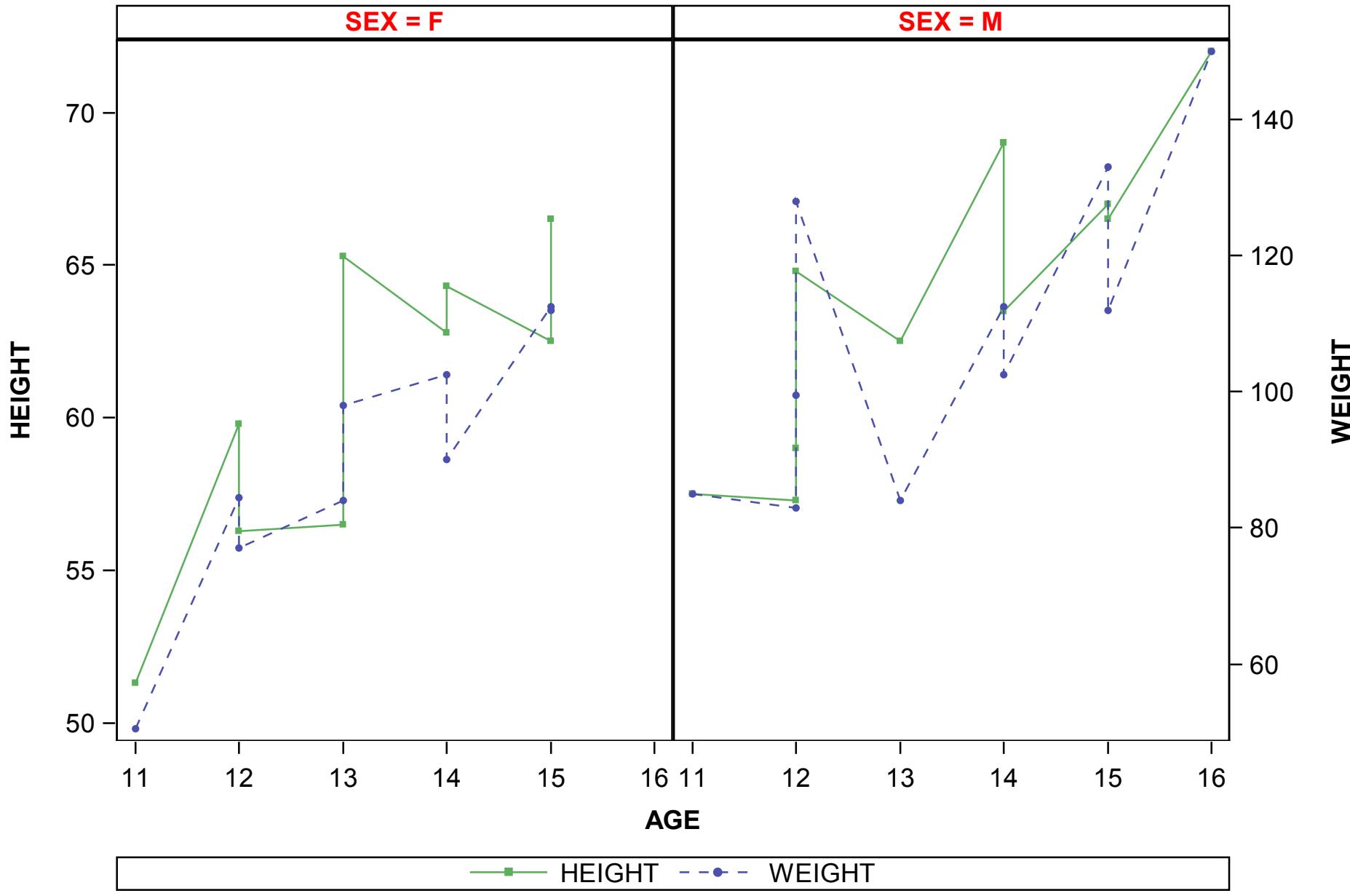
Cholesterol by Sex and Age Group



SERIESPLOT Statement with different Y2AXIS sly290.sas

```
proc template;
define statgraph plot;
begingroup;
entrytitle "SERIESPLOT Statement with Y2AXIS" ;
layout datapanel classvars=(sex) / columns=2 rows=1
headerlabelatrs=(color=red weight=bold)
headeropaque=false; layout prototype;
seriesplot x=age y=height / group=dose display=all name="height"
lineatrs=(color=cx5DAF5D)
markeratrs=(symbol=squarefilled color=cx5DAF5D);
seriesplot x=age y=weight / group=dose
yaxis=y2 display=all name="weight"
lineatrs=(color=cx4B50AA pattern=2)
markeratrs=(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;
```

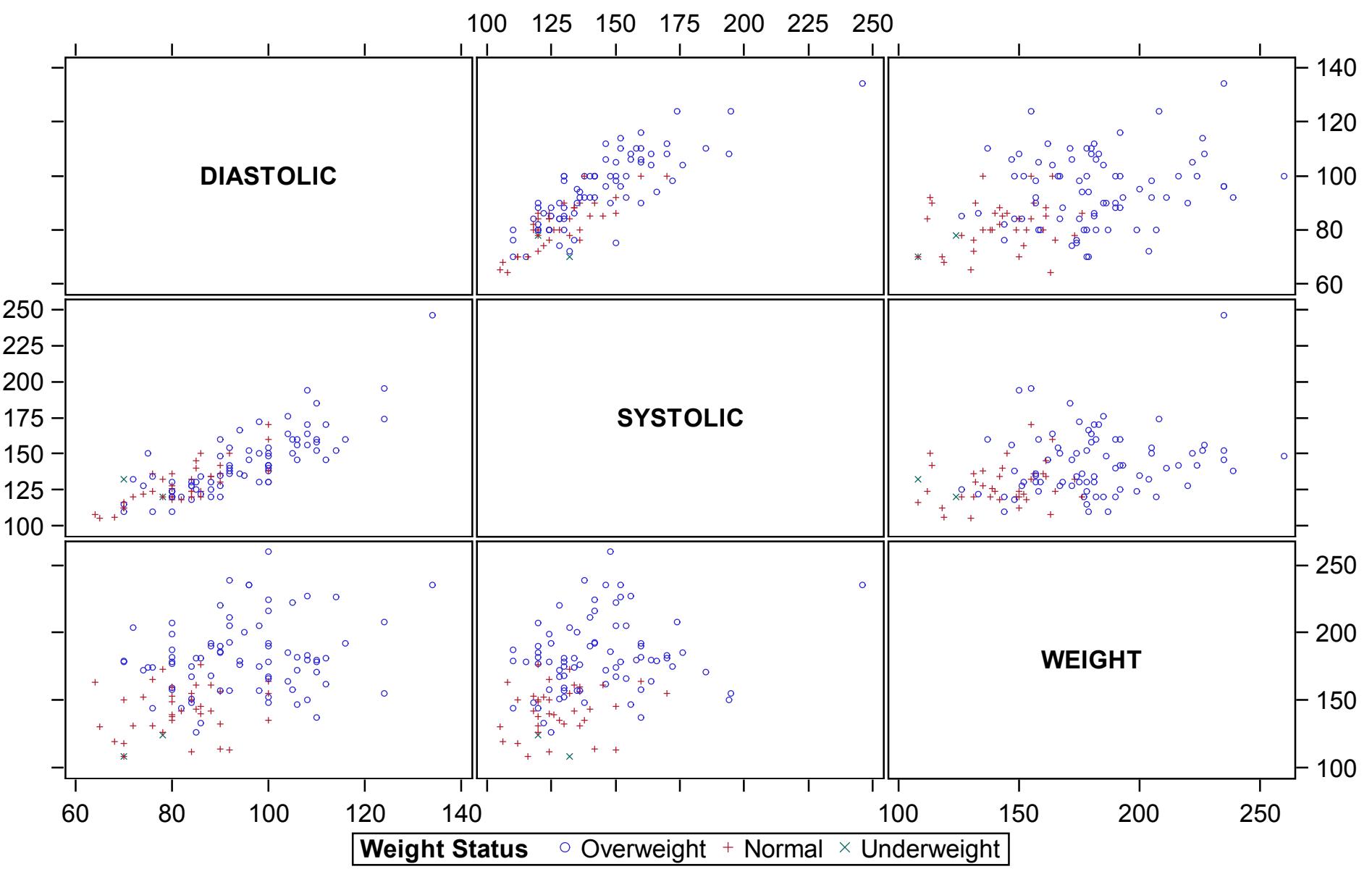
SERIESPLOT Statement with Y2AXIS



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;
```

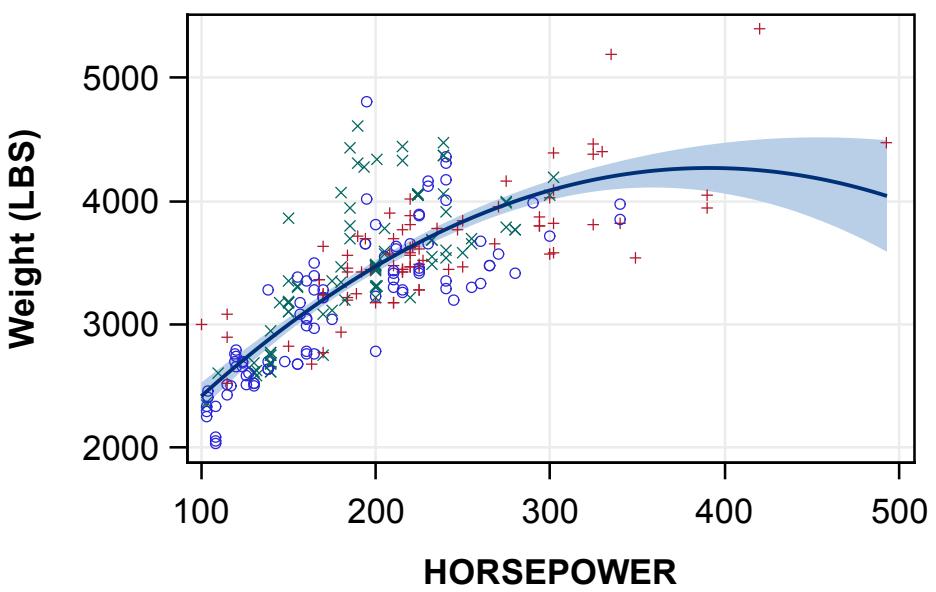
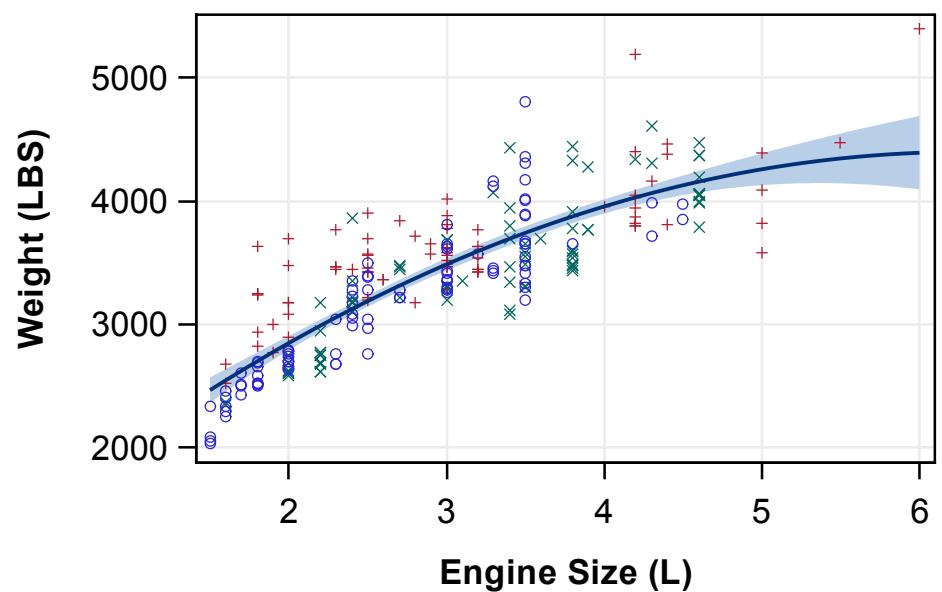
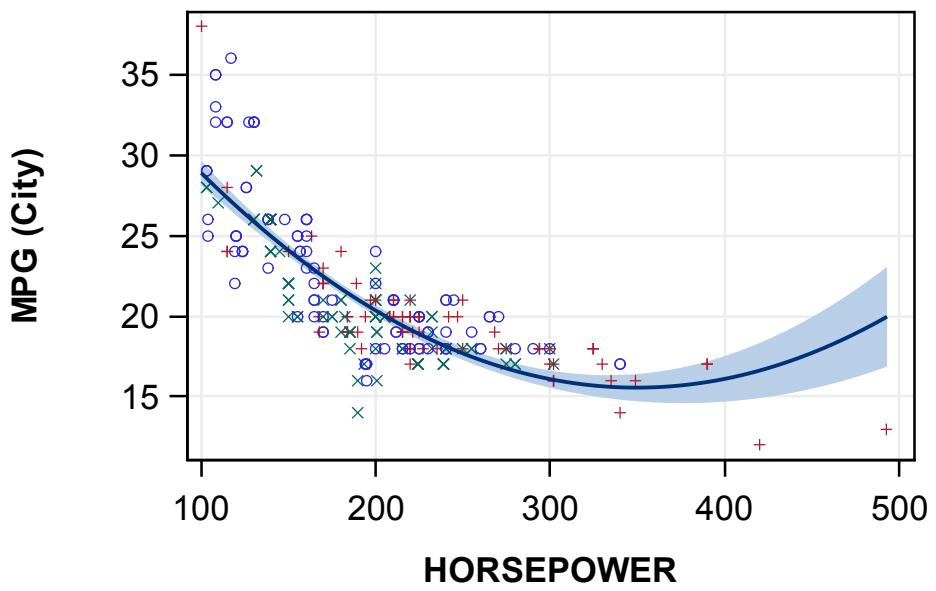
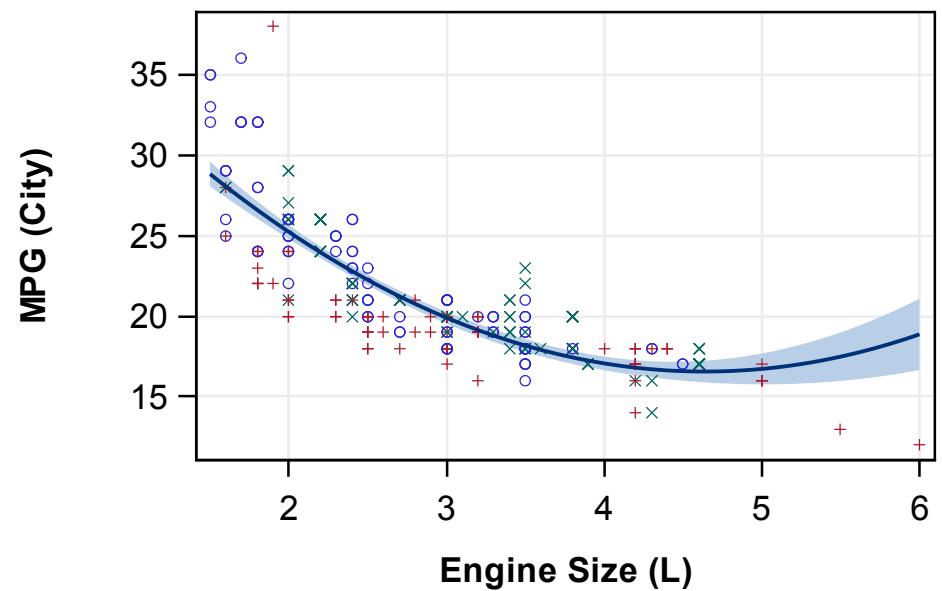
Blood Pressure Trends by Weight Status in heart disease patients under 50



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;
```

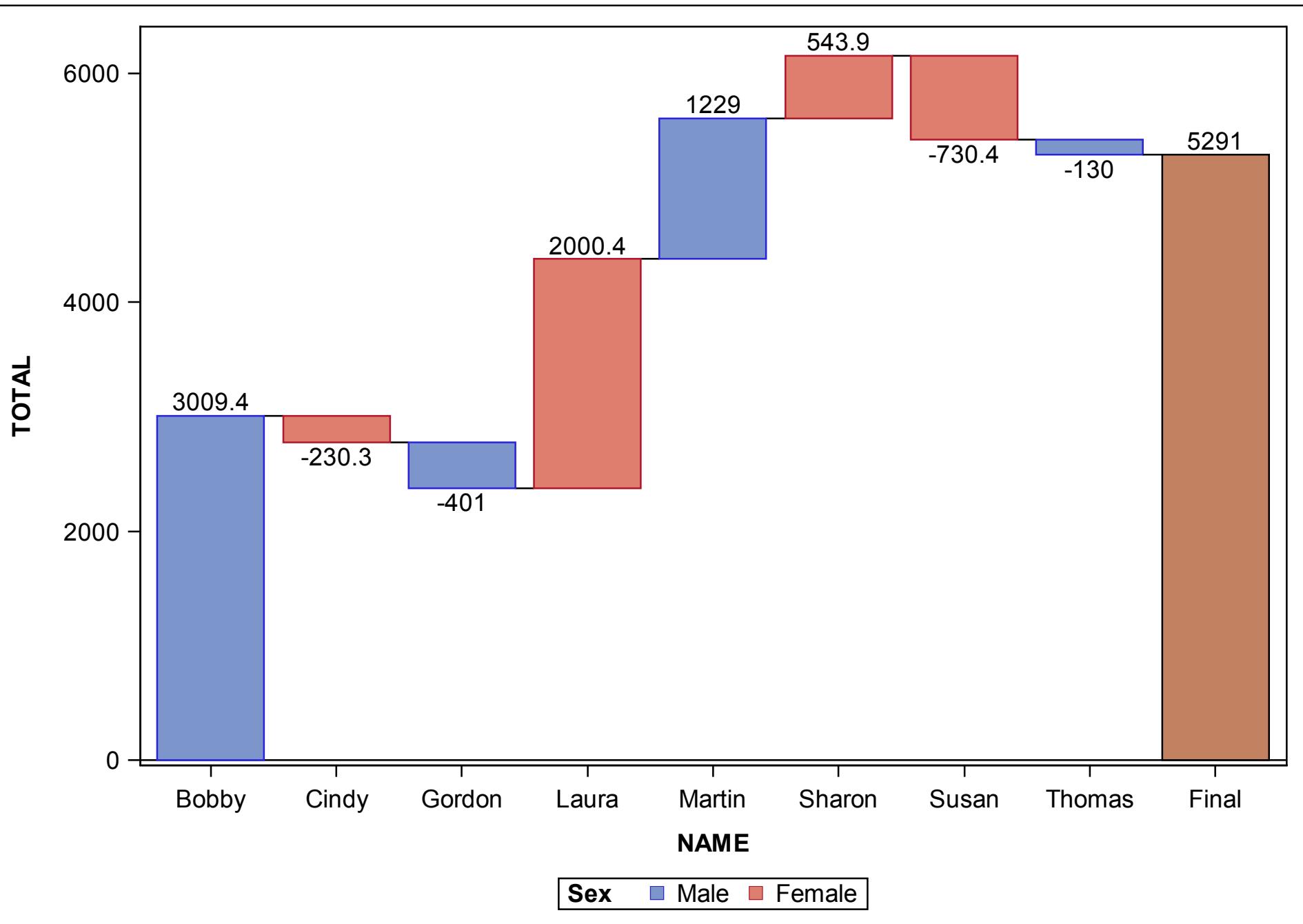
Auto Performance Statistics



ORIGIN ○ Asia + Europe × USA

Waterfallchart SLY320.sas

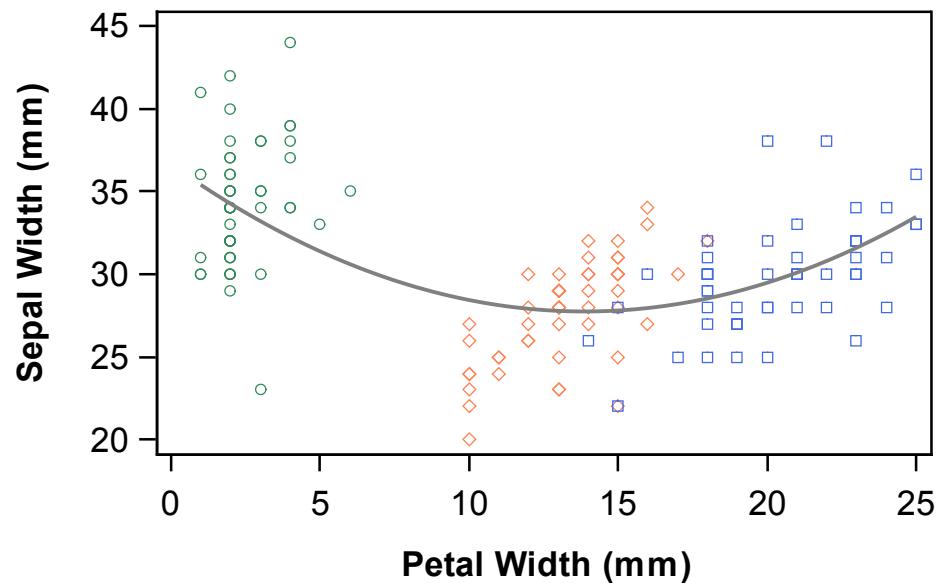
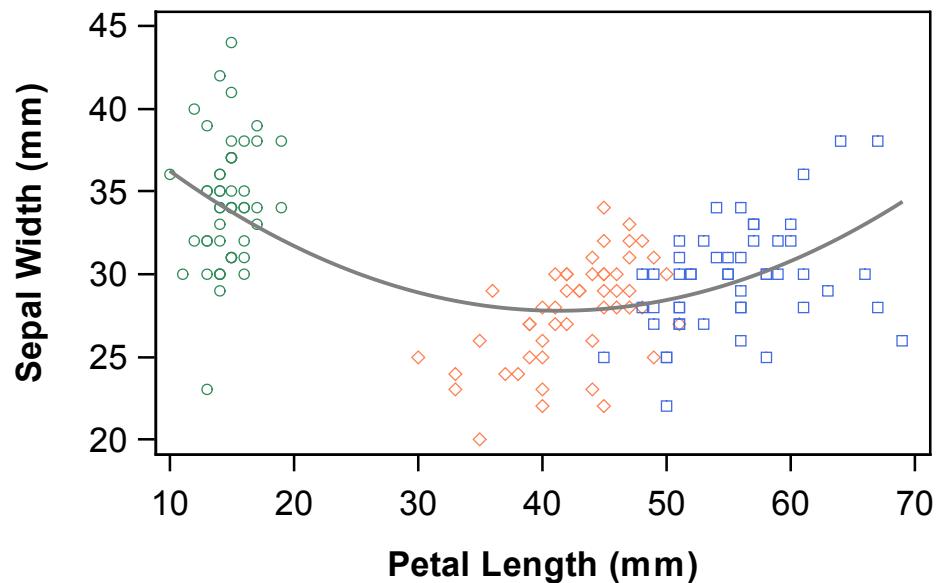
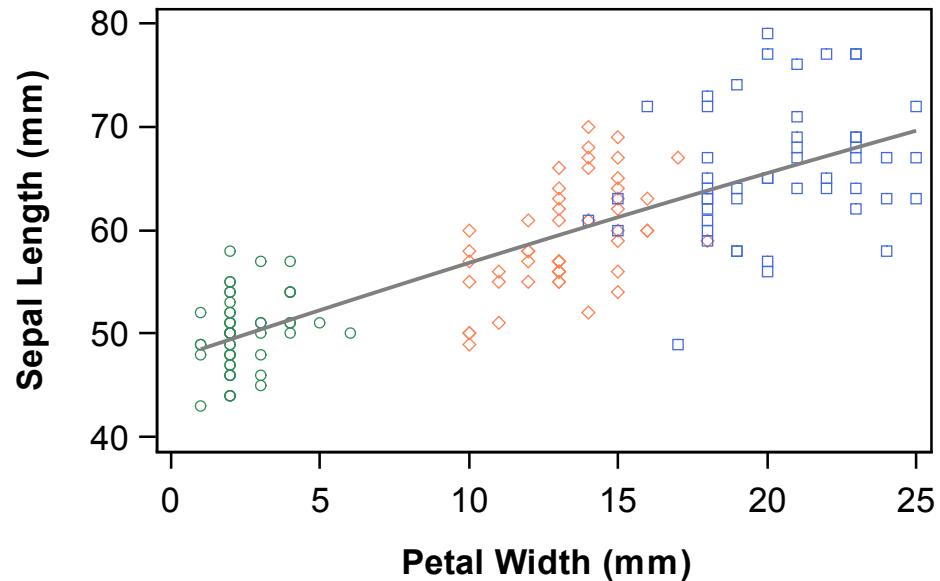
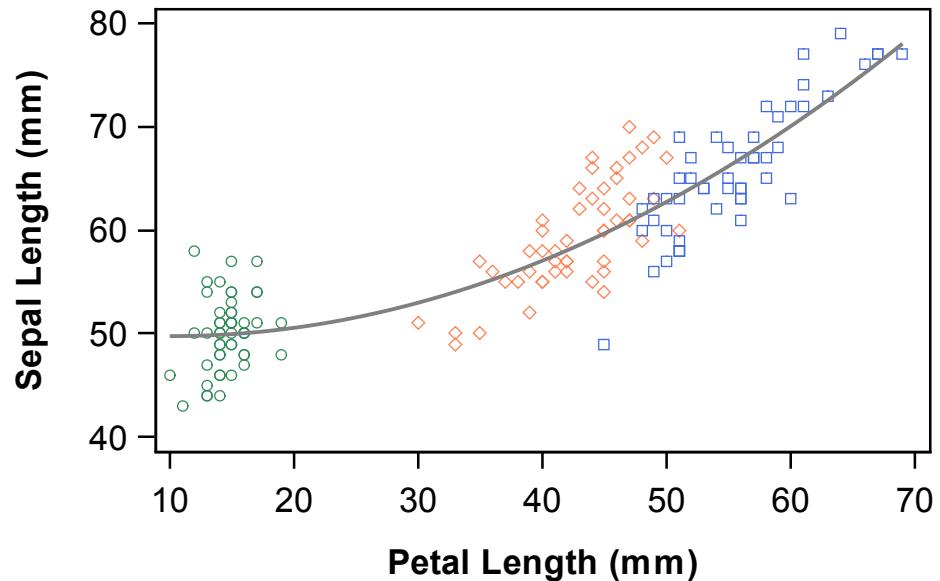
```
data totals;
input sex $ : Name $ Total dollar8.2;
datalines;
Male Martin 1229.00
Male Thomas -130.00
Male Bobby 3009.40
Male Gordon -400.95
Female Susan -730.43
Female Cindy -230.34
Female Sharon 543.90
Female Laura 2000.40
;
run;
proc sort data=totals;by name;run;
proc template;
define statgraph 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;
```



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

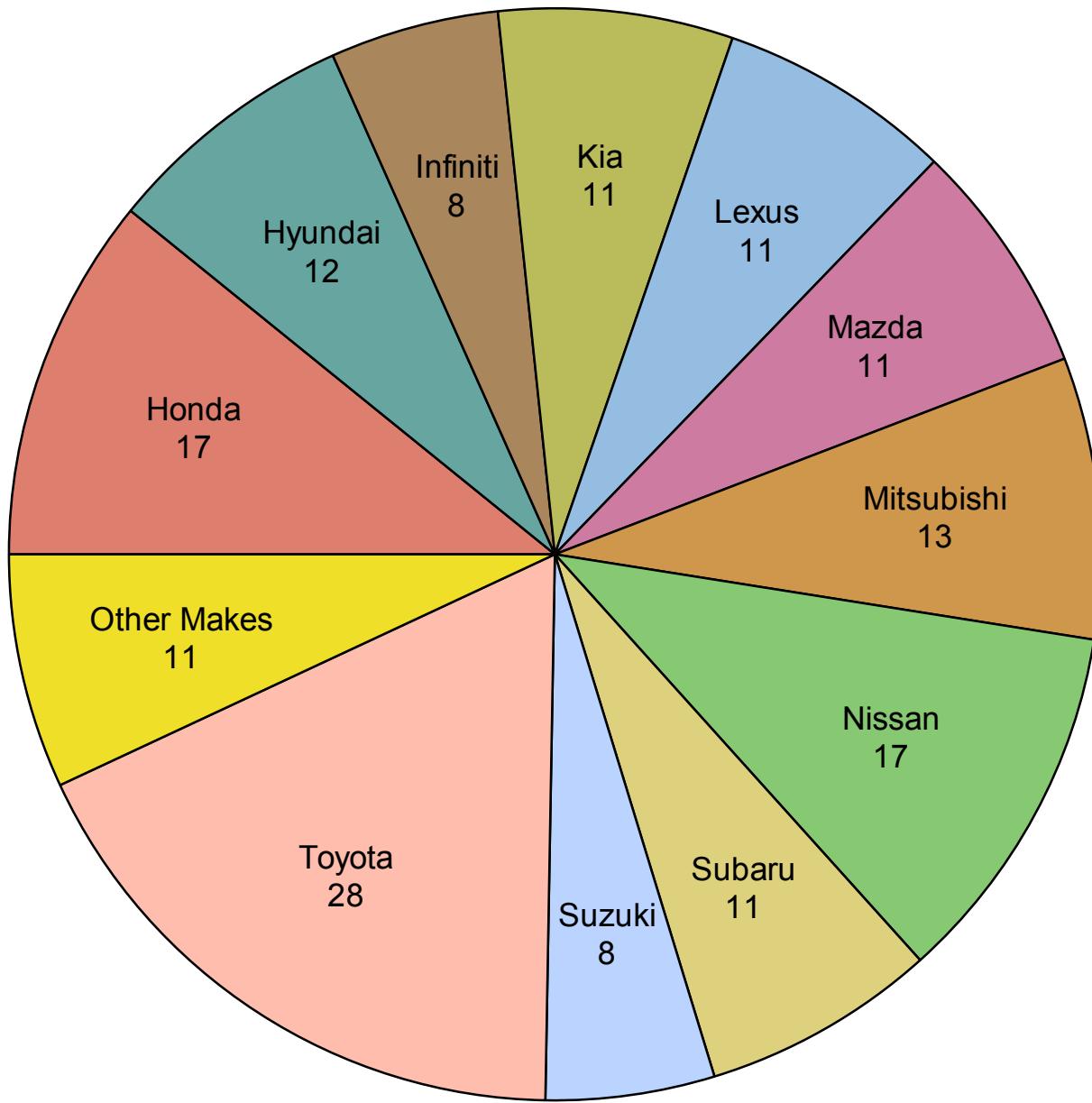


Iris Species ● Setosa ▲ Versicolor ■ Virginica

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;
```

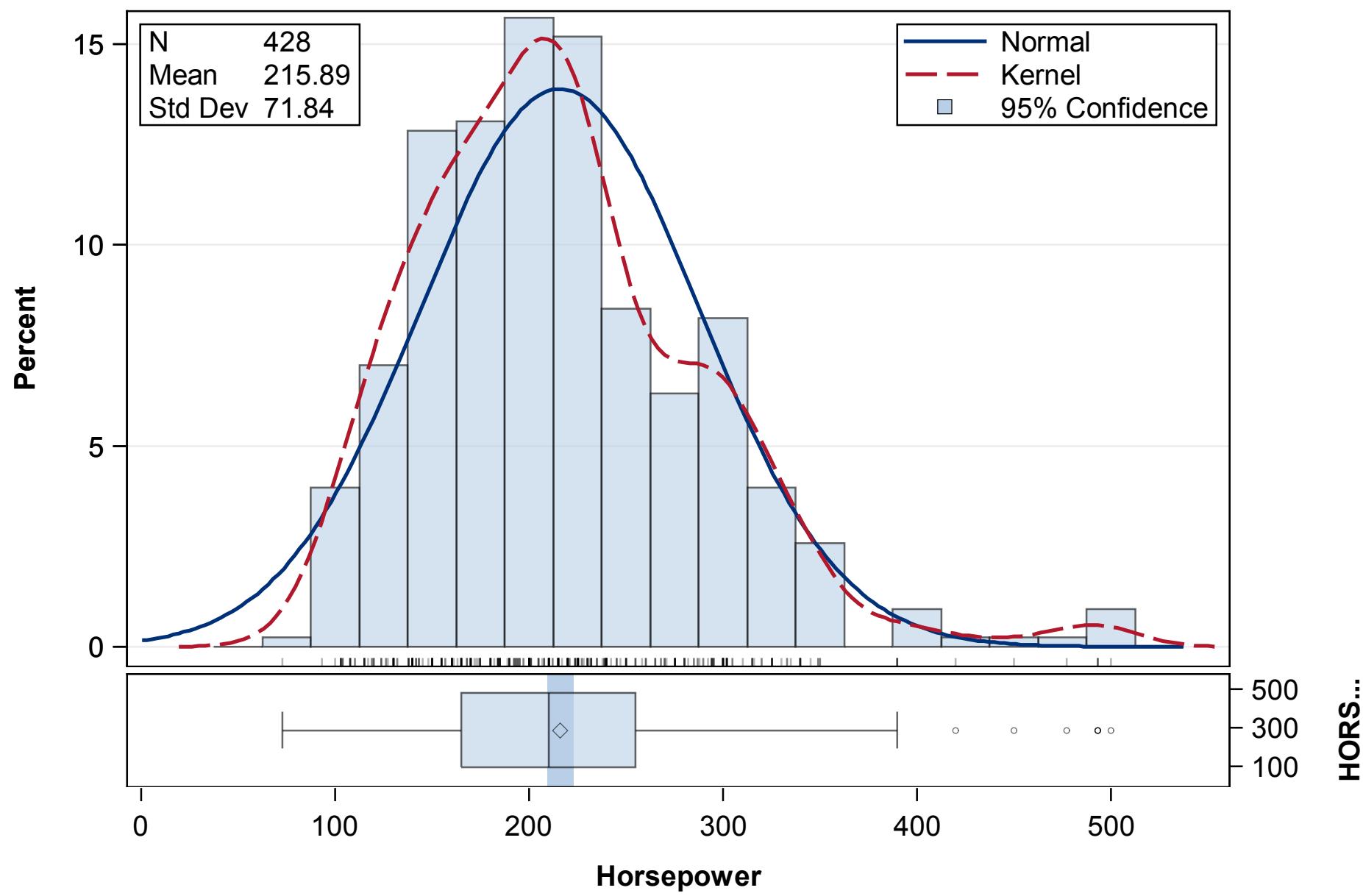
Creating a Pie Chart of Automobile Makes



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" lineatrs=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) fillatrs=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;
```

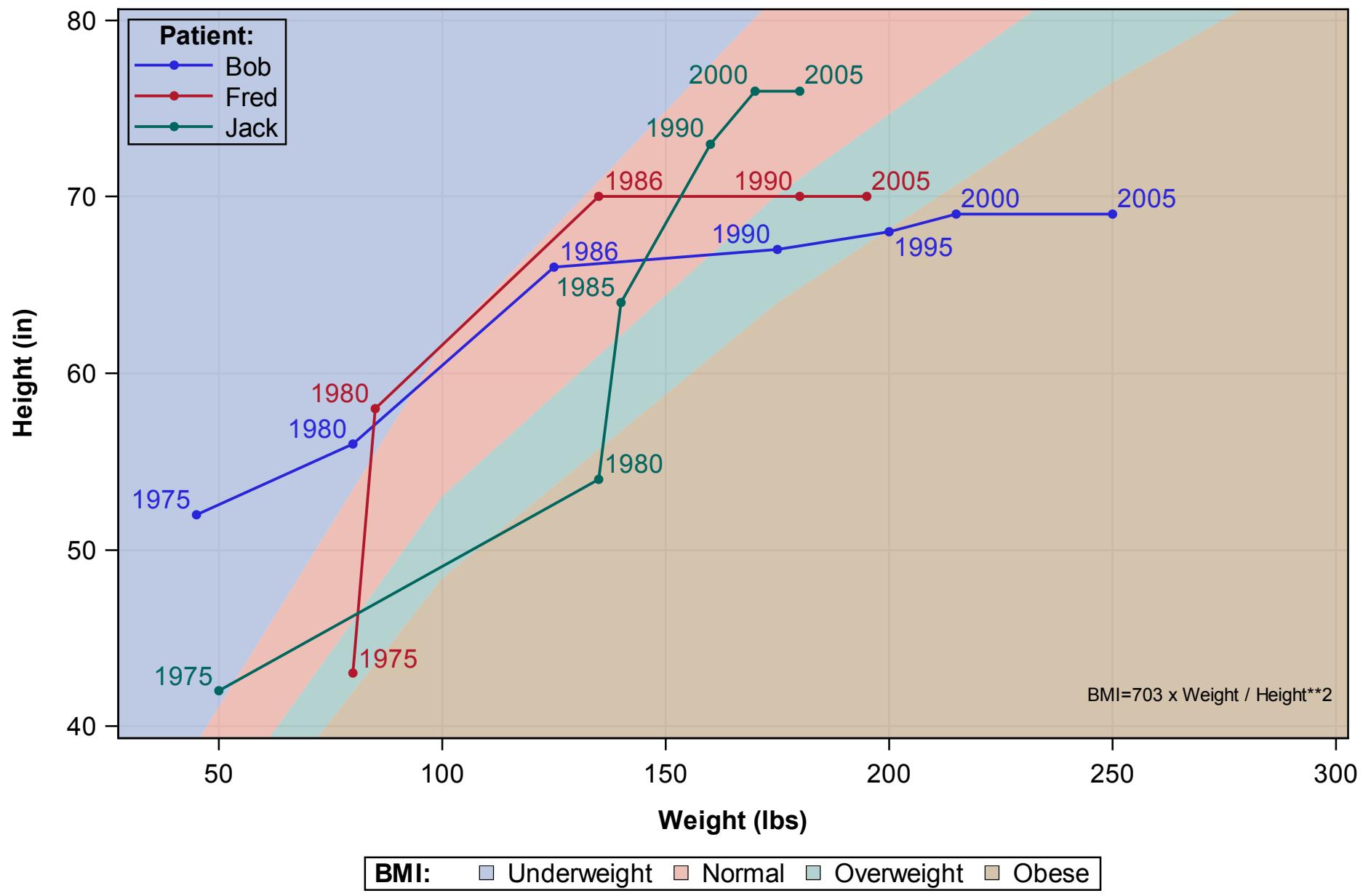
Distribution of Vehicle Horsepower



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
"ldata1"=CXFFFFFF
"ldata3"=CXFDC861
"ldata4"=CXDC531F
"ldata2"=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



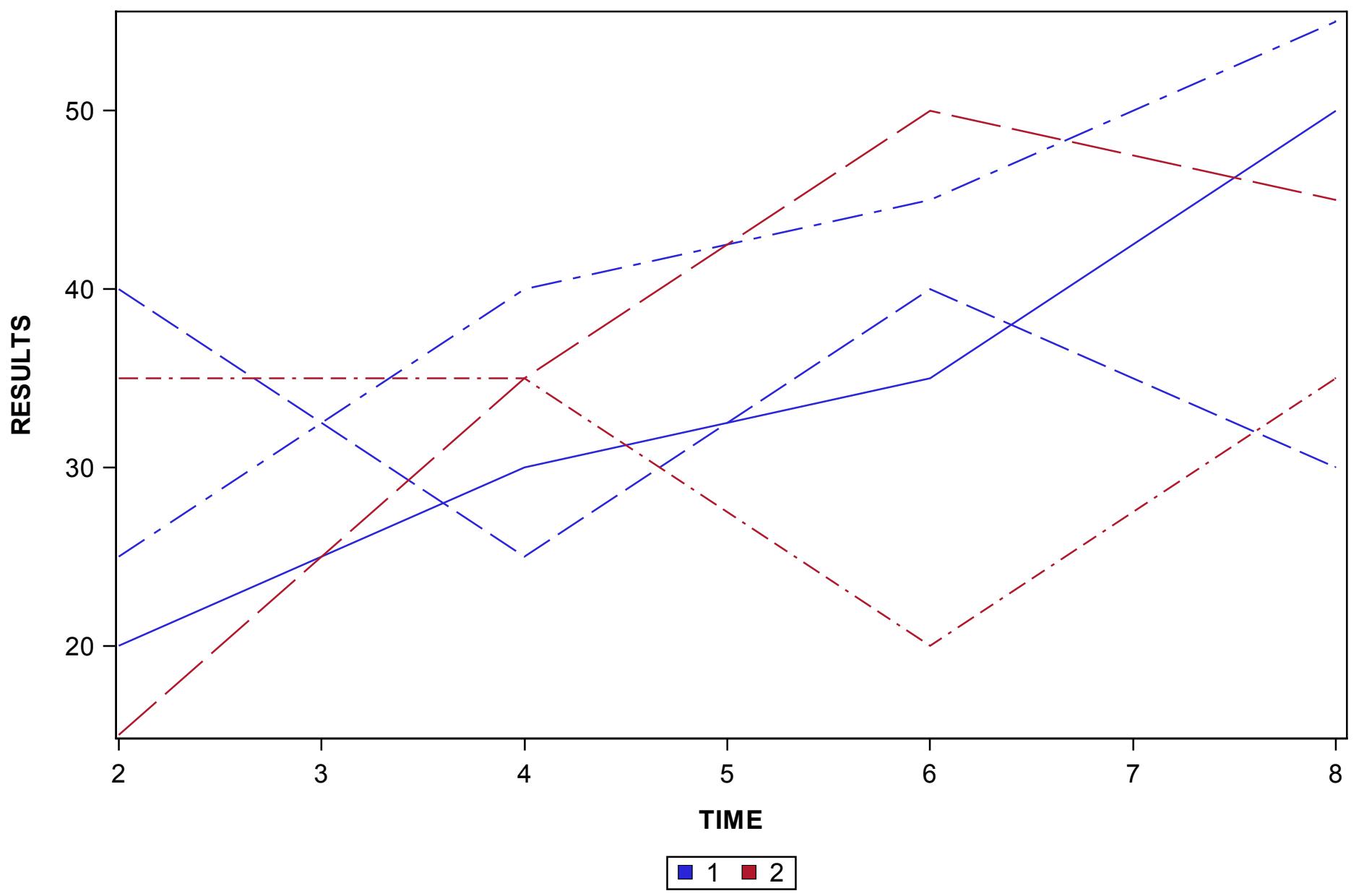
Spaghetti Plots SYL210.sas

```
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;
```

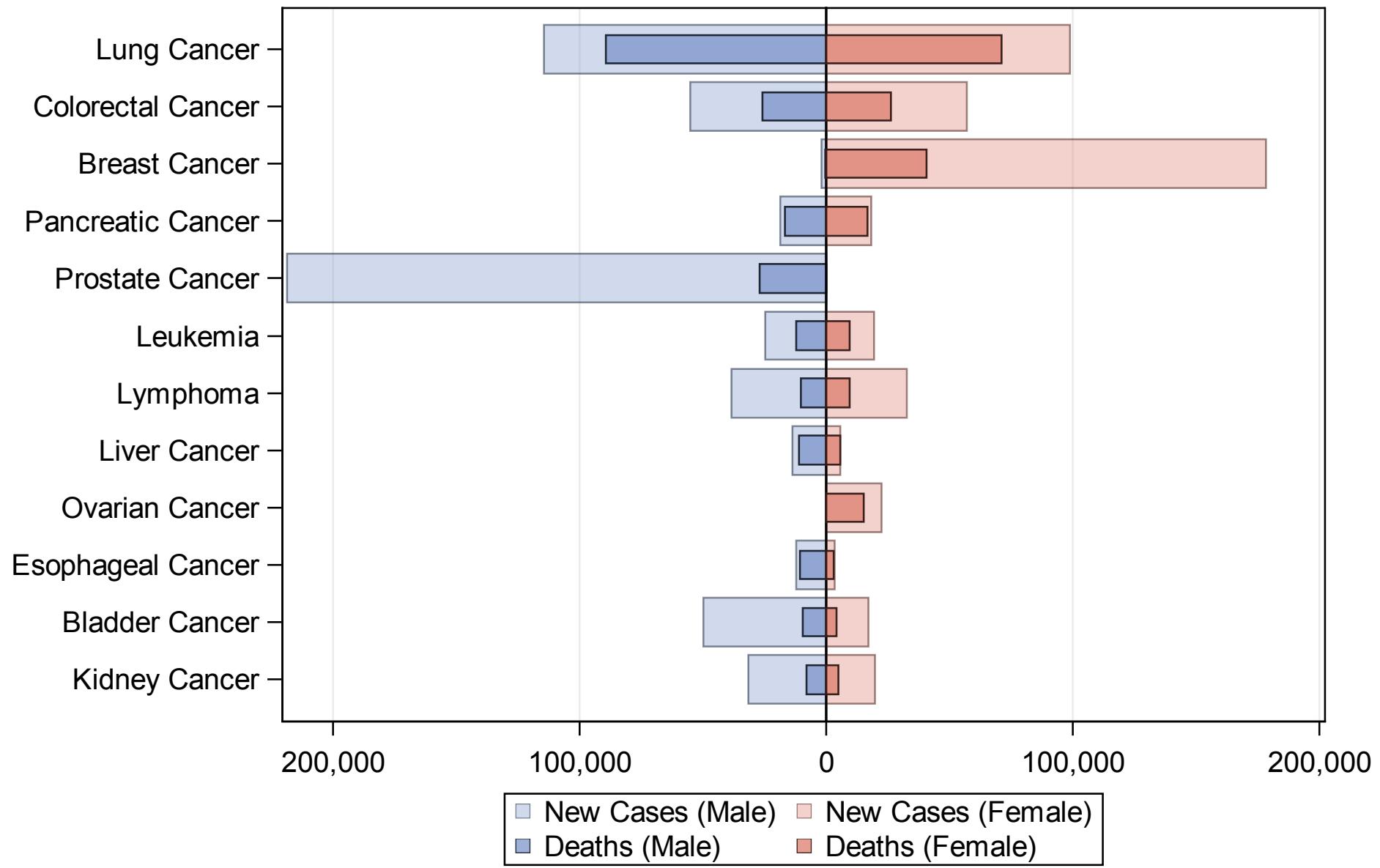
```
title "Spaghetti Plots";
proc sgplot data=one;
title "Study Results by Treatment Group
series x=time y=results/ group=subject
groupcl=trt_group name="grouping";
keylegend "grouping" / type=linecolor;
run;
```

Study Results by Treatment Group



```
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

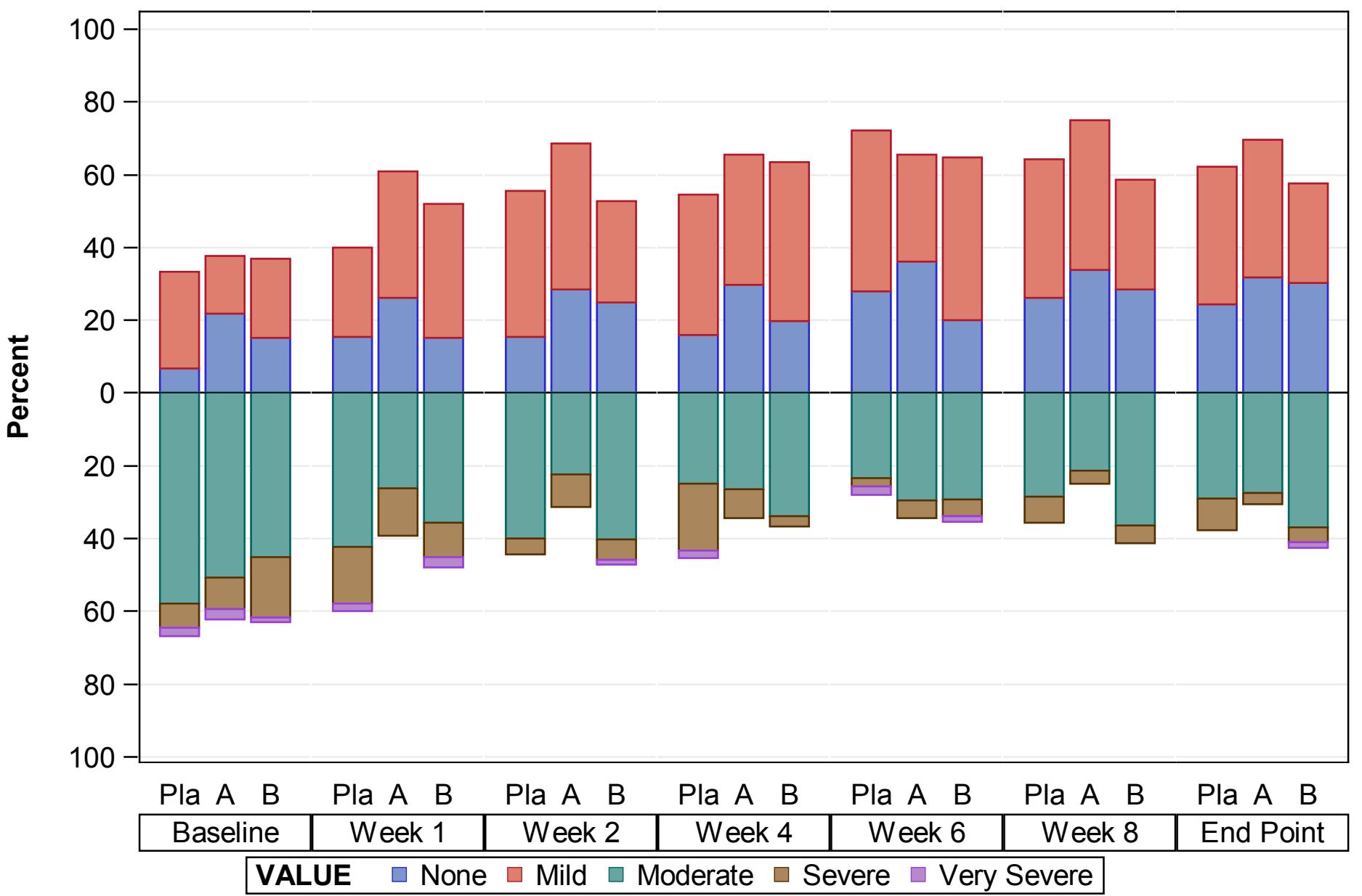


Source: American Cancer Society

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

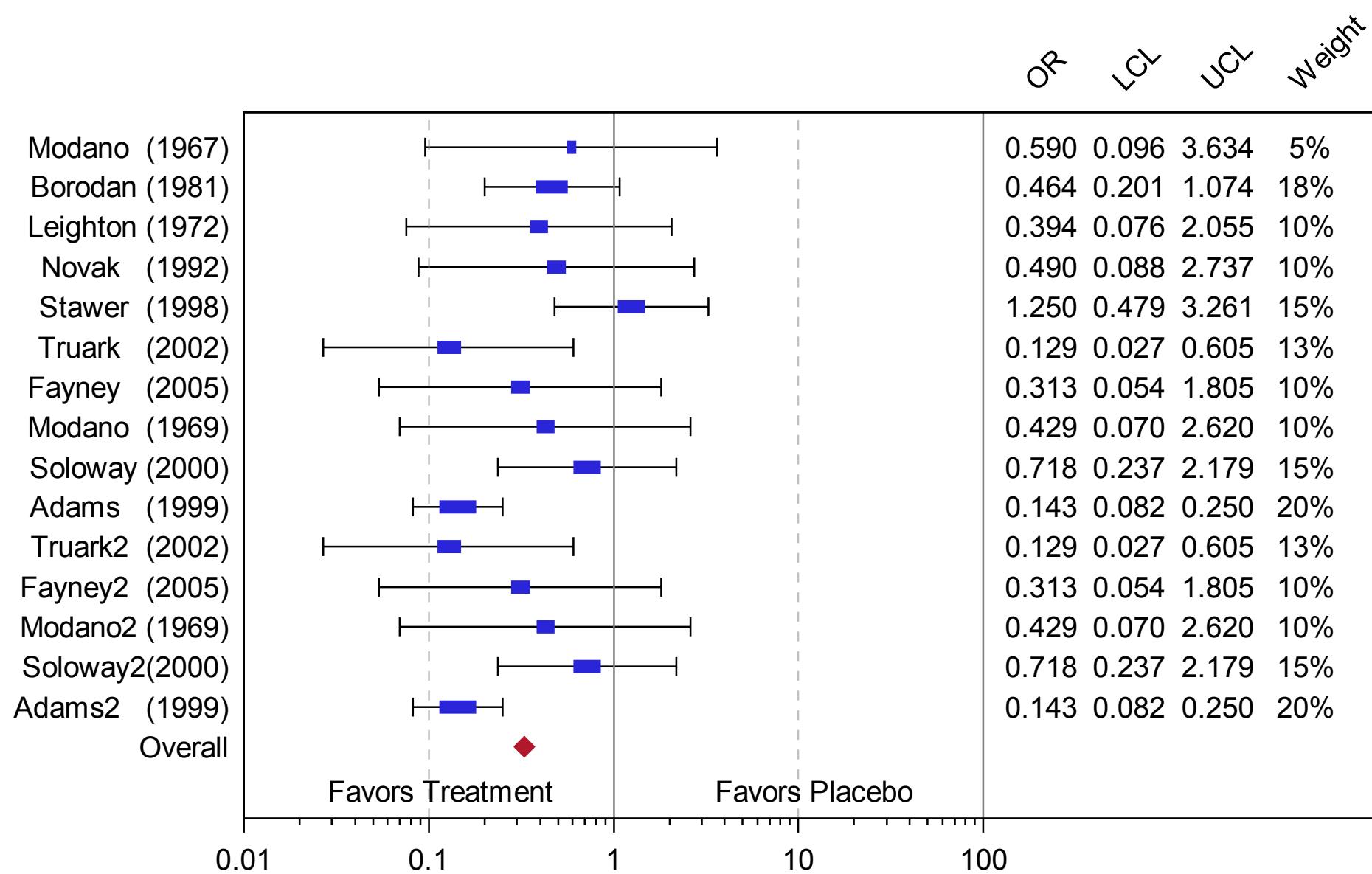


example-> 160

```
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



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
tickvalueclist=(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

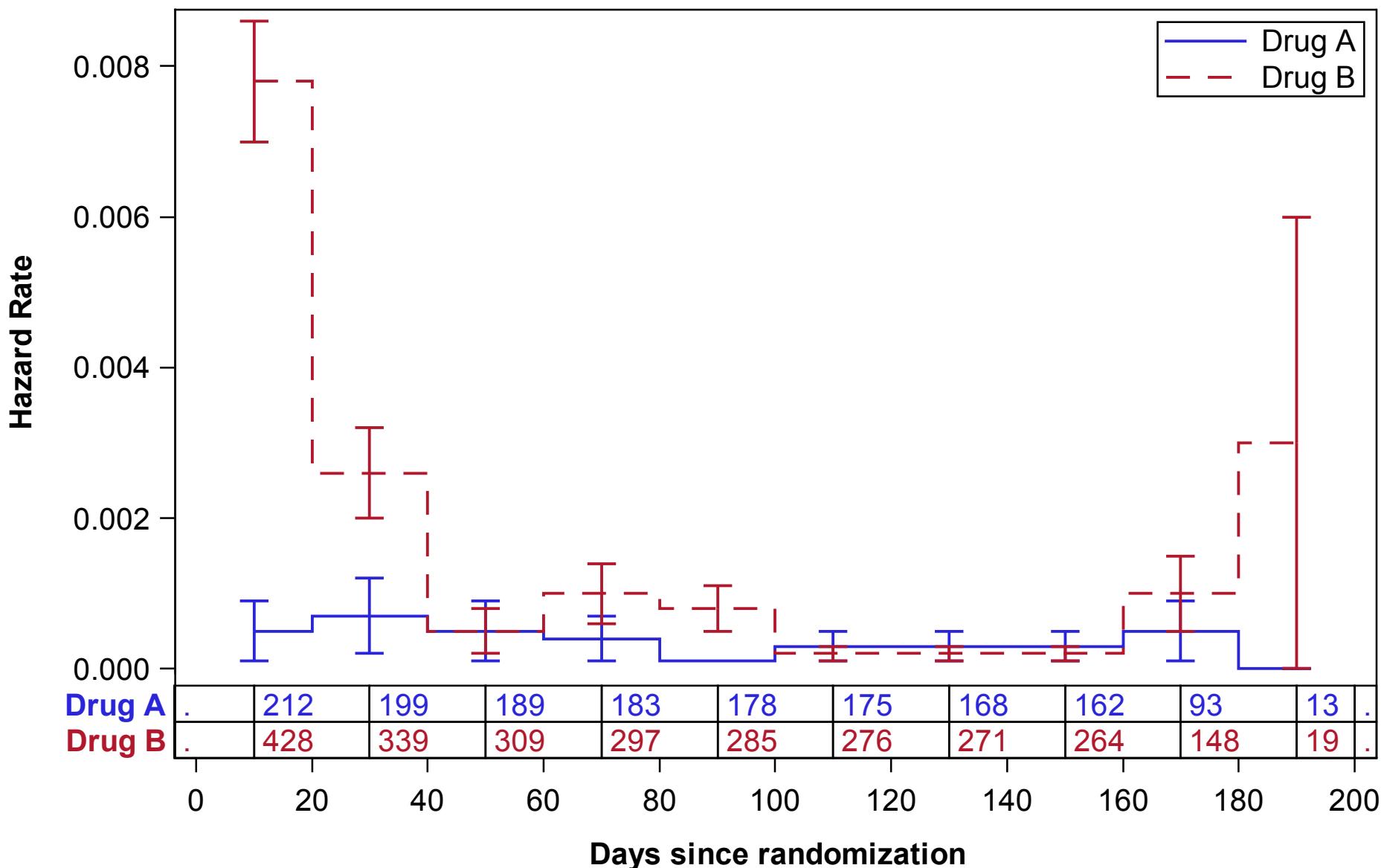


Table: Average number of subjects at risk during interval

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)

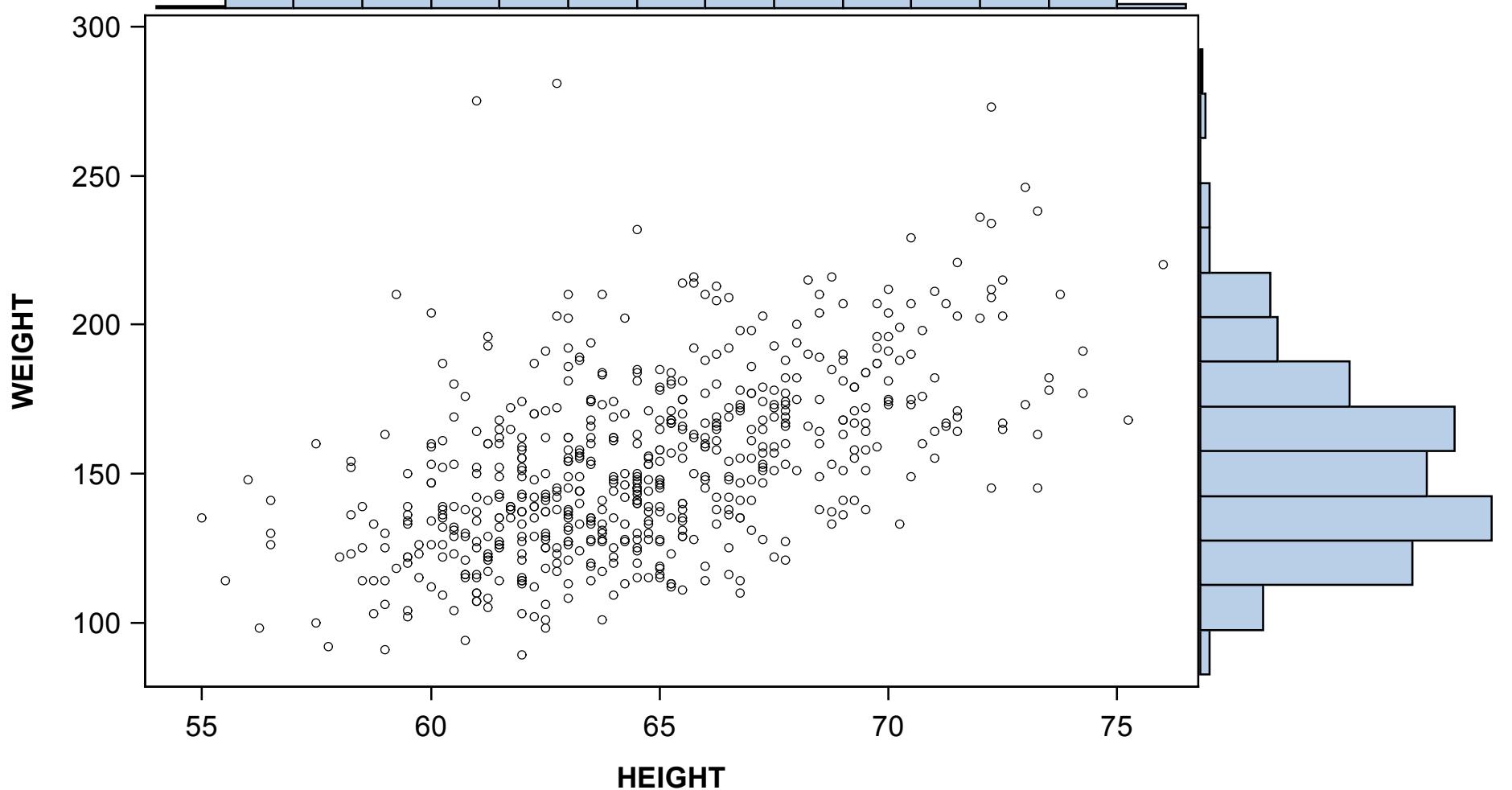
```
proc template;
define Style ScatterHistStyle;
parent = styles.journal;
style GraphFonts from GraphFonts
"Fonts used in graph styles" /
"GraphTitleFont" = ("", "",10pt,bold)
"GraphFootnoteFont" = ("", "",8pt)
"GraphLabelFont" = ("", "",8pt)
"GraphValueFont" = ("", "",7pt)
"GraphDataFont" = ("", "",7pt);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



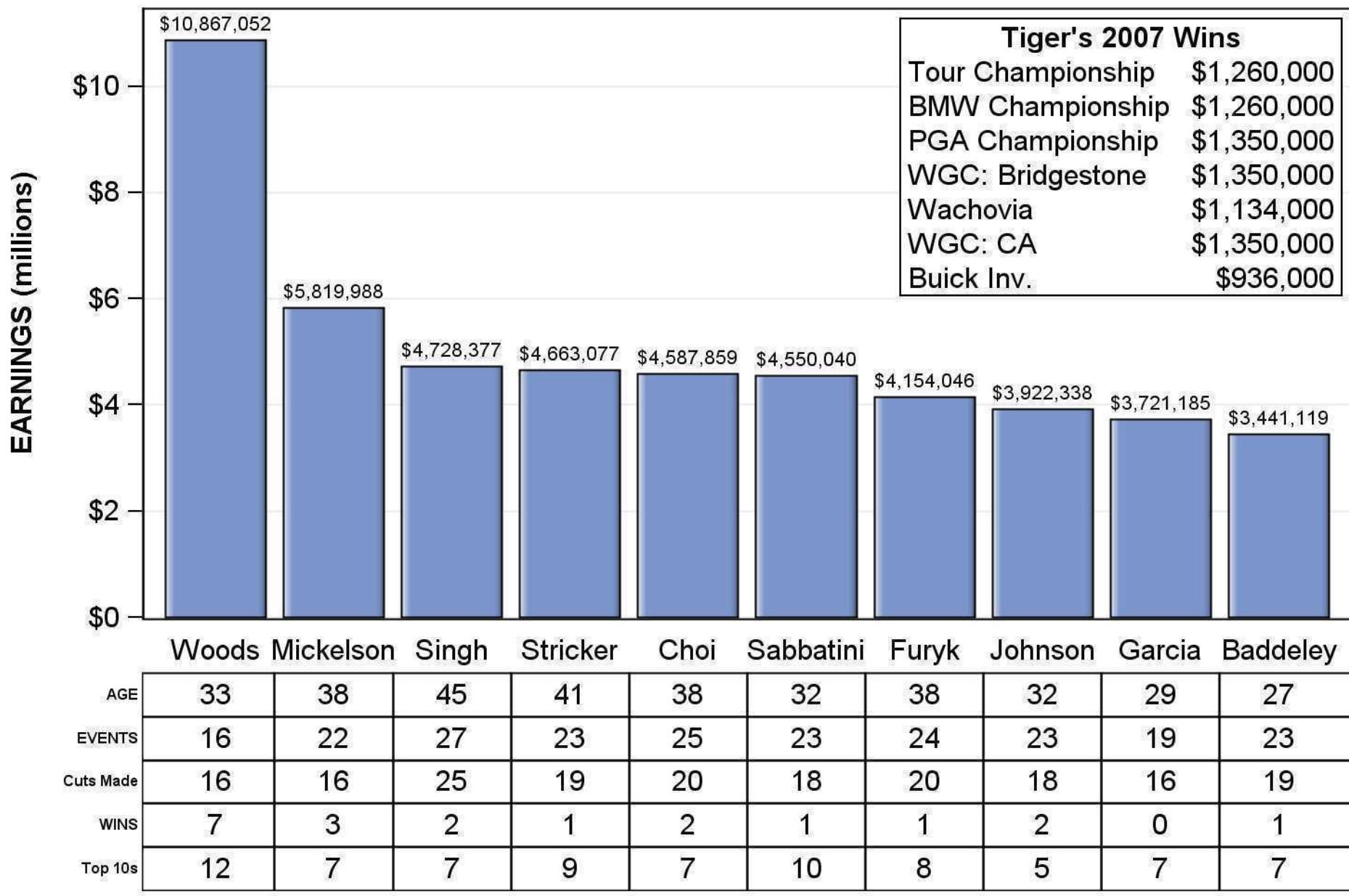
example-> 220

```

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" / textatrs=(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. fillatrs=graphdata1
skin=satin outlineatrs=(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
labelatrs=(size=7pt);endlayout;endlayout;endgraph;end;run;
proc sgrender data=PGA2007 template=bartable;run;quit;

```

Professional Golf Statistics for 2007



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

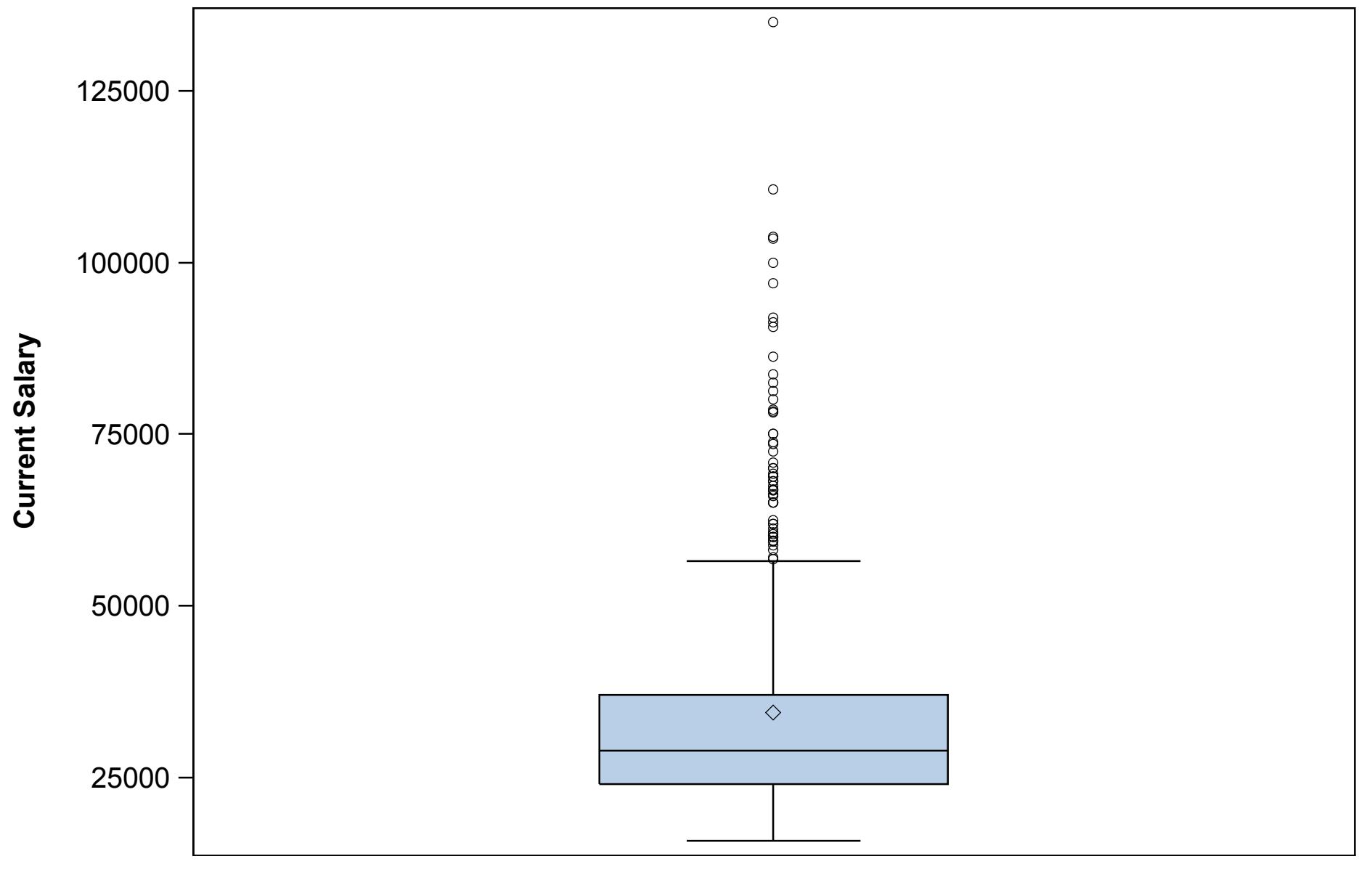
example-> 020

Box Plots

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

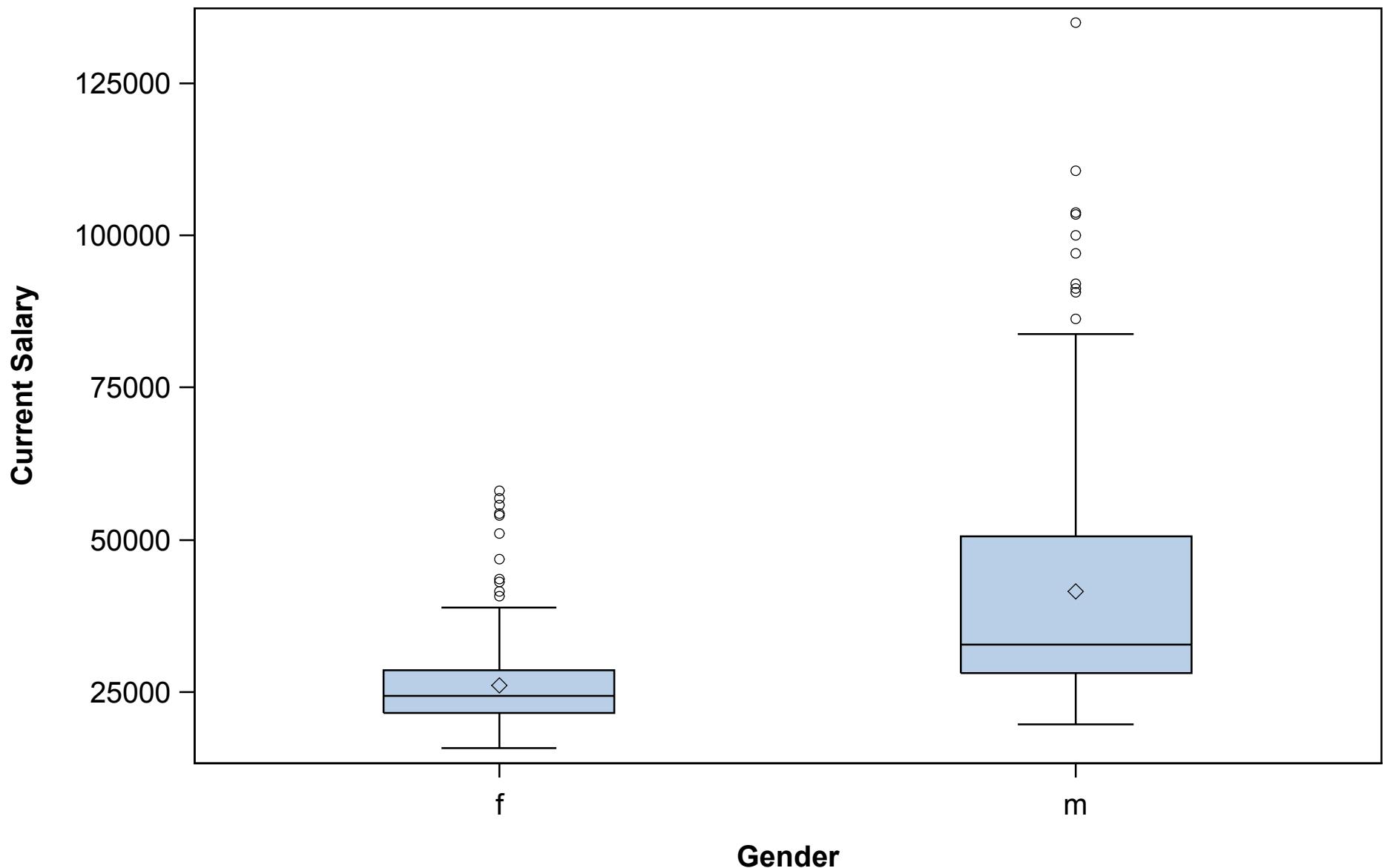
Boxplot

No Categories



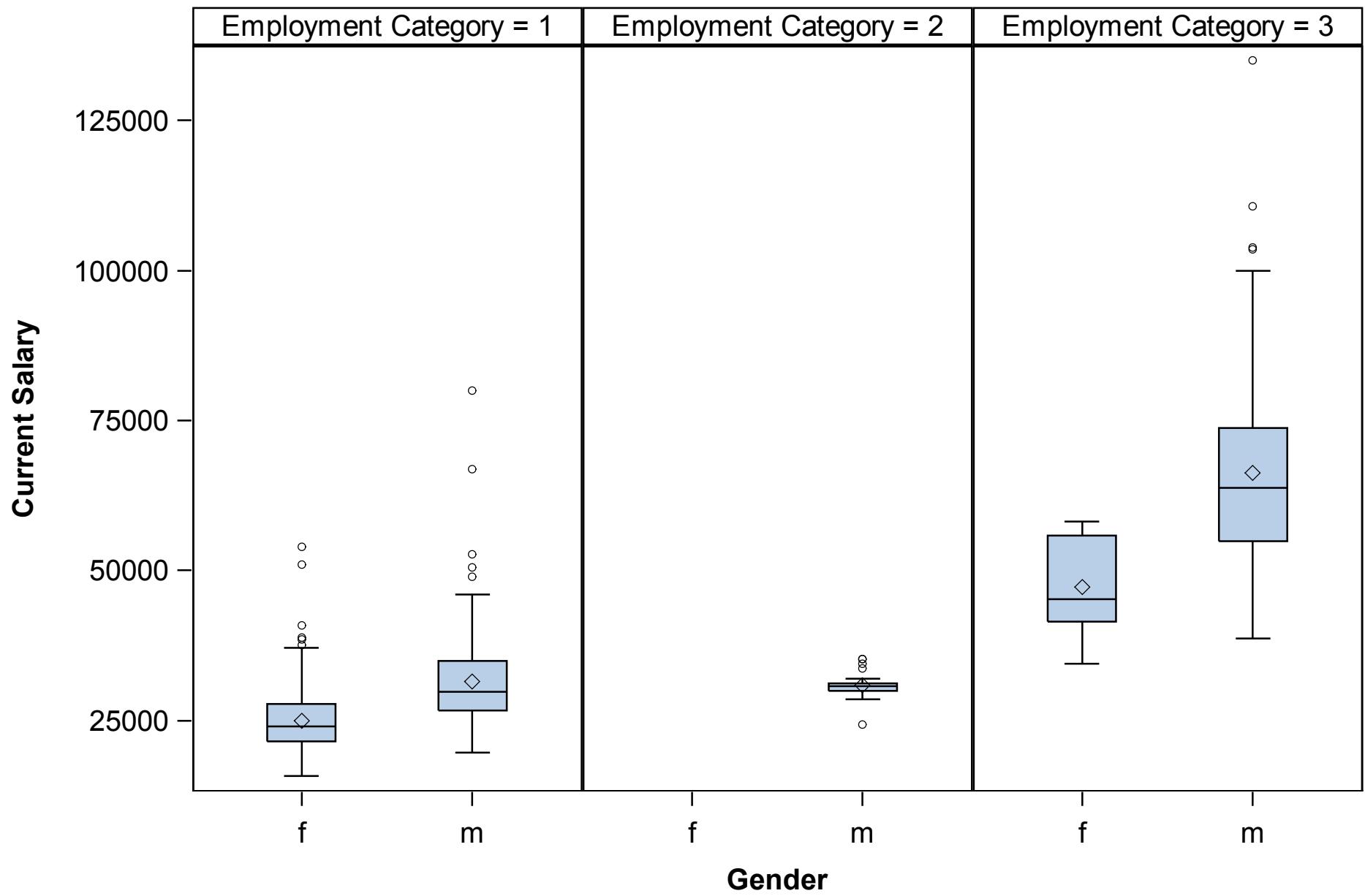
```
title "Boxplot";  
title2 "Category=Gender";  
proc sgplot data=employee;  
vbox salary/ category=gender;  
run;quit;
```

Boxplot
Category=Gender



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

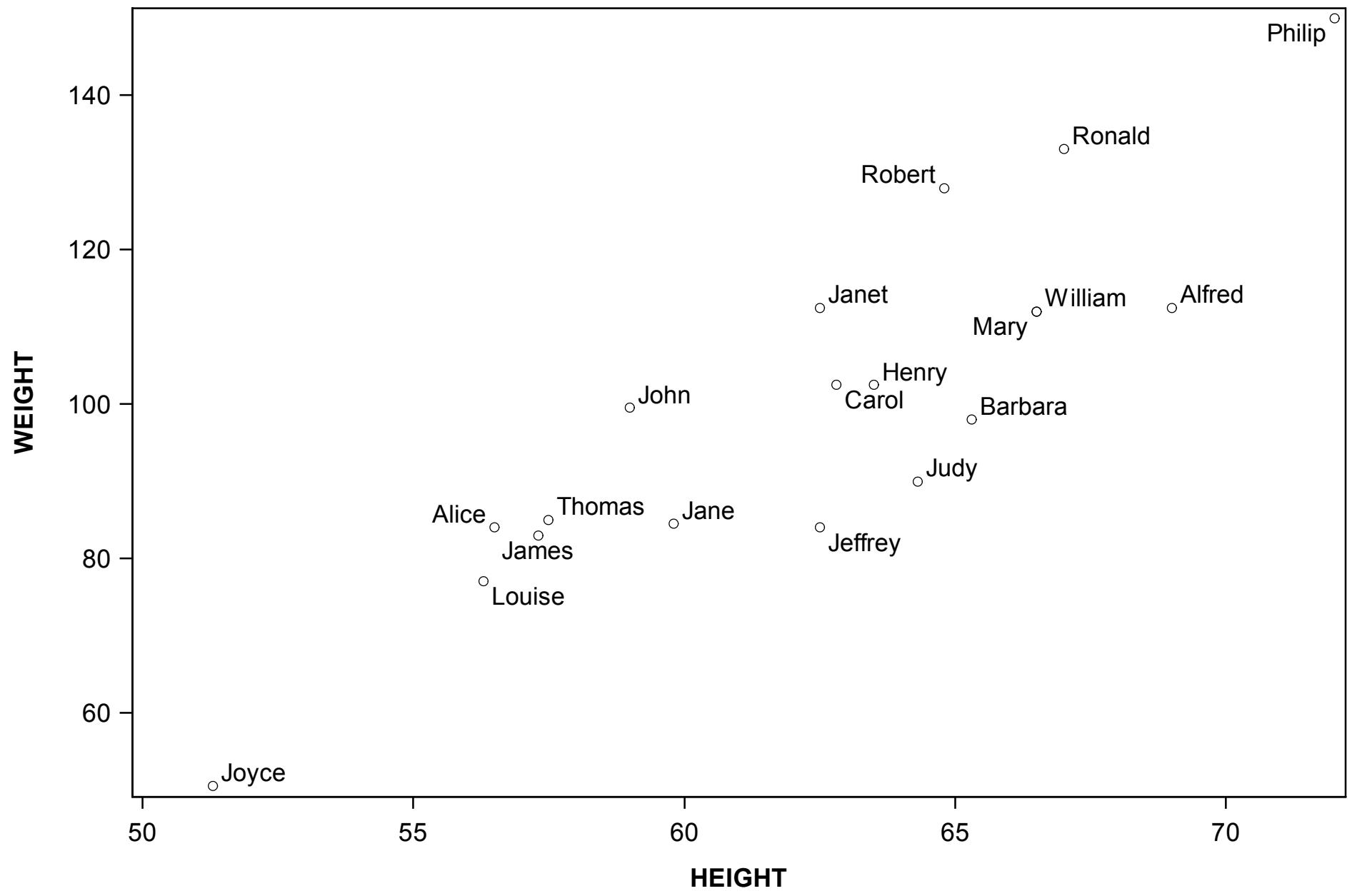
Boxplot with Panels



example-> 030

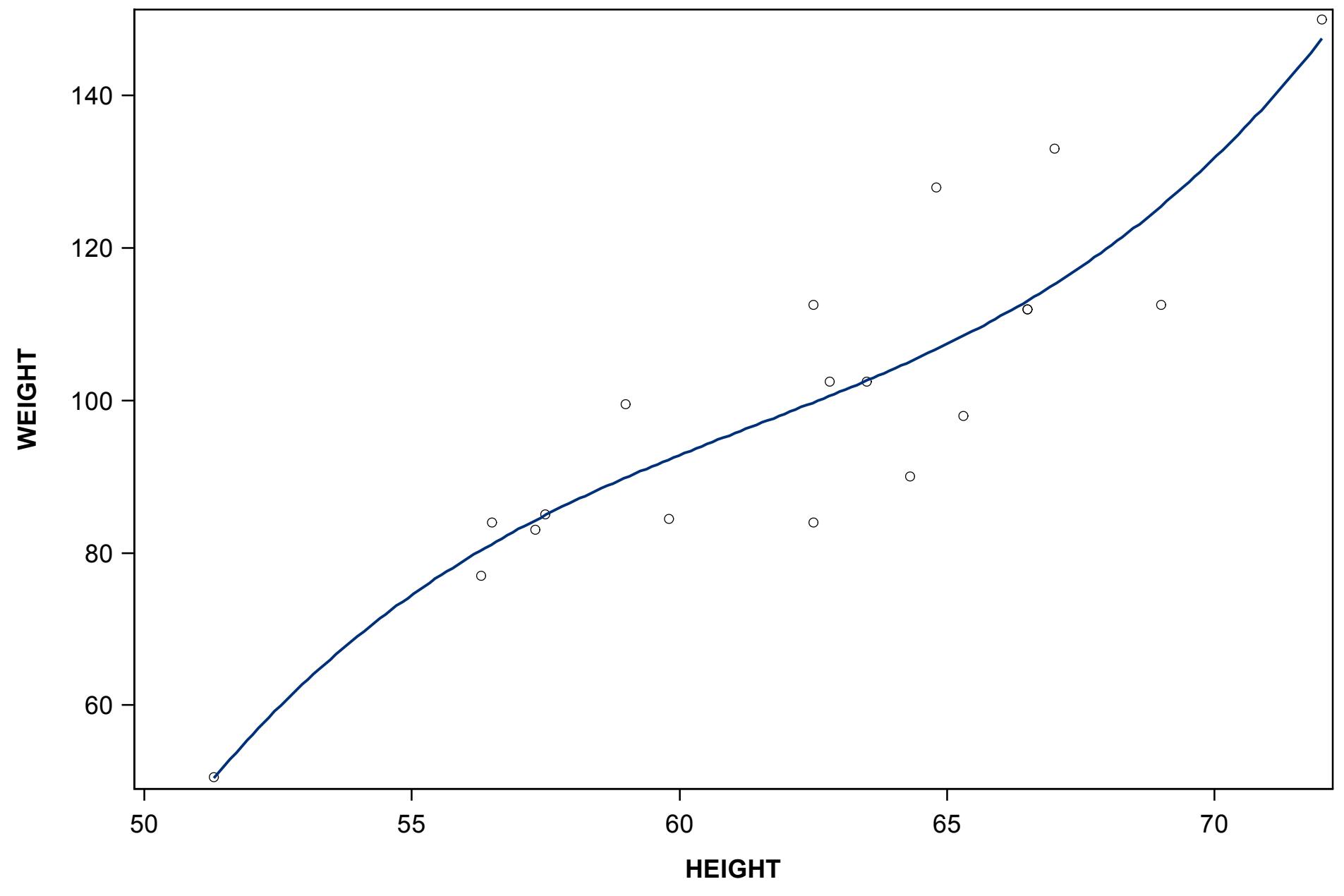
```
proc template;
define statgraph scatter; begingraph;
entrytitle "weight vs height";
layout overlay;
scatterplot y = weight x = height / datalabel = name
datalabelatrs=(size=12); endlayout; endgraph;
end;
run;
proc sgrender data = sashelp.class template = scatter;
run;quit;
```

weight vs height



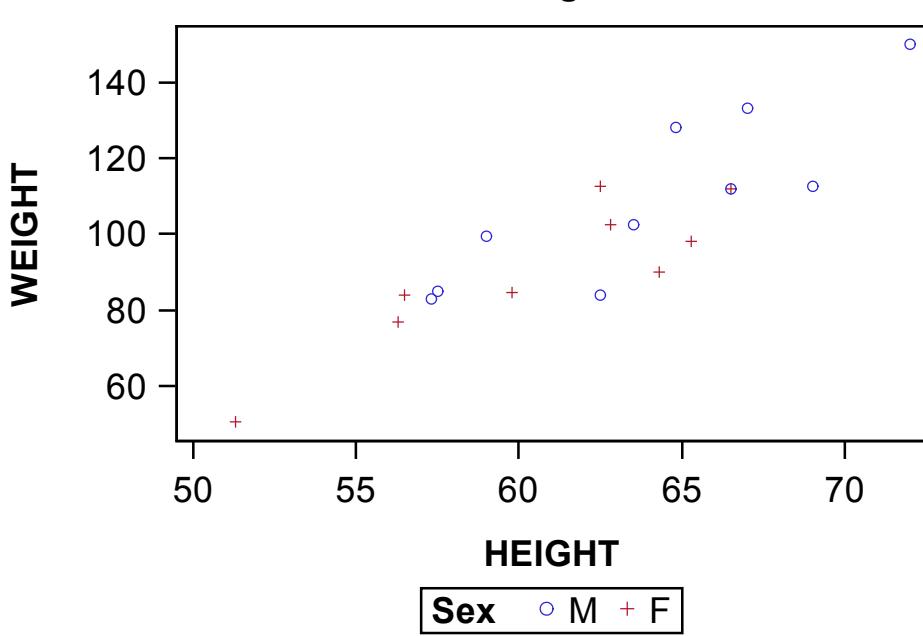
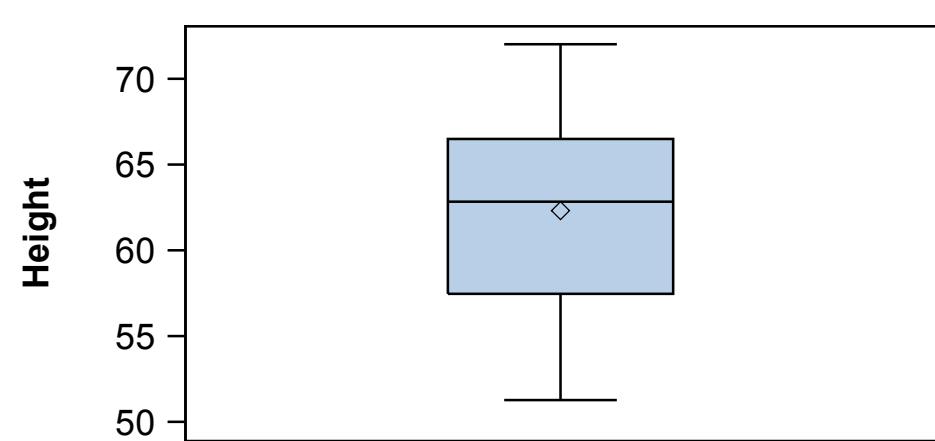
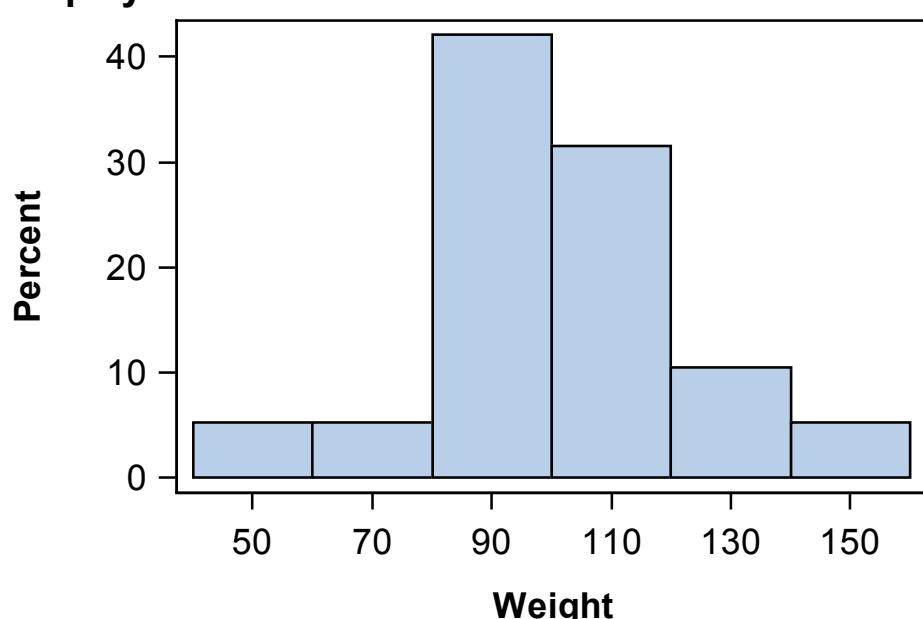
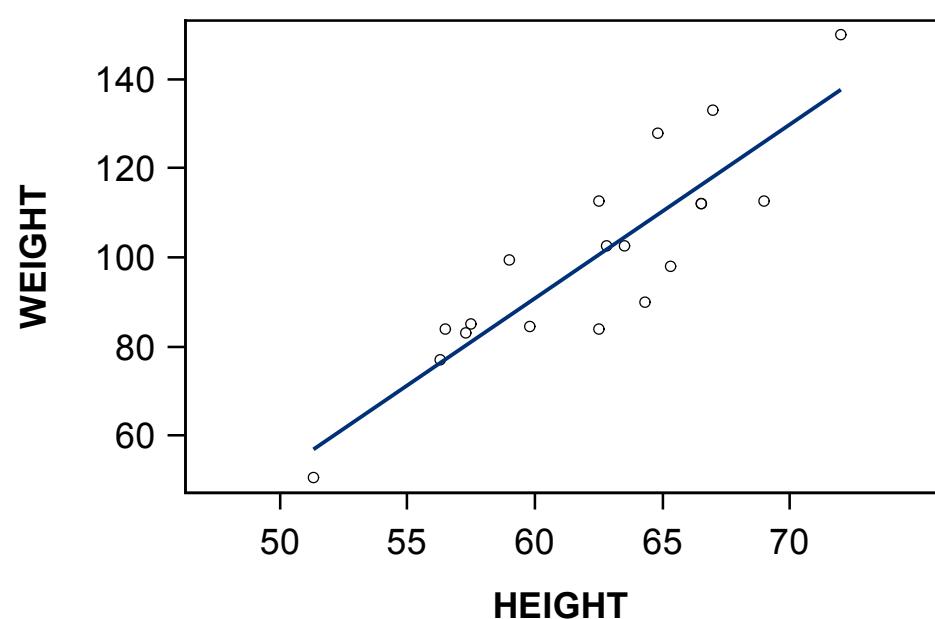
```
PROC TEMPLATE;
DEFINE STATGRAPH Scatter; BEGINGRAPH;
ENTRYTITLE "Scatter Plot with Fit Functions";
LAYOUT OVERLAY; SCATTERPLOT Y = Weight X = Height;
REGRESSIONPLOT Y = Weight X = Height / DEGREE = 3;
ENDLAYOUT; ENDGRAPH; END; RUN;
PROC SGRENDER DATA = Sashelp.Class TEMPLATE = Scatter; RUN;quit;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

Scatter Plot of the Class Data Set with Fit Functions



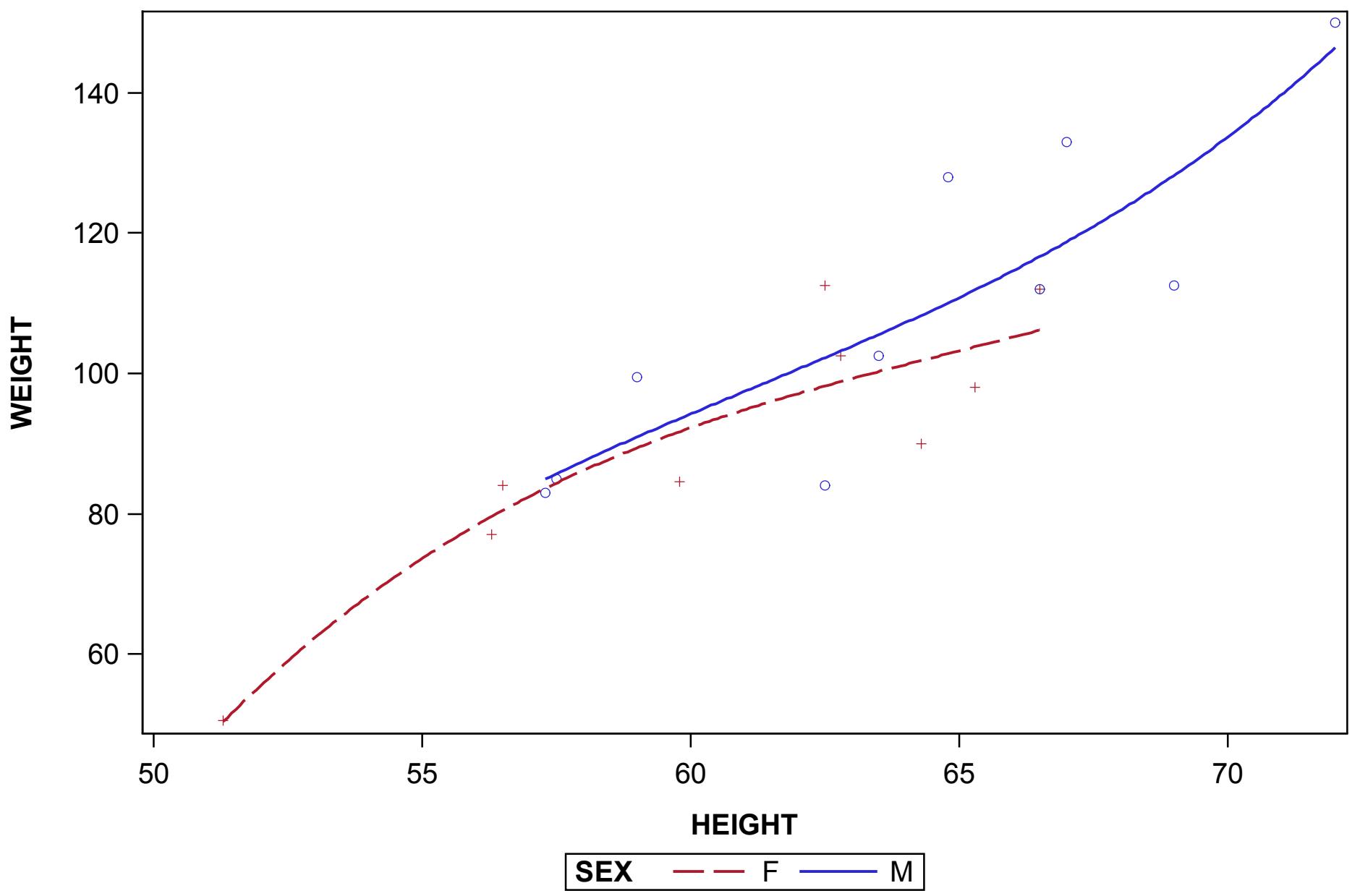
```
PROC TEMPLATE; DEFINE STATGRAPH Panel; BEGINGRAPH;
ENTRYTITLE "Paneled Display ";
LAYOUT LATTICE / ROWS = 2 COLUMNS = 2 ROWGUTTER = 10
COLUMNGUTTER = 10;
LAYOUT OVERLAY; SCATTERPLOT Y = Weight X = Height;
REGRESSIONPLOT Y = Weight X = Height; ENDLAYOUT;
LAYOUT OVERLAY / XAXISOPTS = (LABEL = "Weight");
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



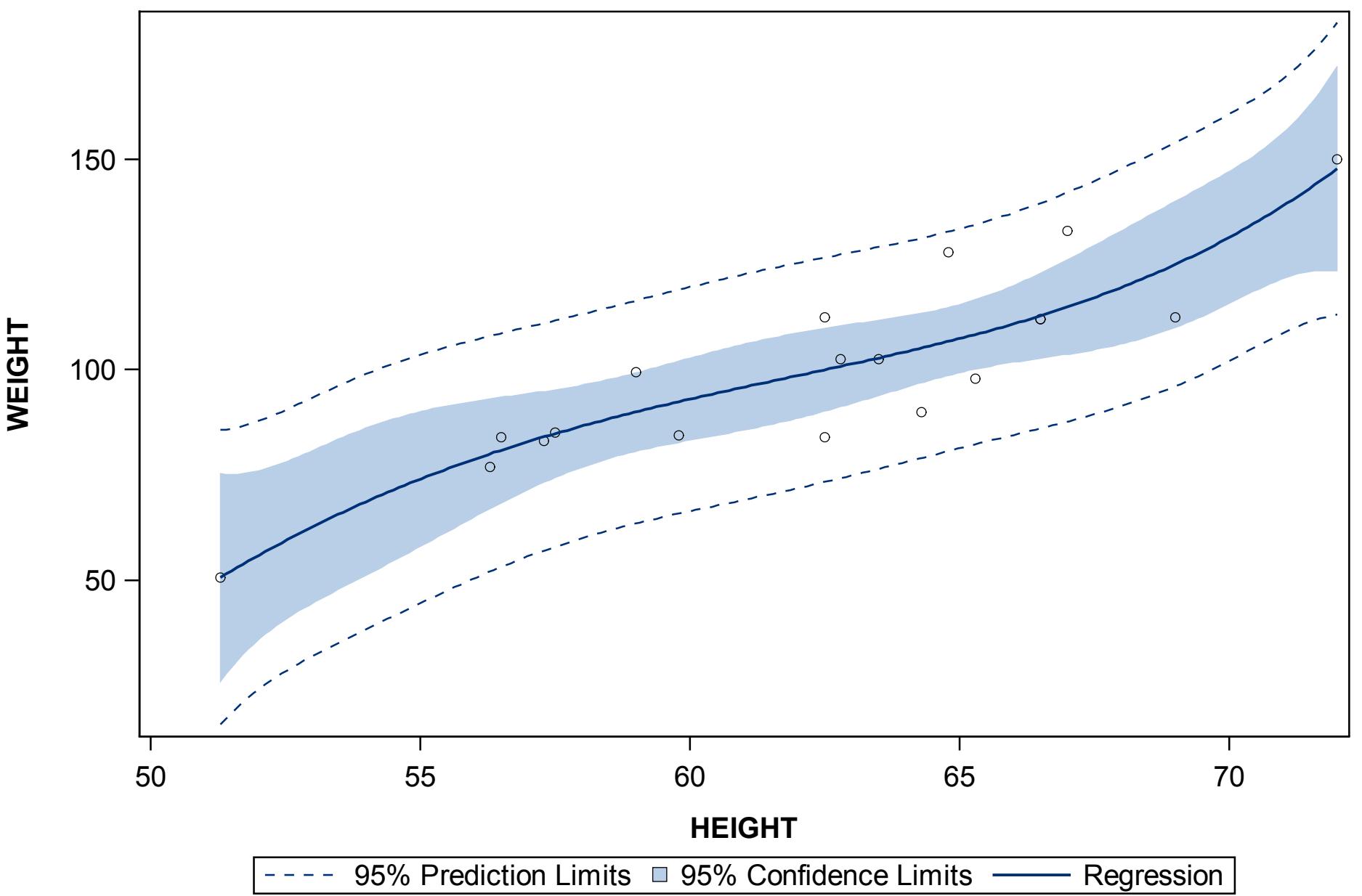
```
PROC SGPLOT DATA = Sashelp.Class ;  
TITLE "Separate Fit by Sex" ;  
REG Y = Weight X = Height / GROUP= Sex DEGREE= 3;  
RUN;
```

Separate Fit by Sex

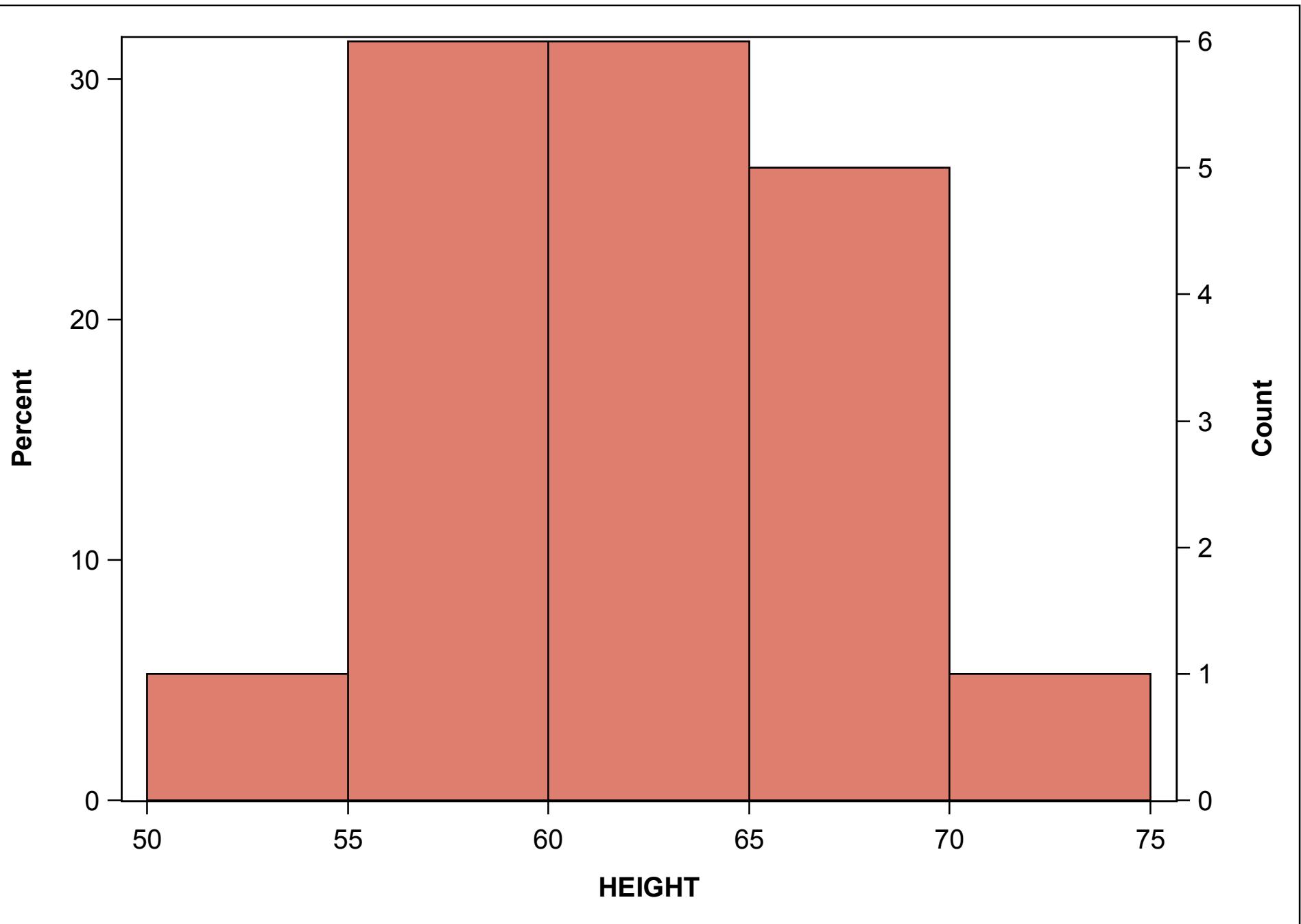


```
PROC SGPLOT DATA = Sashelp.Class ;  
TITLE "Regression Plot with Limits" ;  
REG Y = Weight X = Height / DEGREE= 4 CLI CLM ;  
RUN;
```

Regression Plot with Limits

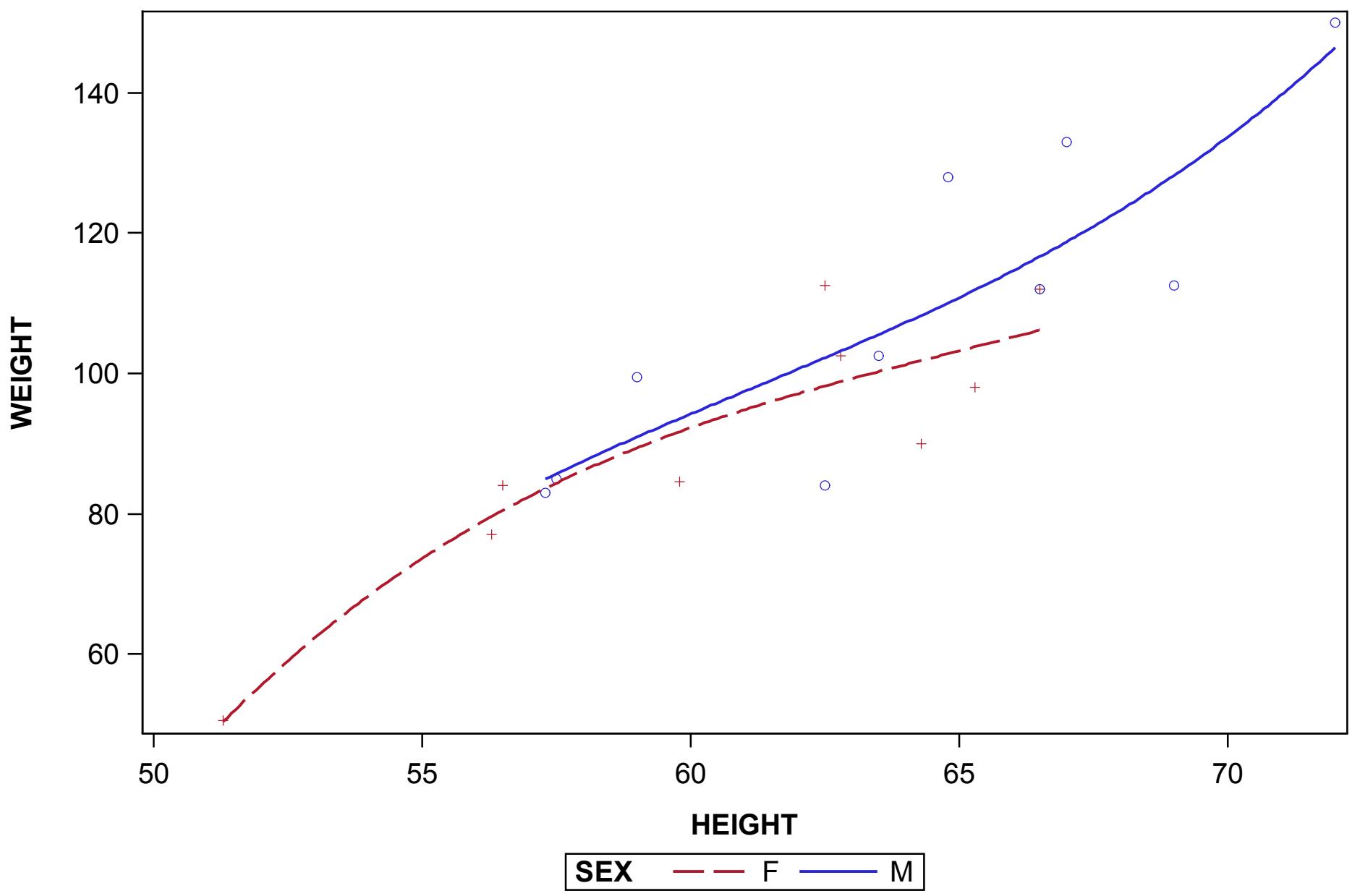


```
PROC SGPLOT DATA = Sashelp.Class NOAUTOLEGEND;  
HISTOGRAM Height;  
HISTOGRAM Height / SCALE= COUNT Y2AXIS;  
RUN;
```



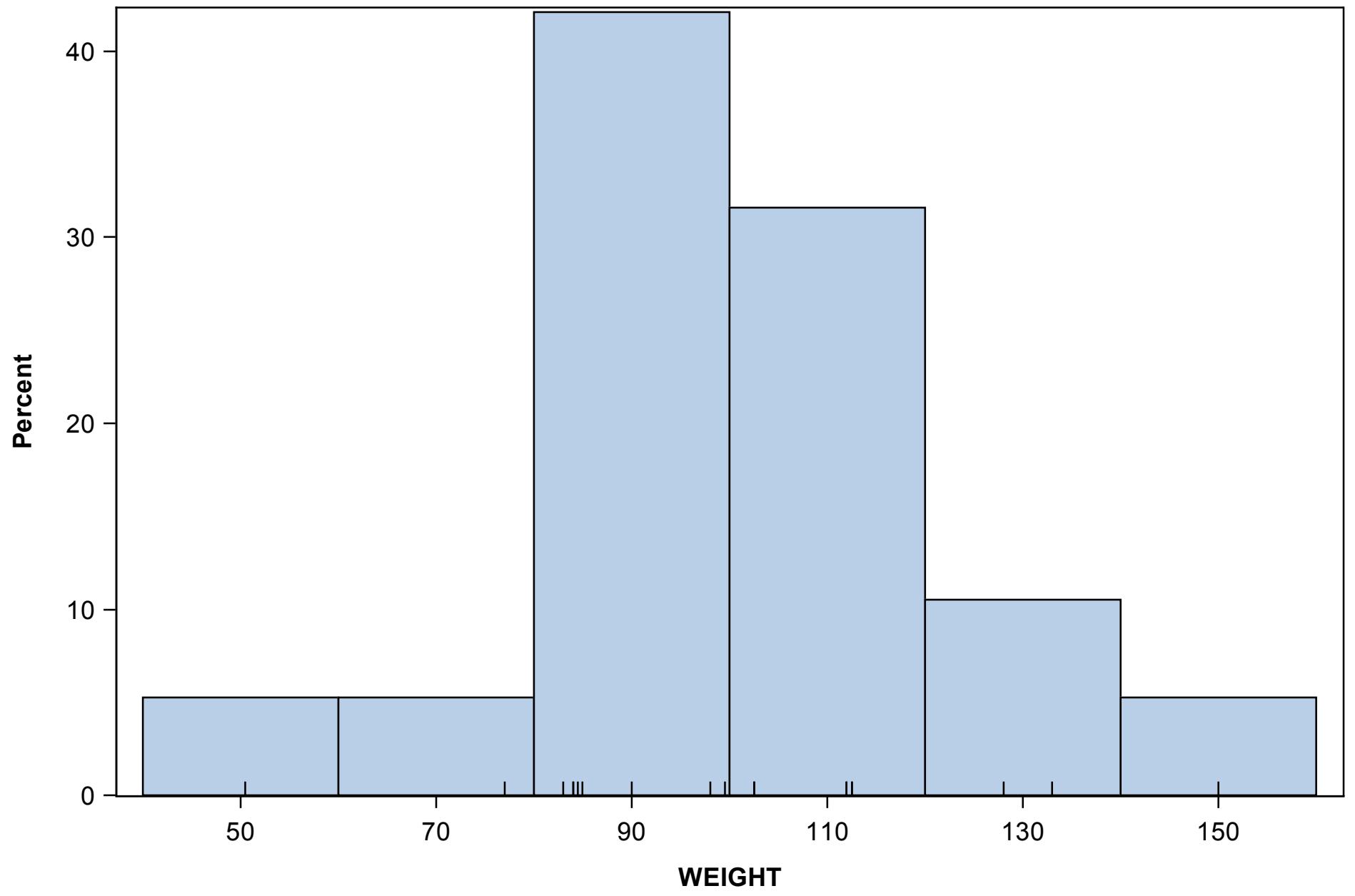
```
PROC SGPLOT DATA = Sashelp.Class ;  
TITLE "Separate Fit by Sex" ;  
REG Y = Weight X = Height / GROUP= Sex DEGREE= 3;  
RUN;
```

Separate Fit by Sex

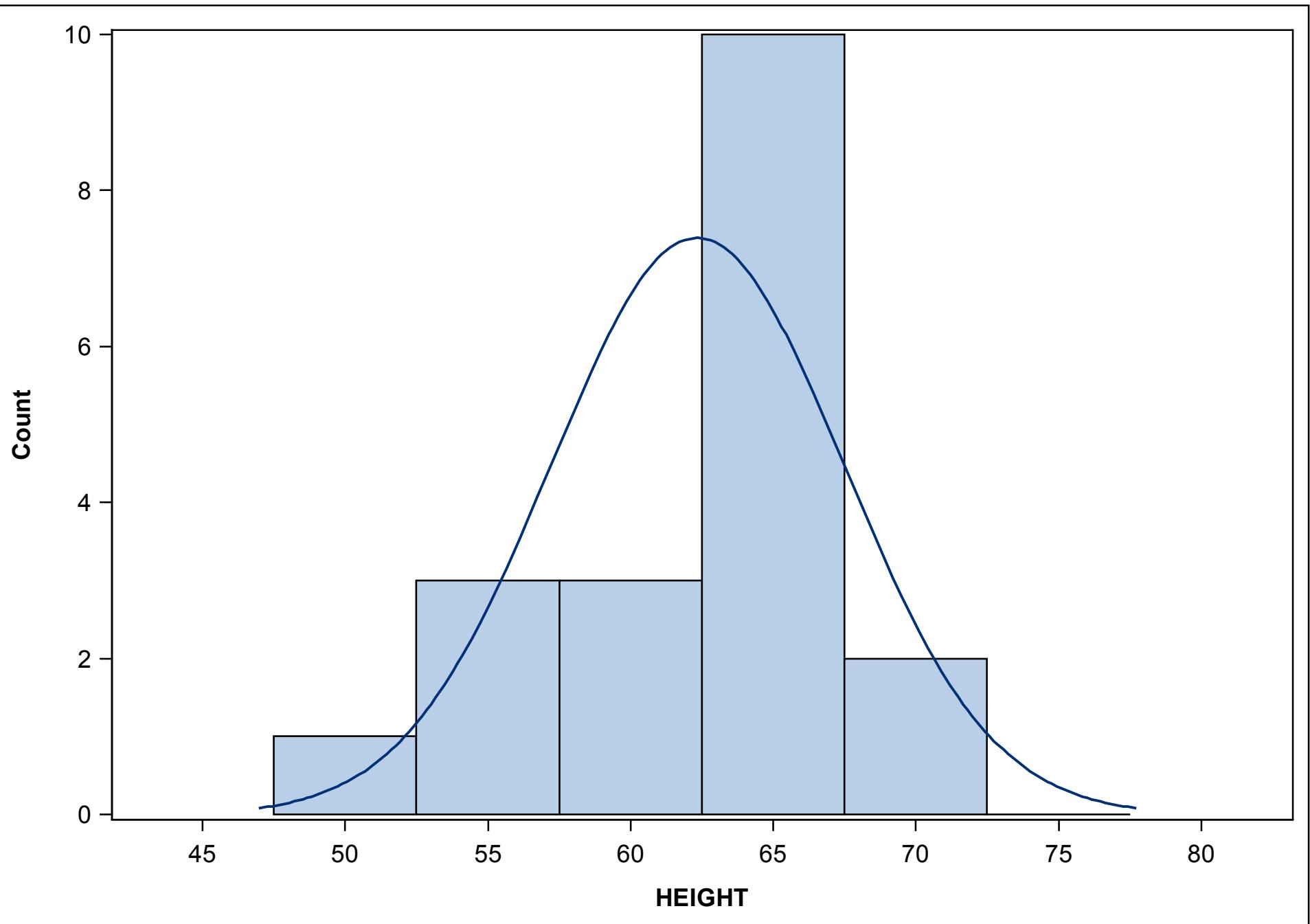


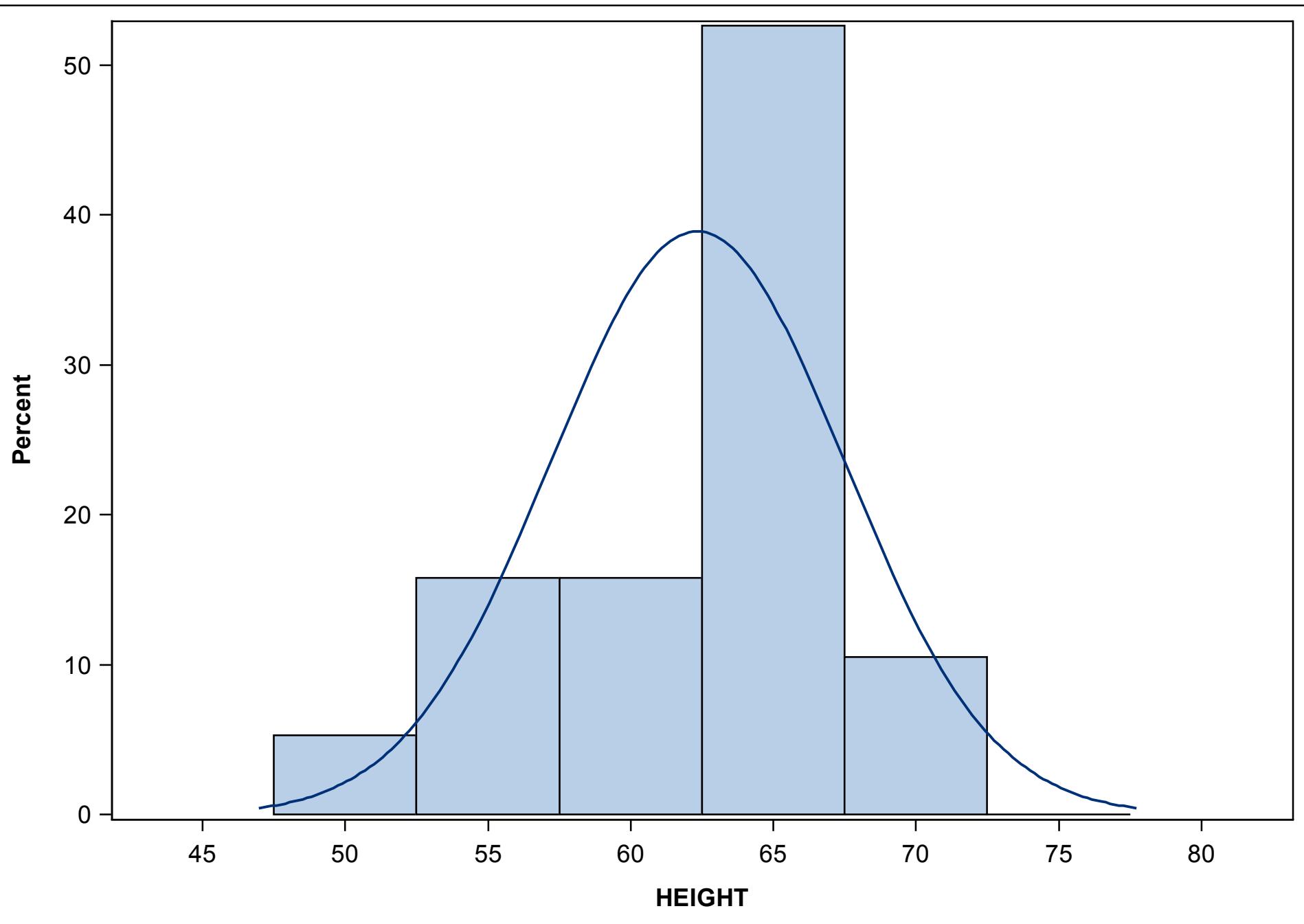
```
PROC TEMPLATE ;
DEFINE STATGRAPH hist_fringe;
BEGINGRAPH ;
ENTRYTITLE " Distribution of Weight ";
LAYOUT OVERLAY ;
HISTOGRAM Weight;
FRINGE PLOT WEIGHT;
ENDLAYOUT ;
```

Distribution of Weight



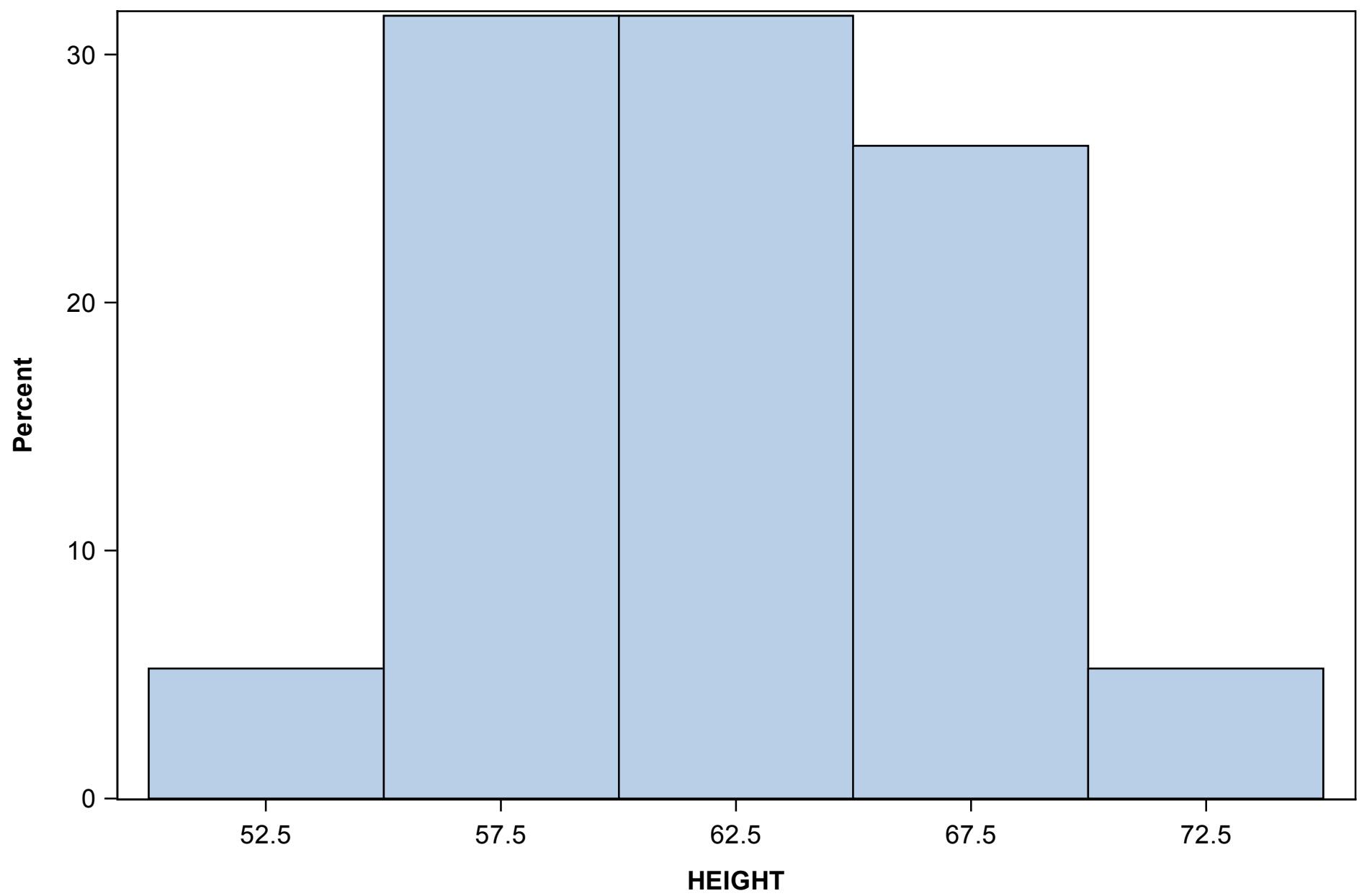
```
PROC TEMPLATE;
DEFINE STATGRAPH dynamic;
BEGINGRAPH;
MVAR scale;
NMVAR bins;
DYNAMIC var ;
LAYOUT OVERLAY ;
HISTOGRAM var / SCALE = scale NBINS = bins;
DENSITYPLOT var;
ENDLAYOUT;
ENDGRAPH;
END;
RUN;
%LET bins = 6;
%LET scale = count;
PROC SGRENDER DATA = sashelp.class TEMPLATE= dynamic;
DYNAMIC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



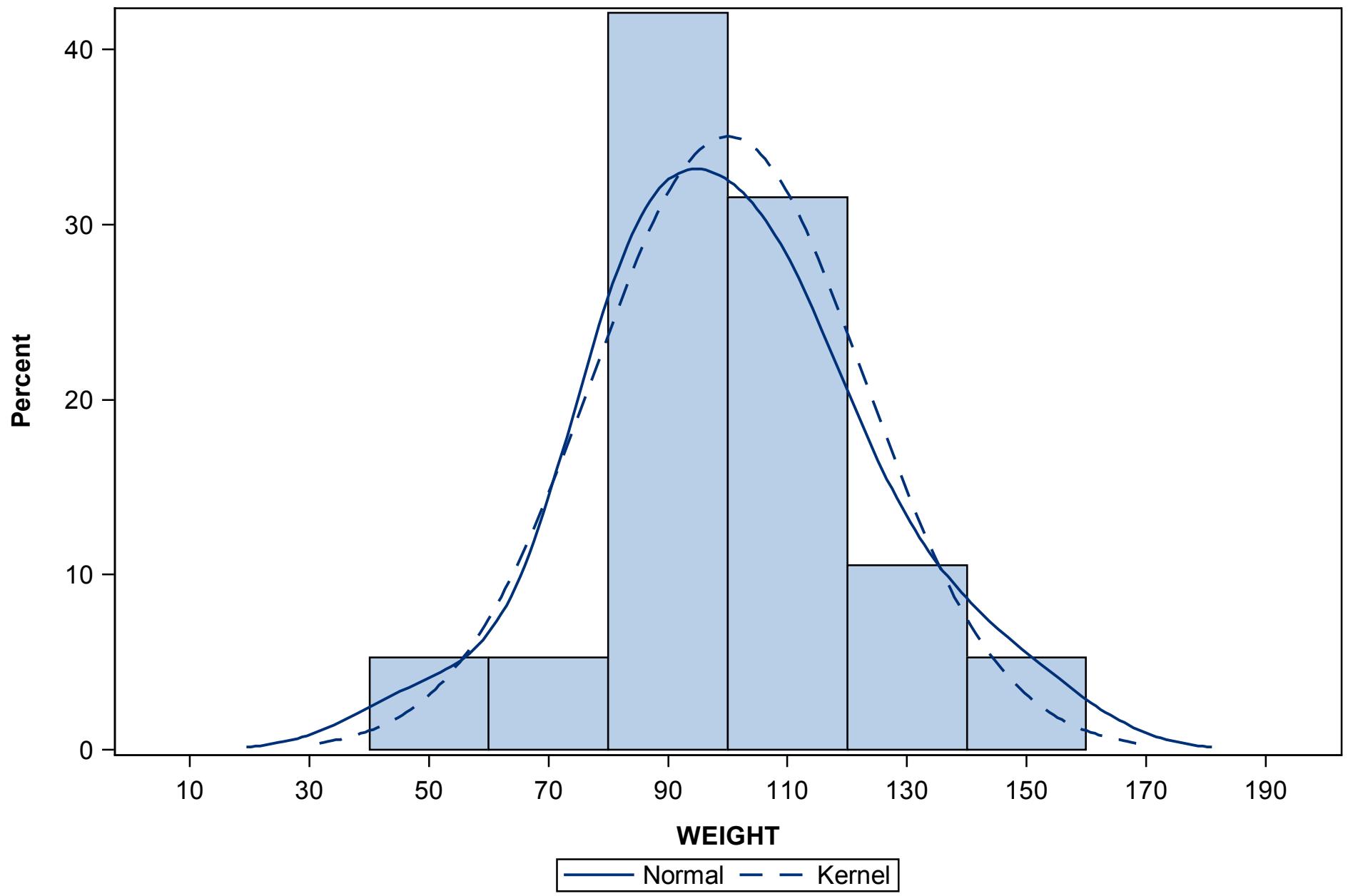


```
PROC TEMPLATE ;
DEFINE STATGRAPH conditional;
DYNAMIC var curve;
BEGINGRAPH;
ENTRYTITLE " Distribution of " var;
LAYOUT OVERLAY ;
HISTOGRAM VAR ;
IF( UPCASE(curve) = "NONE" )
HISTOGRAM var;
ENDIF;
IF( UPCASE(curve) = "ALL" )
DENSITYPLOT VAR / KERNEL() NAME= "n" LEGENDLABEL= "Normal" ;
ENDIF;
IF (upcase(curve) = "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



Distribution of Weight

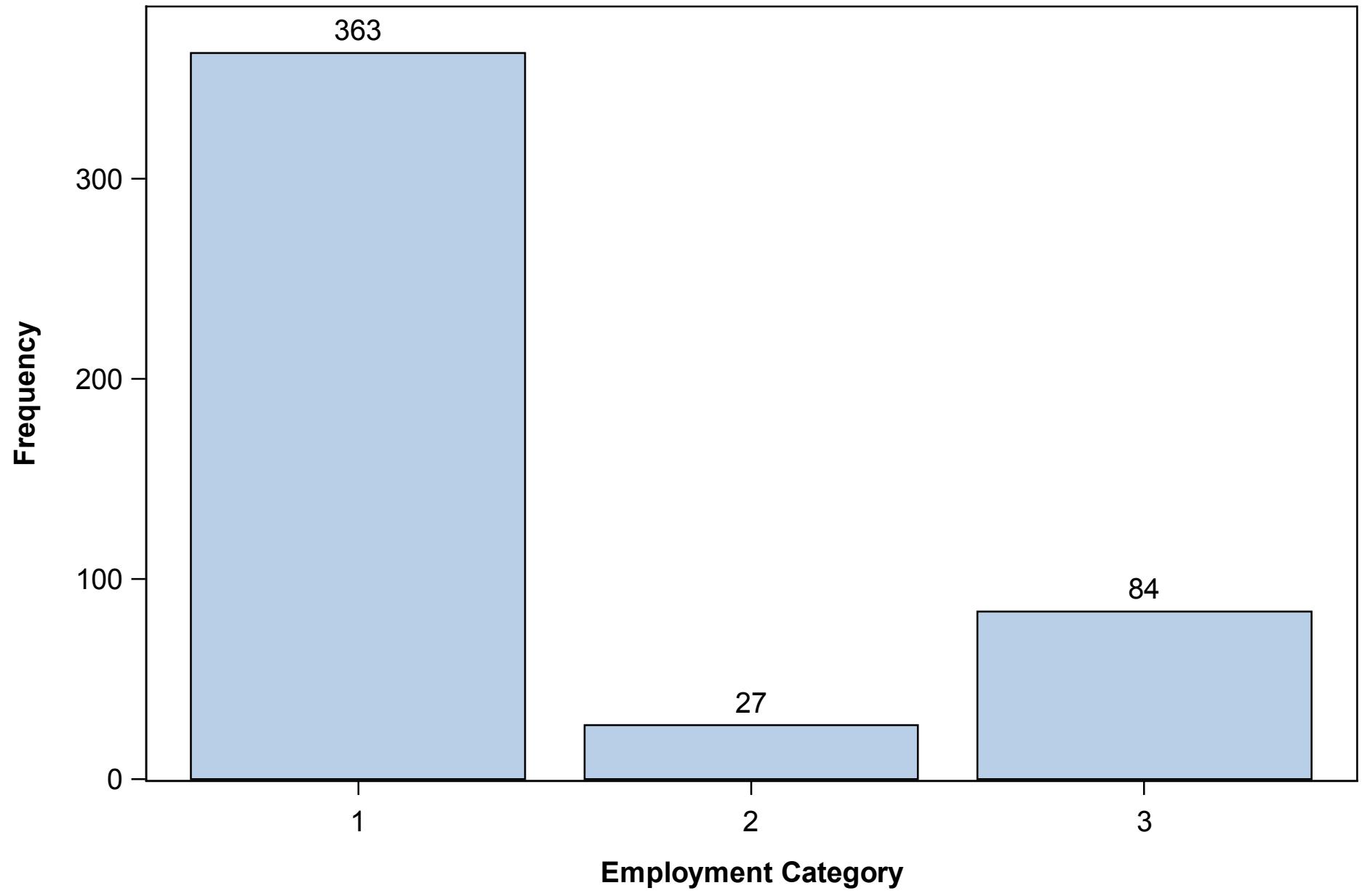


example-> 040

Bar Charts

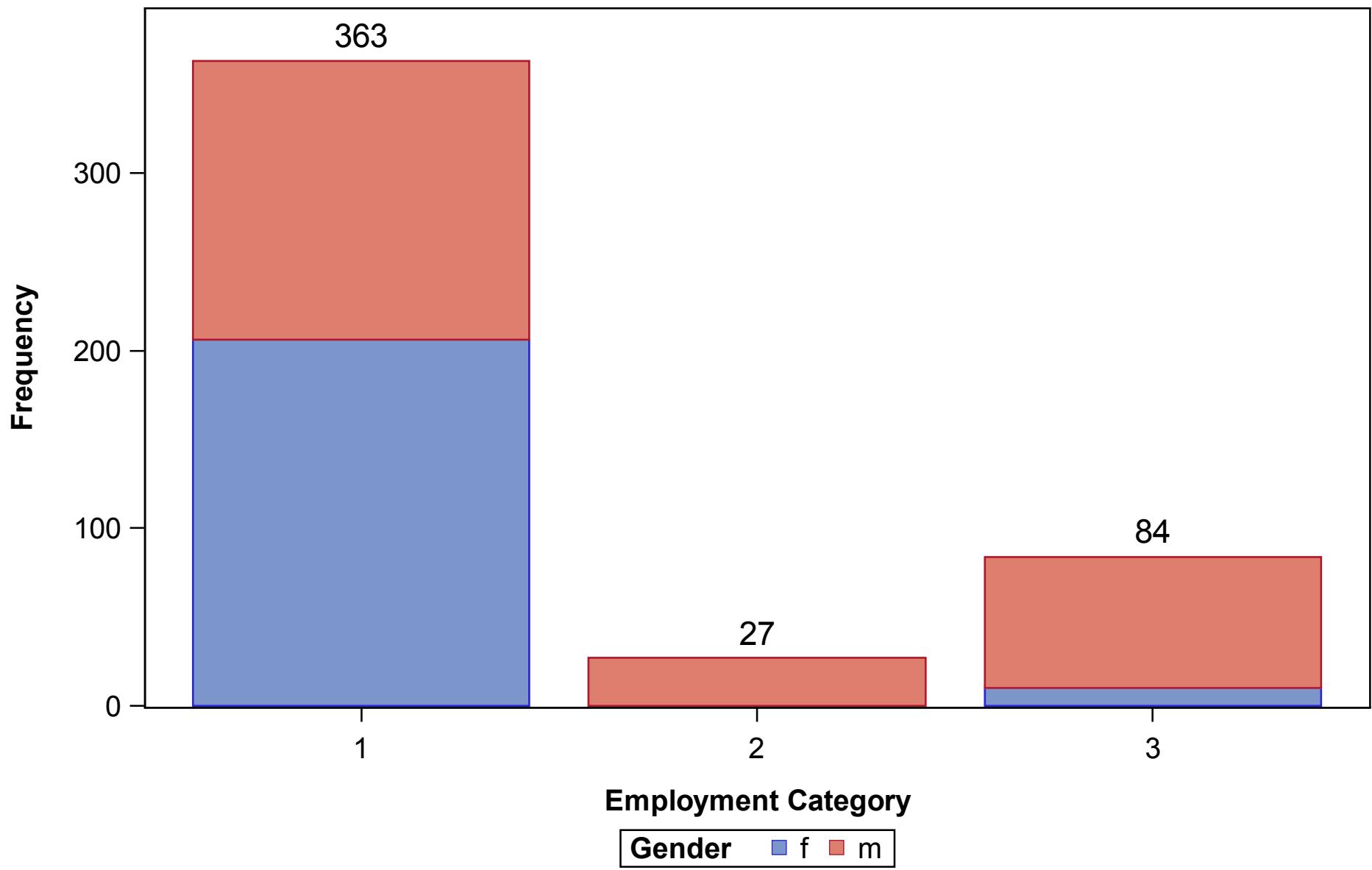
```
title "Vertical Bar Chart";  
proc sgplot data=employee;  
vbar jobcat / datalabel;  
run;
```

Vertical Bar Chart



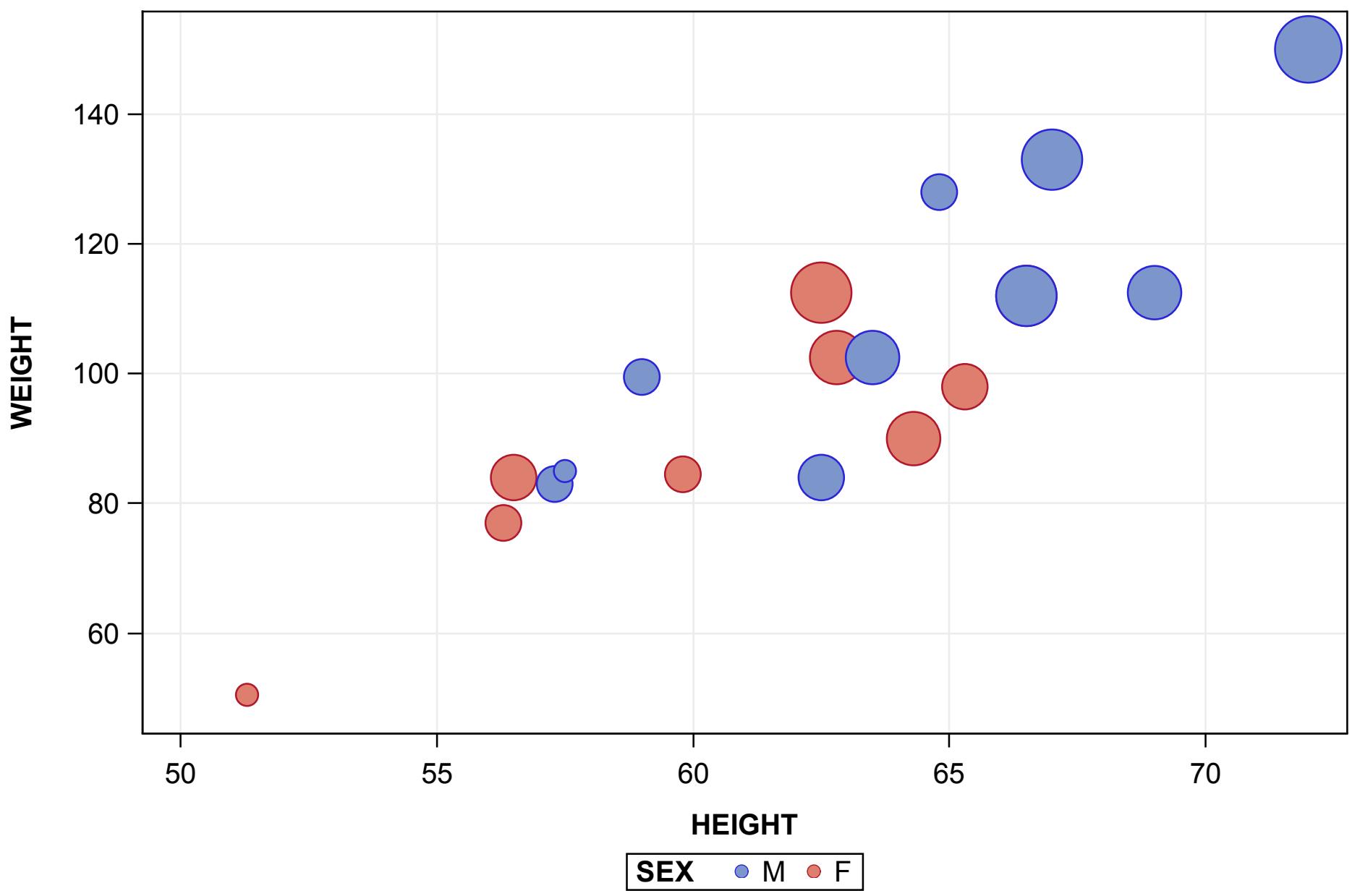
```
title "Vertical Bar Chart";  
title2 "Grouped by Gender";  
proc sgplot data=employee;  
vbar jobcat /group=Gender datalabel;  
run;
```

Vertical Bar Chart Grouped by Gender



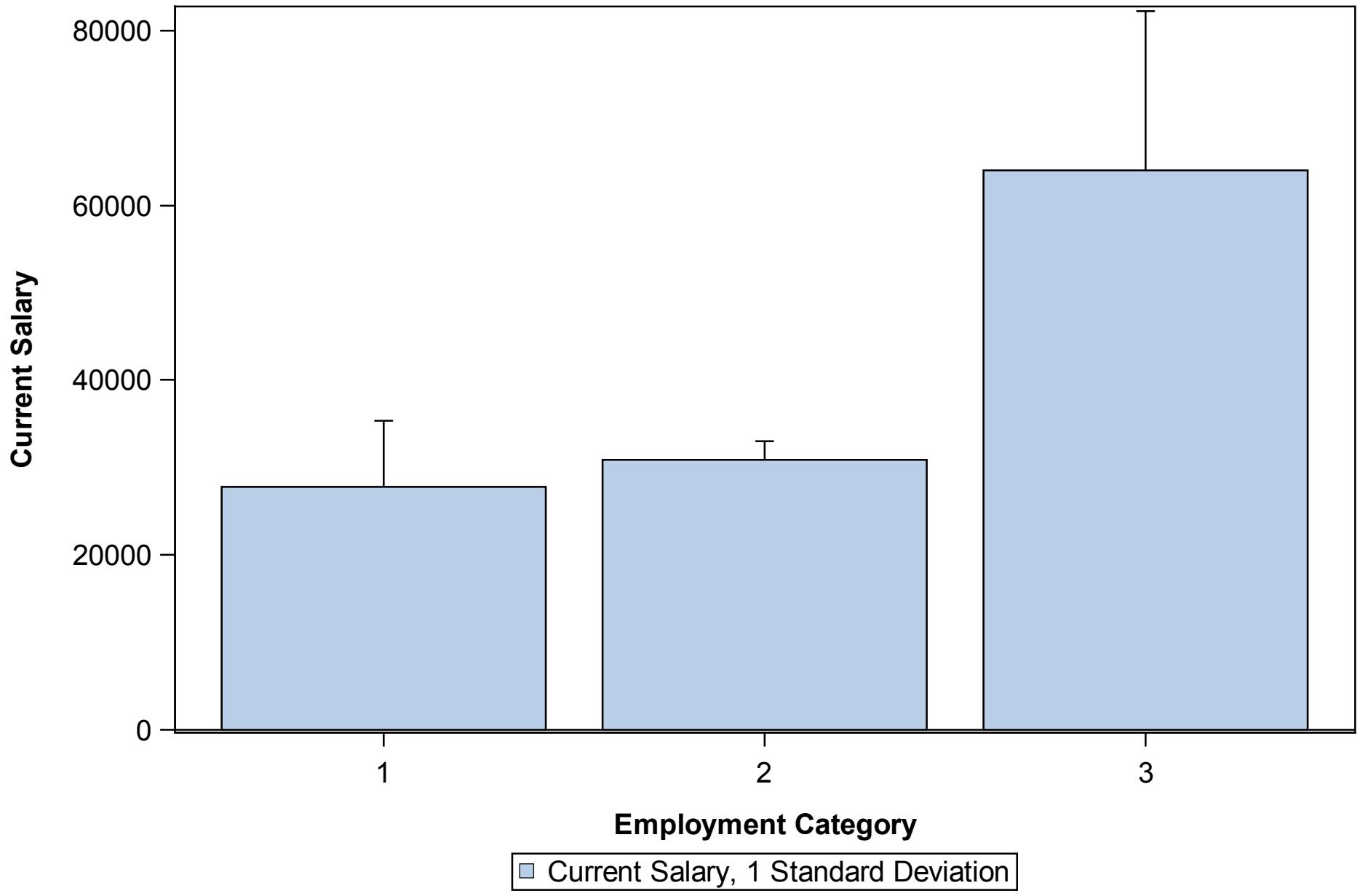
```
title "Student Age by Height and Weight";  
proc sgplot data=sashelp.class;  
bubble x=height y=weight size=age / group=sex;  
xaxis grid; yaxis grid;  
run;
```

Student Age by Height and Weight



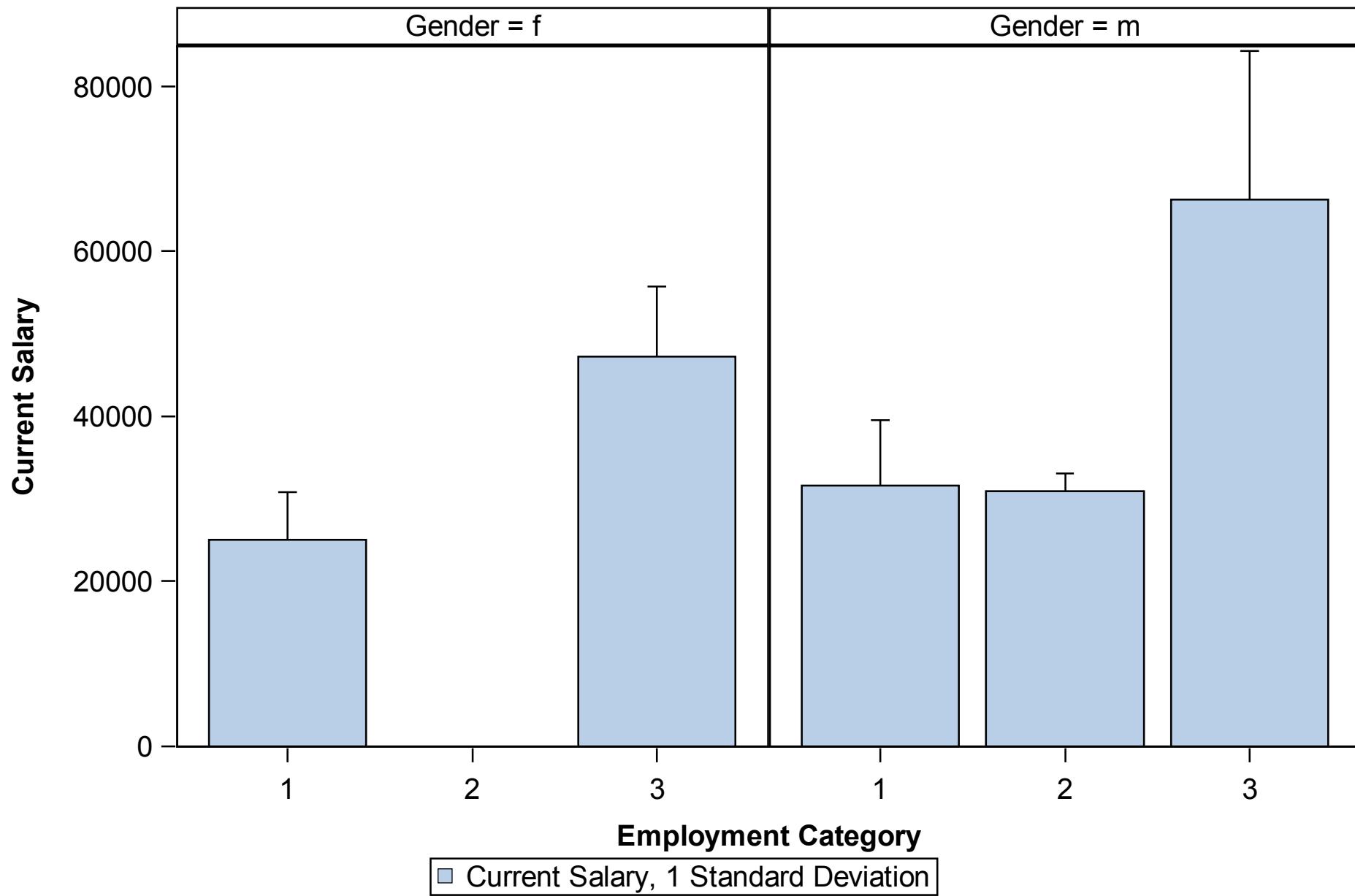
```
title "BarChart with Mean and Standard Deviation";  
proc sgplot data=employee;  
vbar jobcat / response=salary limitstat = stddev  
limits = upper stat=mean;  
run;
```

BarChart with Mean and Standard Deviation



```
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

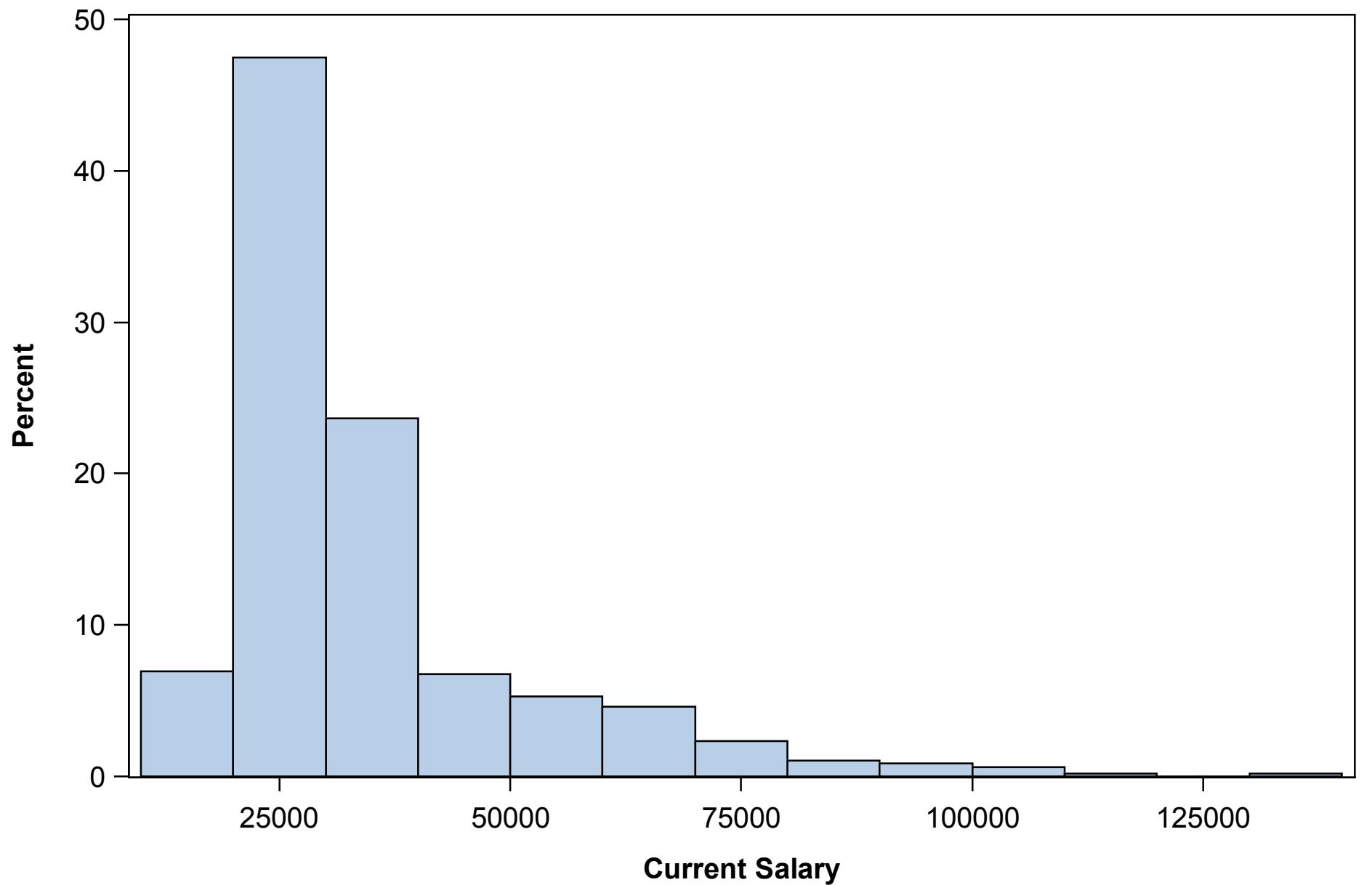


example-> 050

Histograms

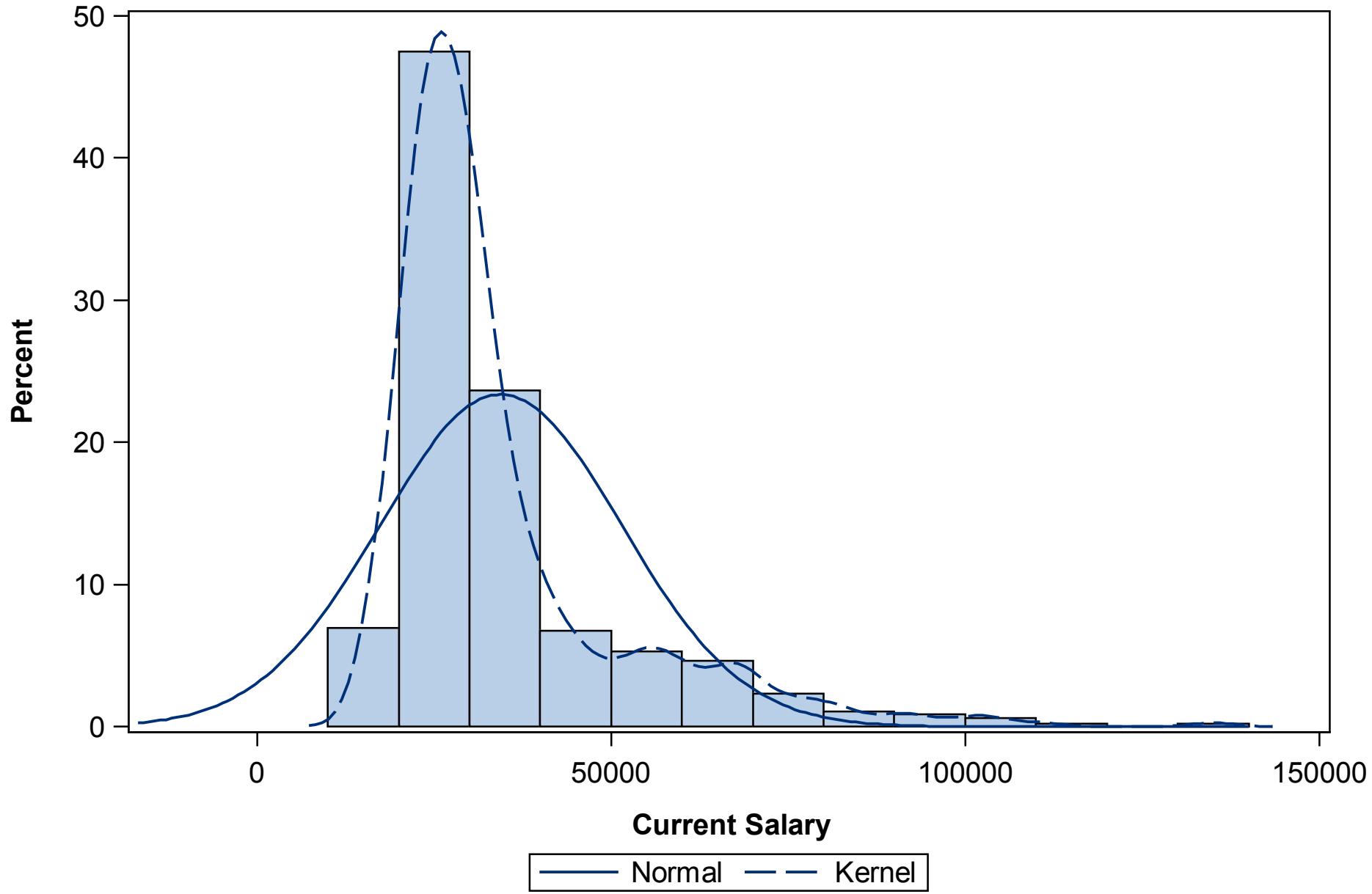
```
title "Histogram";  
proc sgplot data=employee;  
histogram salary ;  
run;
```

Histogram



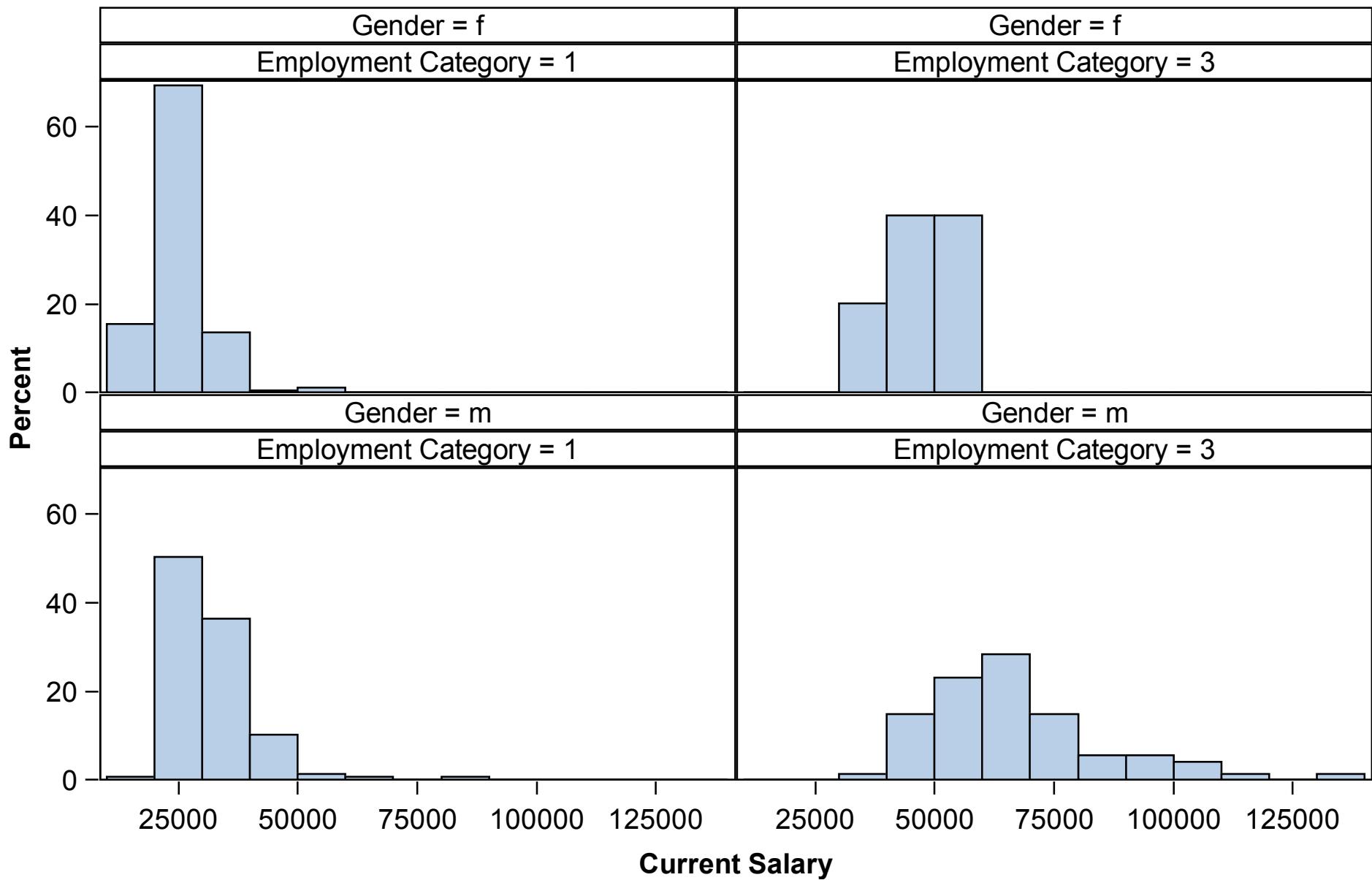
```
title "Histogram With Density Overlaid";
proc sgplot data=employee;
histogram salary ;
density salary;
density salary / type=kernel;
run;
```

Histogram With Density Overlaid



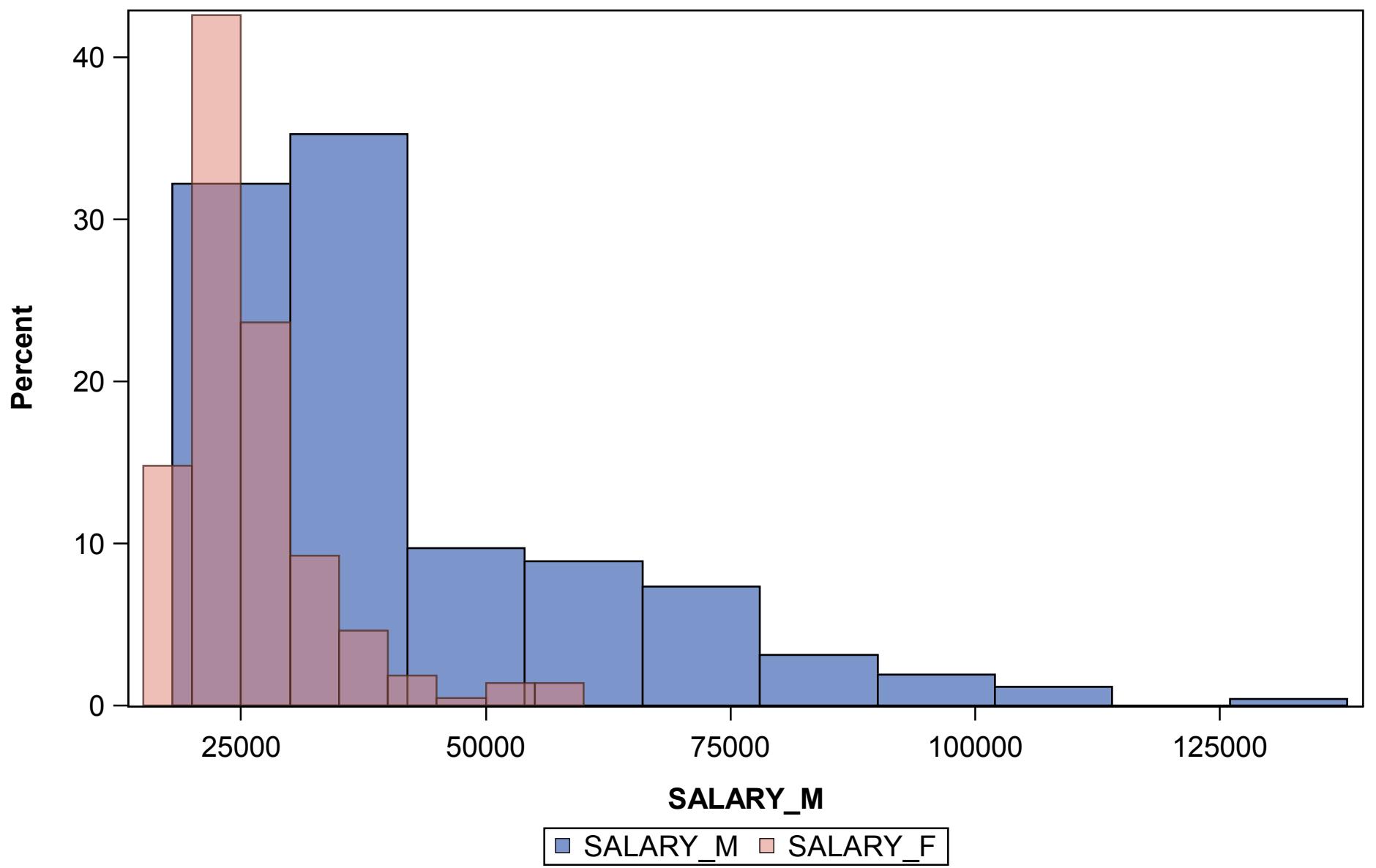
```
title "Histogram with Panels";  
title2 "Exclude Custodial";  
proc sgpanel data=employee;  
where jobcat not=2;  
panelby gender jobcat/ rows=2 columns = 2 ;  
  
histogram salary;  
run;
```

Histogram with Panels Exclude Custodial



```
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

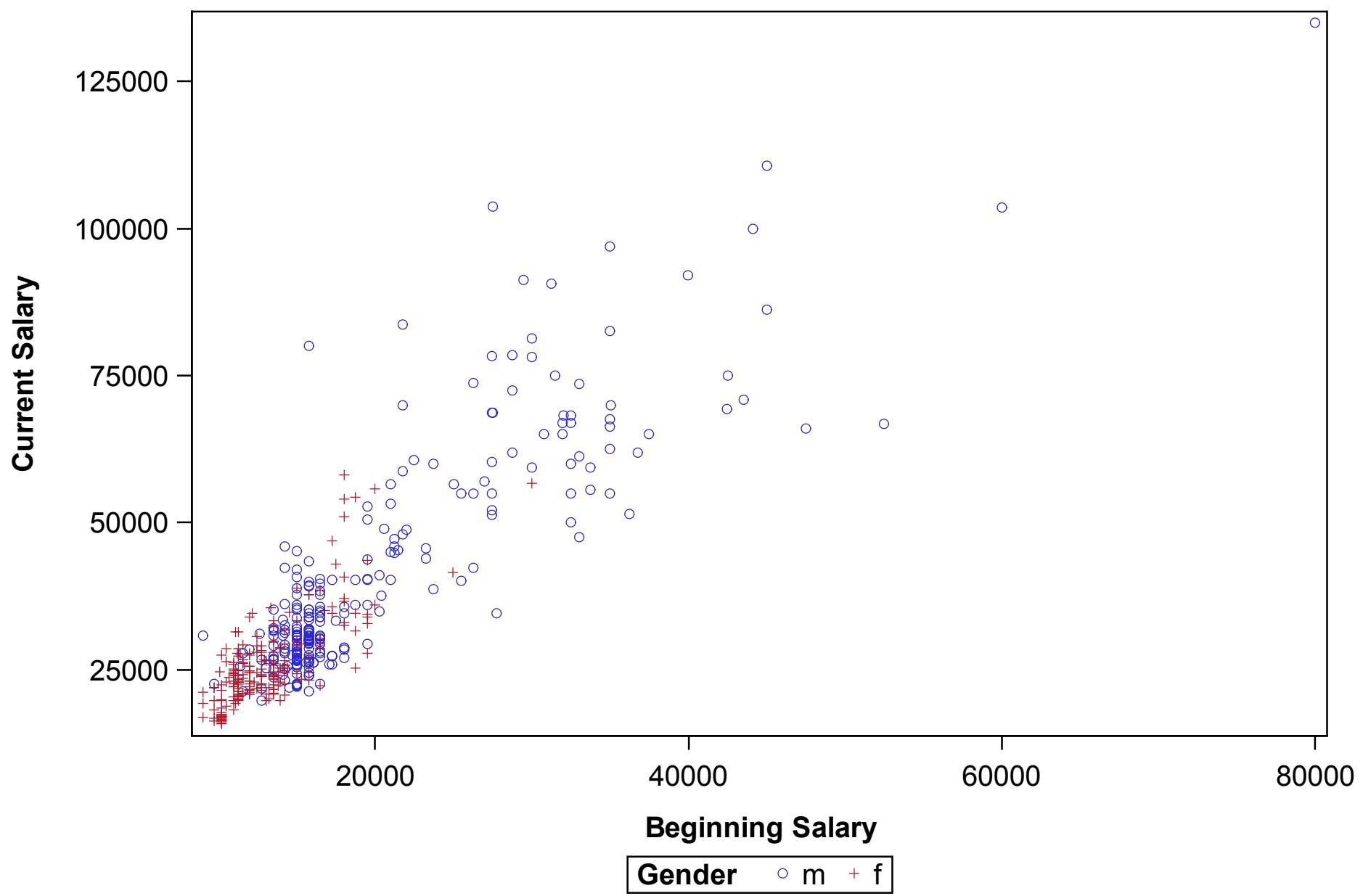


example-> 060

Scatterplot

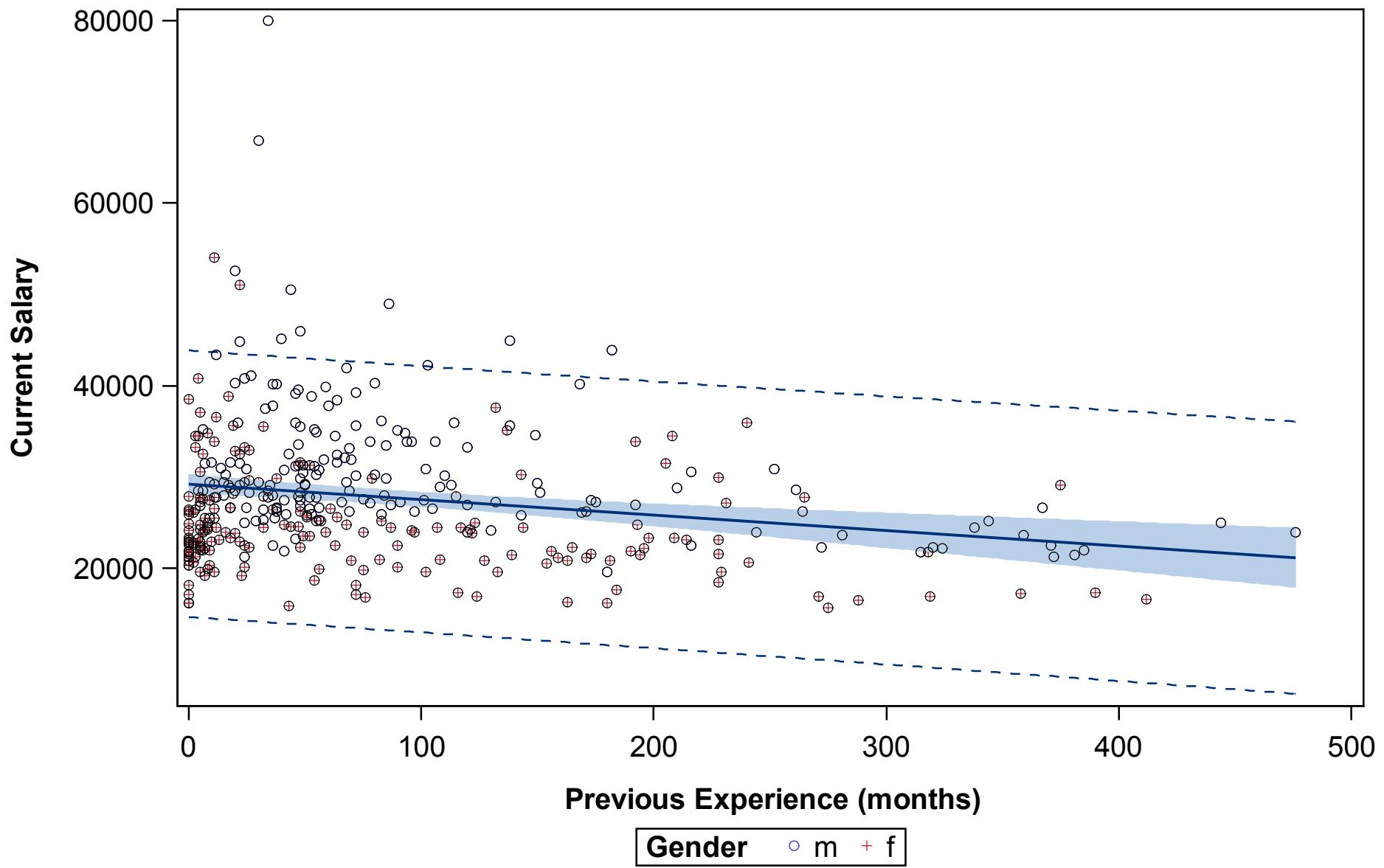
```
title "Scatterplot";  
proc sgplot data=employee;  
scatter x=salbegin y=salary / group=gender ;  
run;
```

Scatterplot



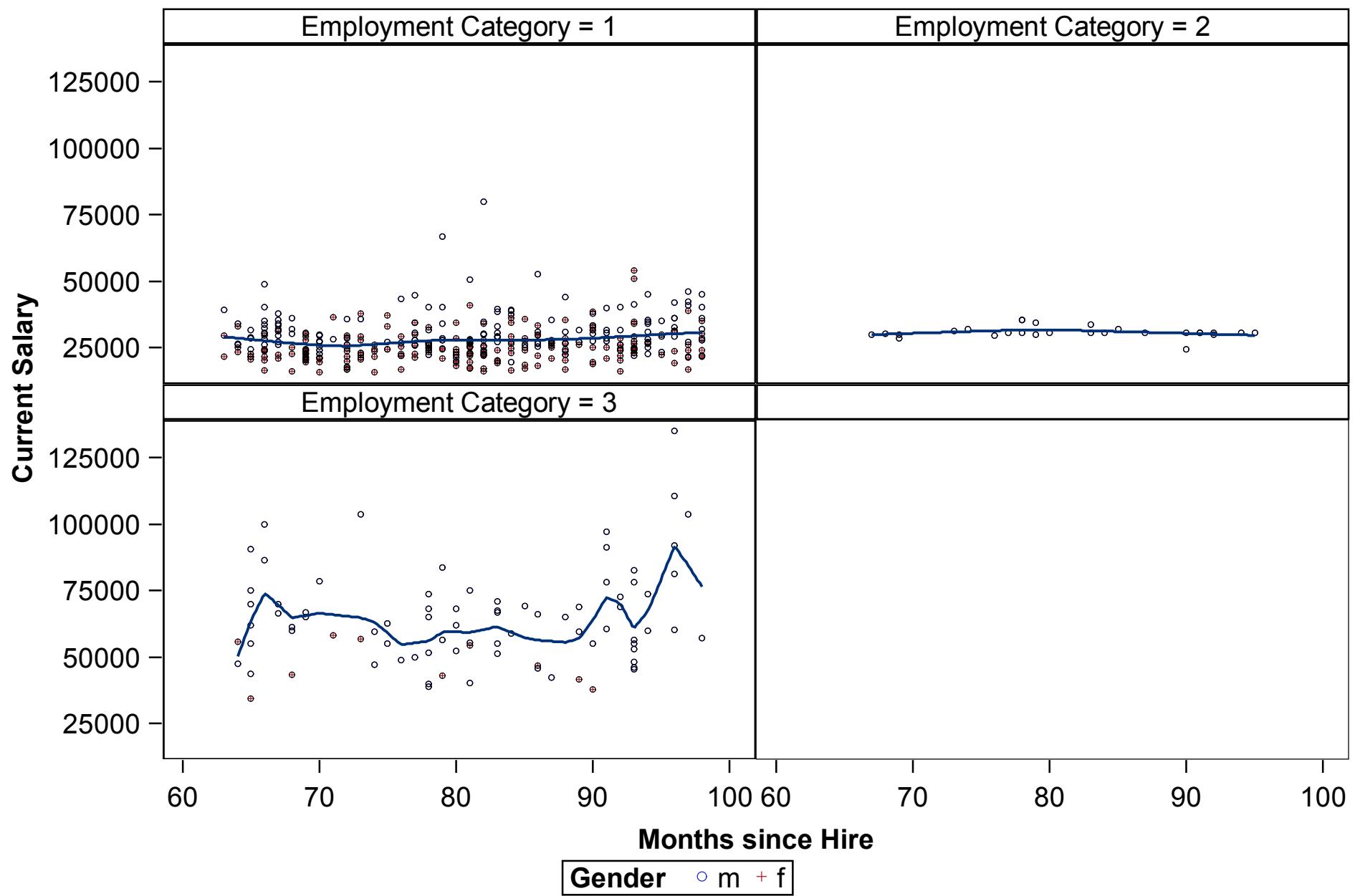
```
title "Scatterplot with Regression Line";  
title2 "Clerical Only";  
proc sgplot data=employee;  
where jobcat=1;  
scatter x=prevexp y=salary / group=gender ;  
  
reg x=prevexp y=salary / cli clm;  
run;
```

Scatterplot with Regression Line Clerical Only



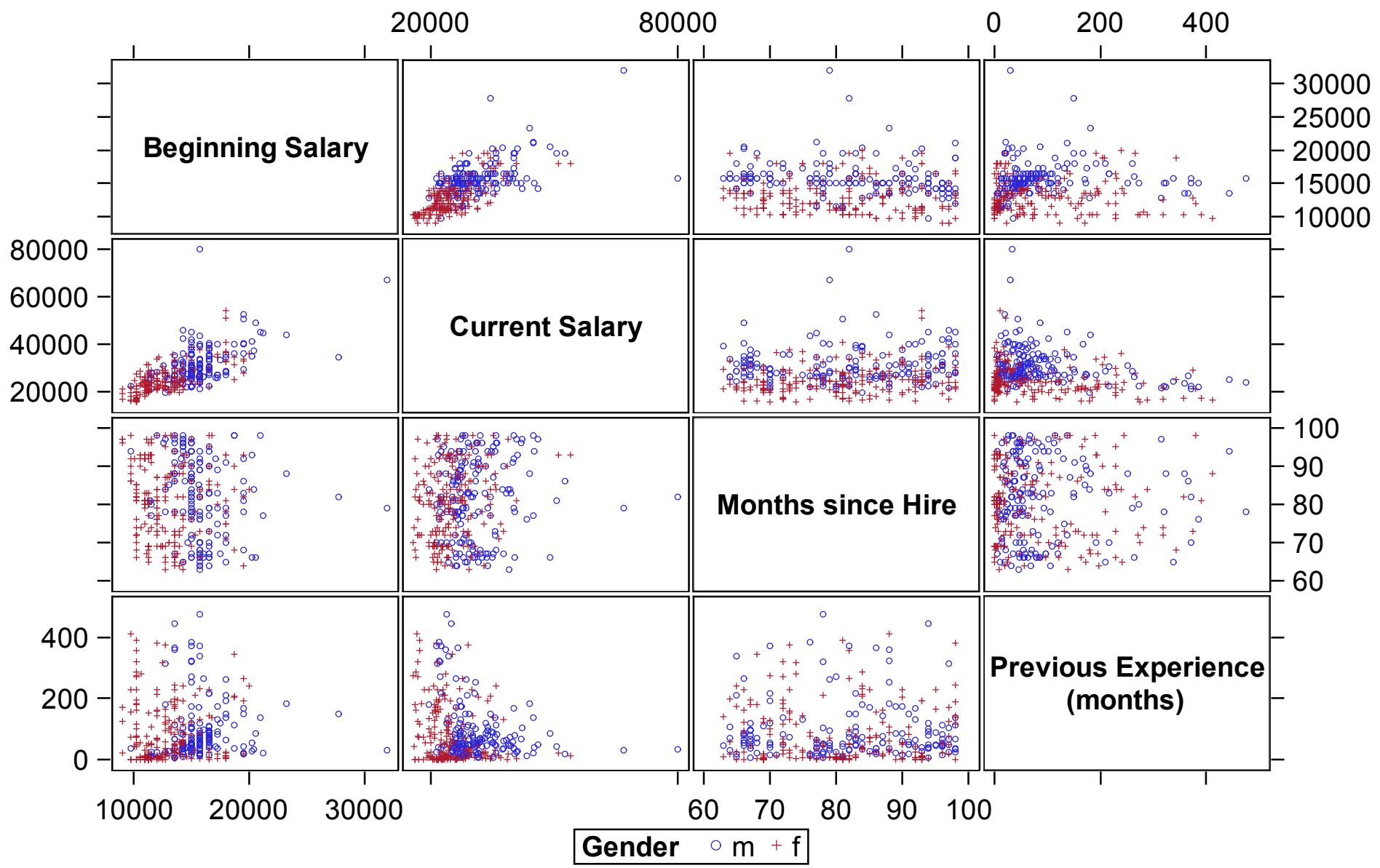
```
title "Scatterplot Panels. Males only";
proc sgpanel data=employee;
panelby jobcat;
scatter x=jobtime y=salary / group=gender;
loess x=jobtime y=salary ;
run;
```

Scatterplot Panels. Males only



```
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



example-> 070

Misc

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

WEIGHT

150

125

100

75

50

50

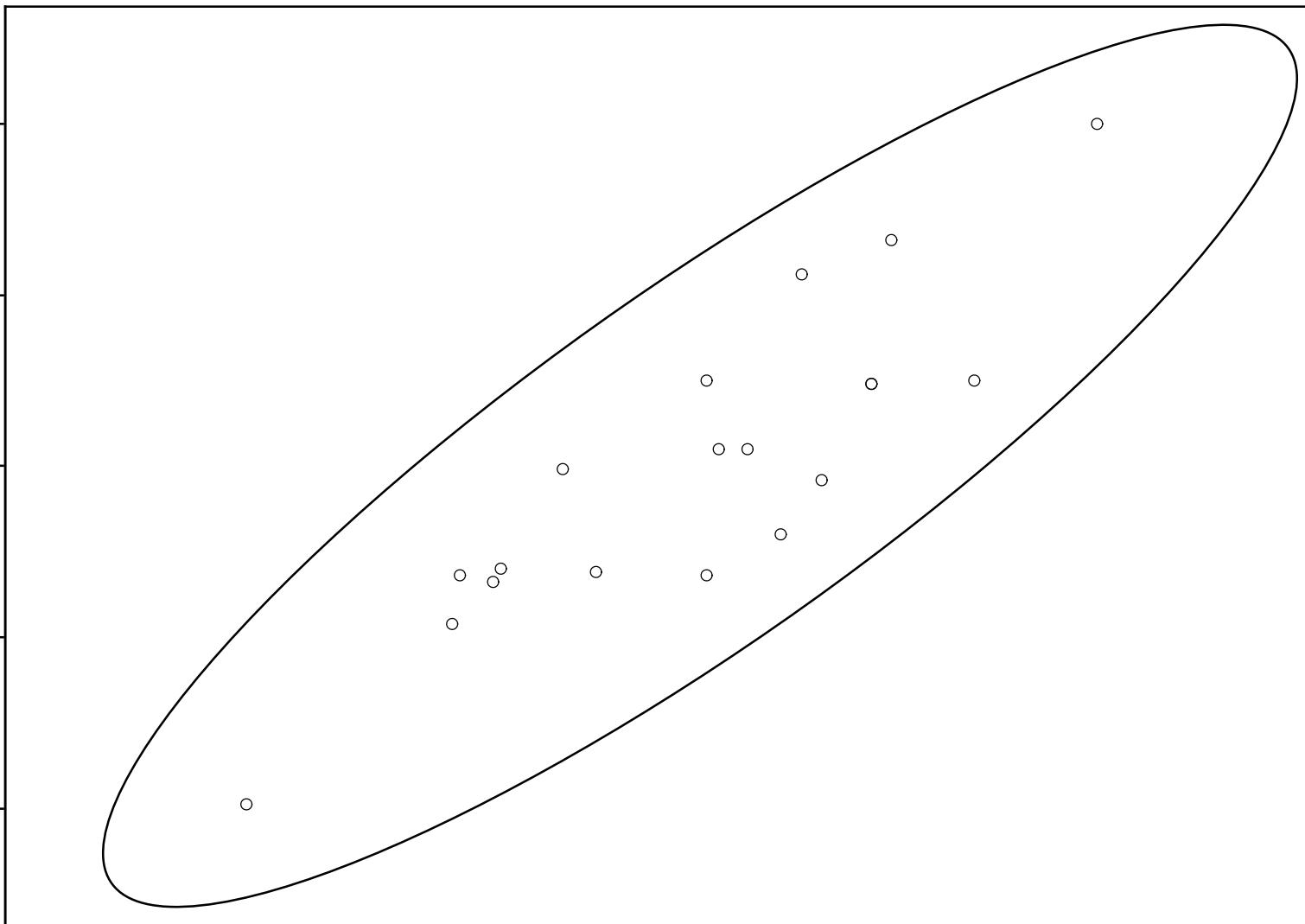
60

70

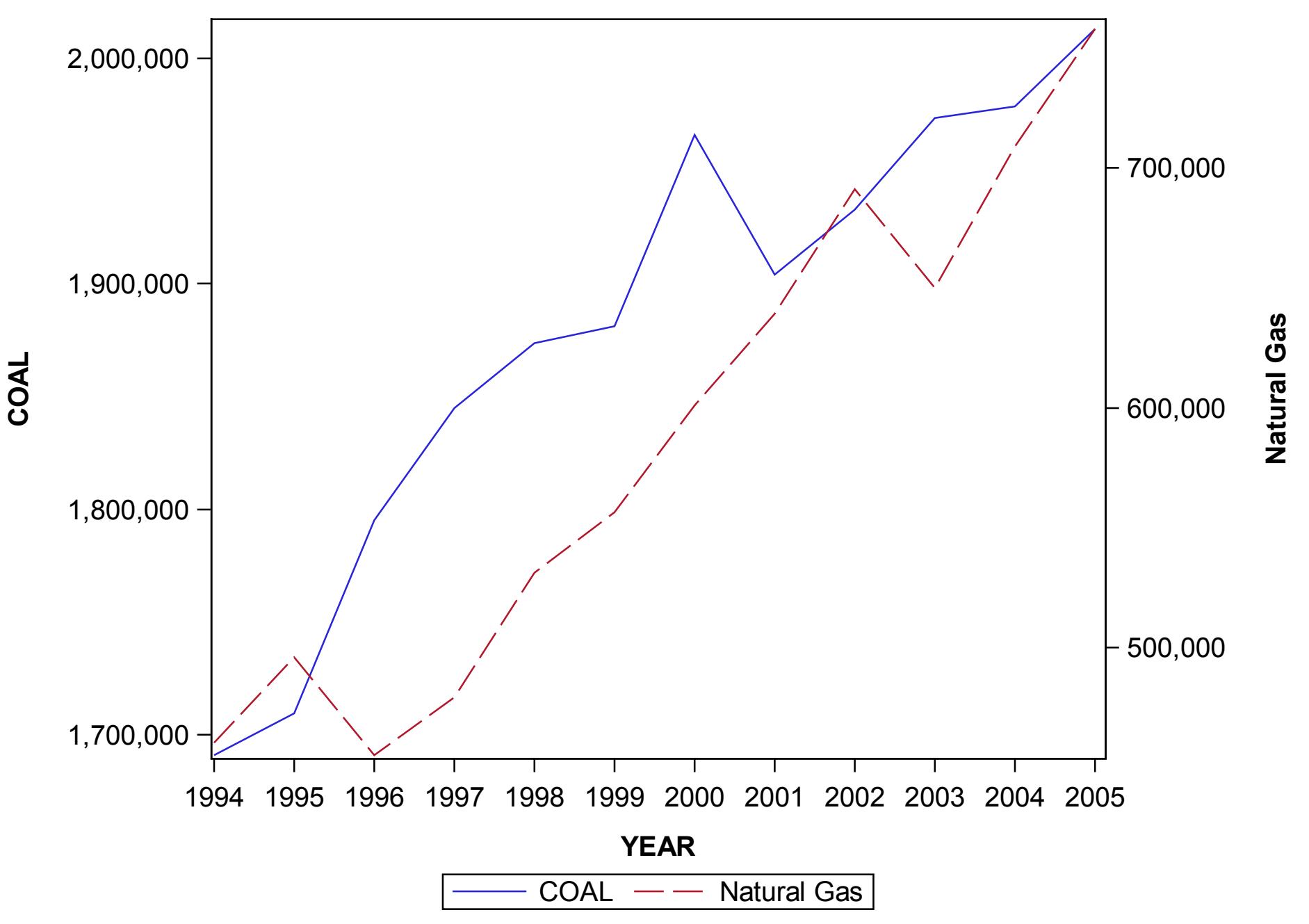
80

HEIGHT

○ WEIGHT —— 95% Prediction Ellipse

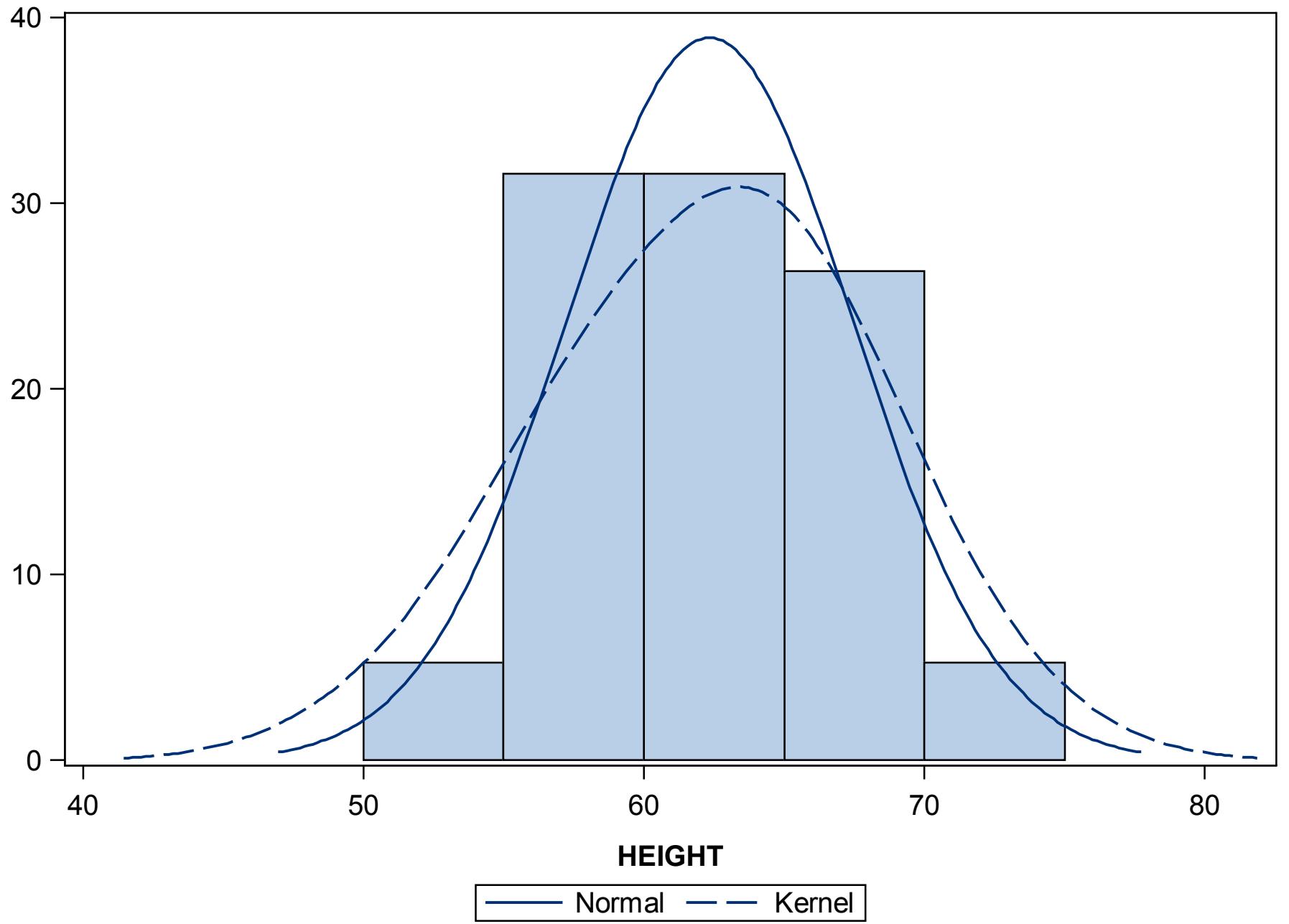


```
proc sgplot data=sashelp.electric(  
where=(customer="Residential"));  
xaxis type=discrete;  
series x=year y=coal;  
series x=year y=naturalgas / y2axis;  
  
run;quit;
```

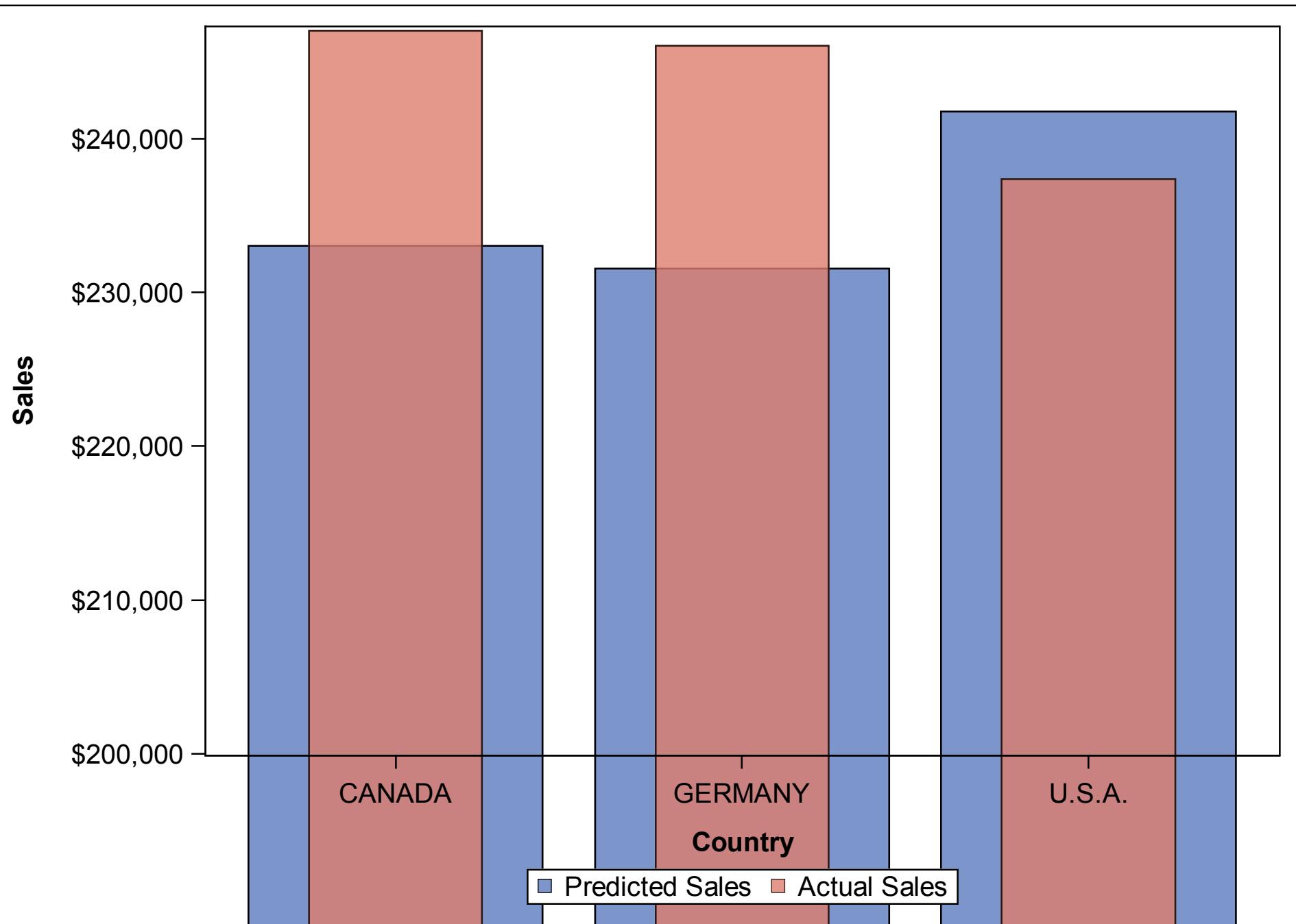


```
proc sgplot data=sashelp.class;
histogram height;
density height;
density height / type=kernel;
run;quit;
```

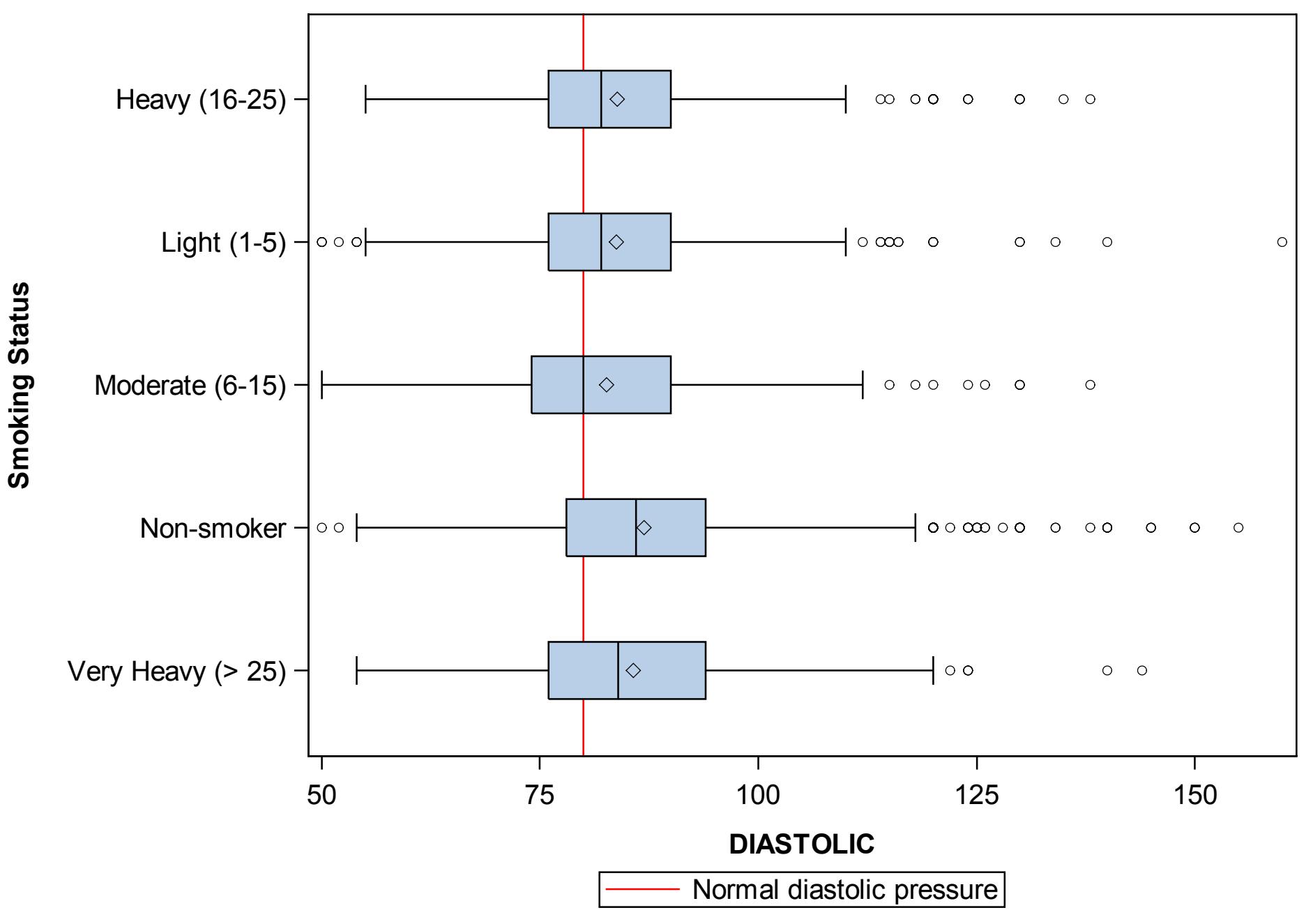
Percent



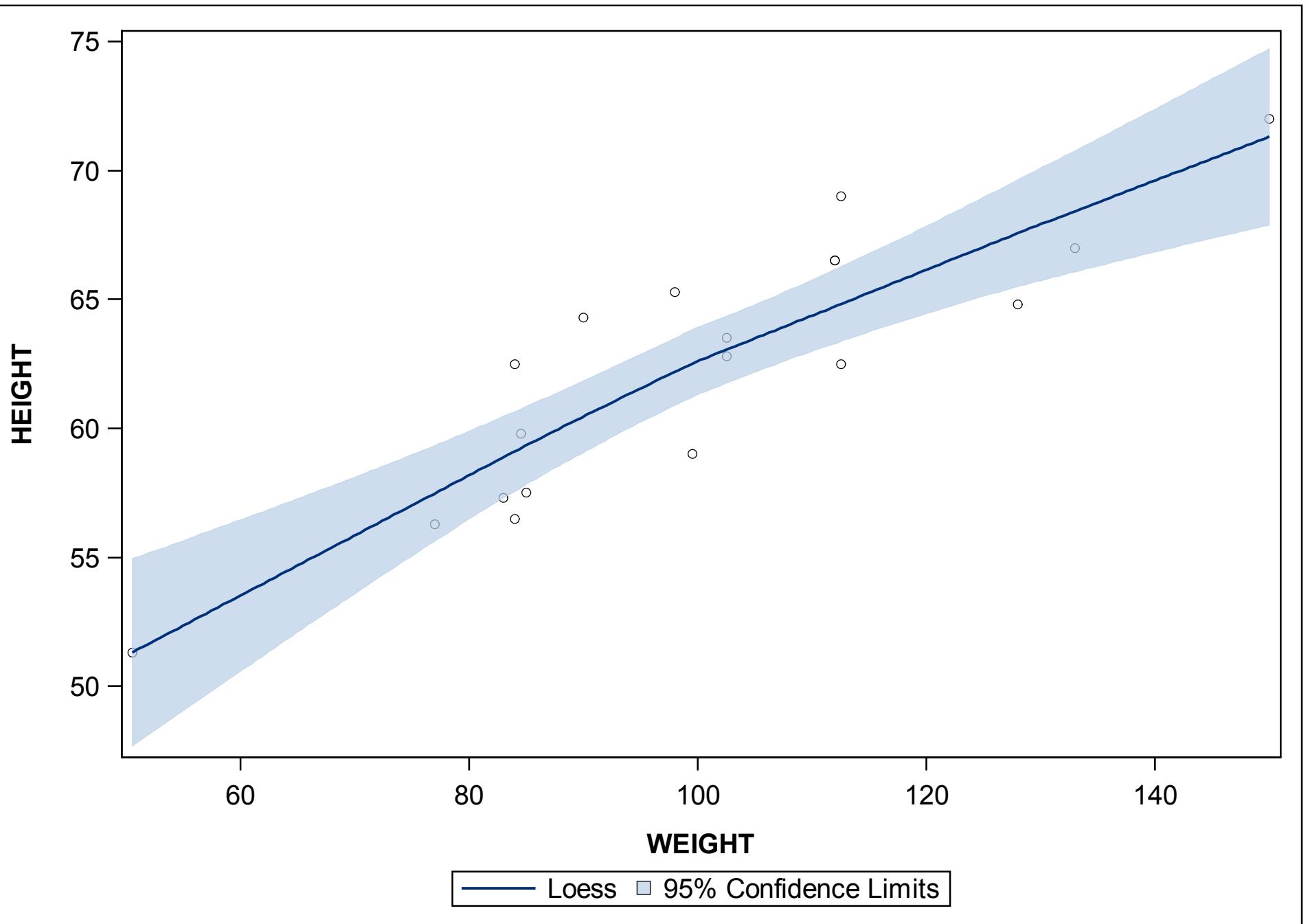
```
proc sgplot data=sashelp.prdsale;
yaxis label="Sales" min=200000;
vbar country / response=predict;
vbar country / response=actual
barwidth=0.5
transparency=0.2;
run;quit;
```



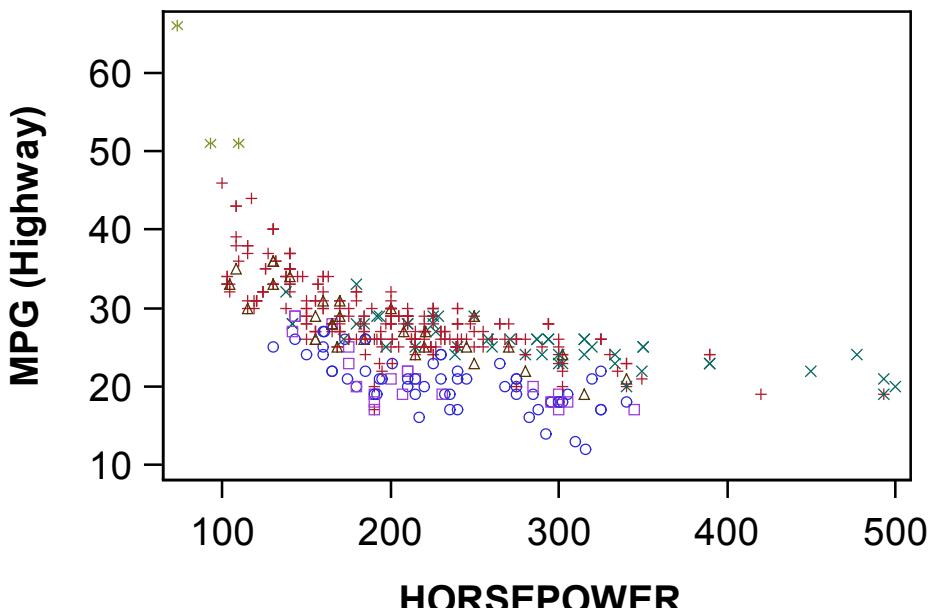
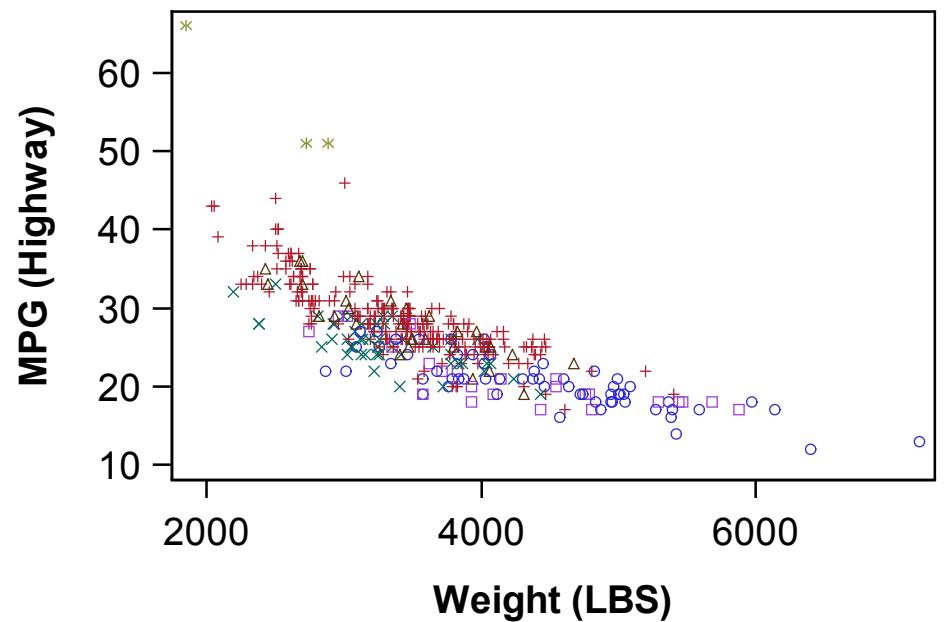
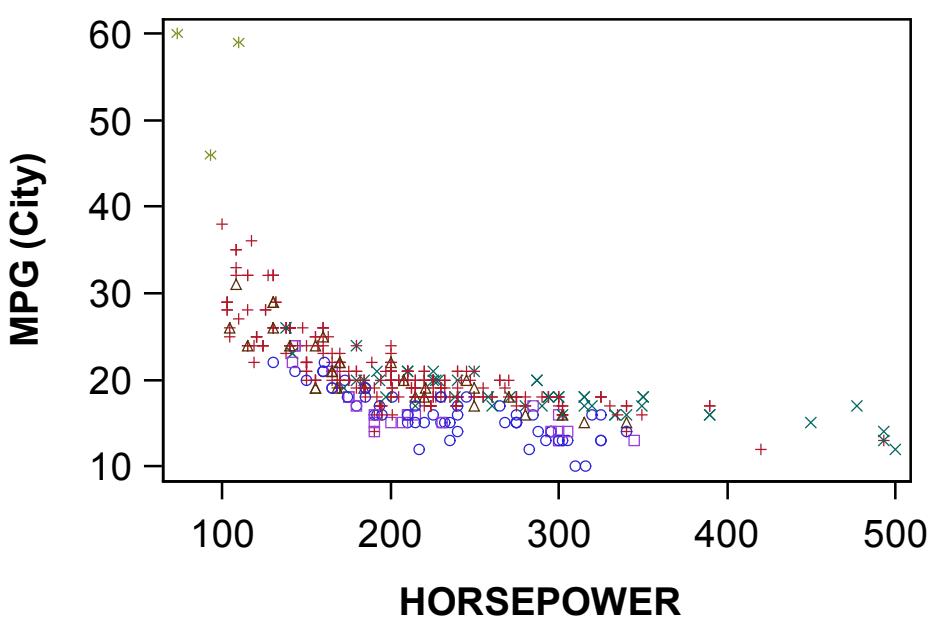
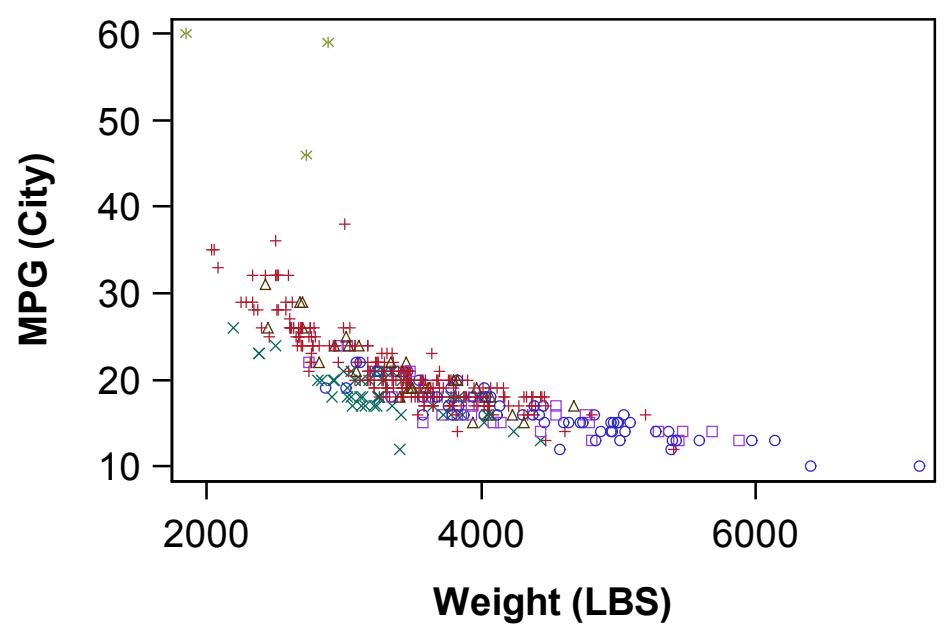
```
proc sgplot data=sashelp.heart (where=(smoking_status ne " "));  
refline 80 / axis=x name="normal" lineattrs=(color=red)  
legendlabel="Normal diastolic pressure";  
hbox diastolic / category=smoking_status;  
keylegend "normal";  
  
run;quit;
```



```
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;
```

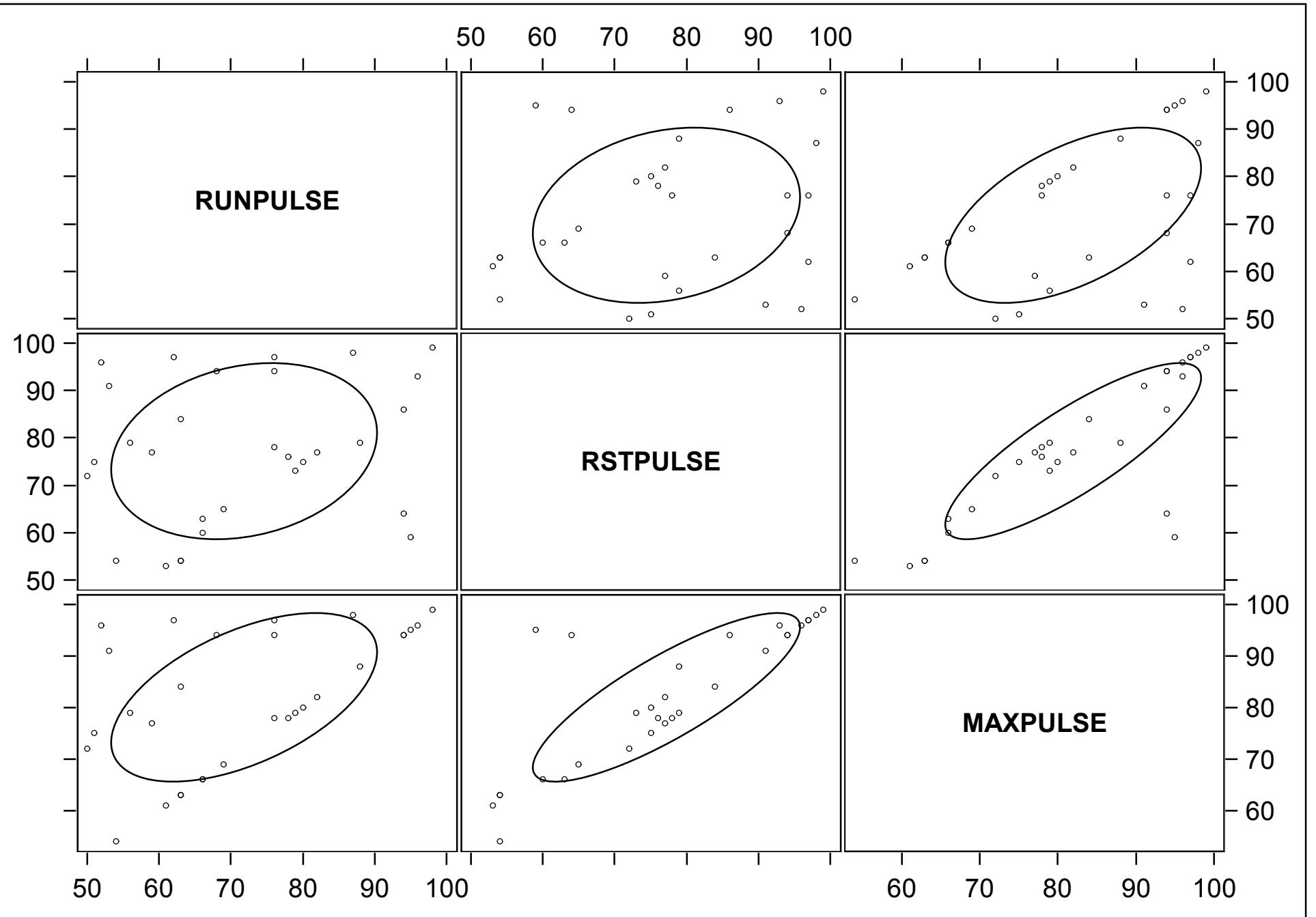


```
proc sgscatter data=sashelp.cars;  
plot (mpg_city mpg_highway)*(weight horsepower) / group=type;  
run;quit;
```

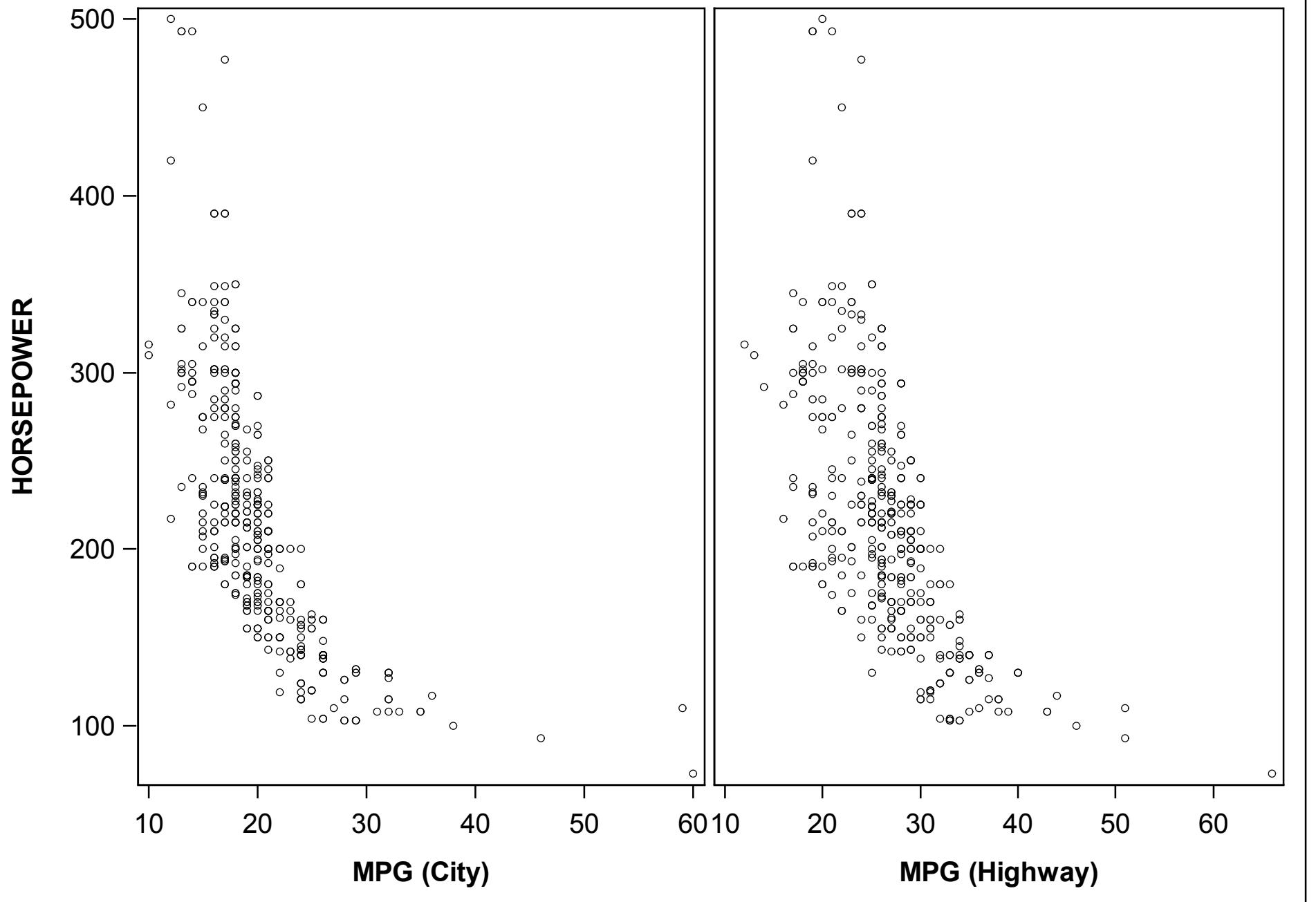


TYPE ○ SUV + Sedan × Sports △ Wagon □ Truck * Hybrid

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



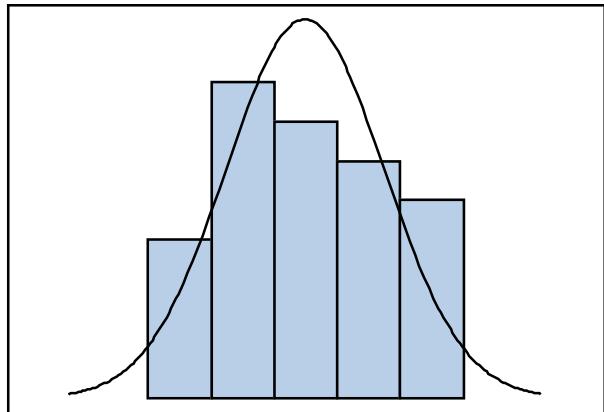
```
proc sgscatter data=sashelp.cars;  
compare x=(mpg_city mpg_highway) y=horsepower;  
run;quit;
```



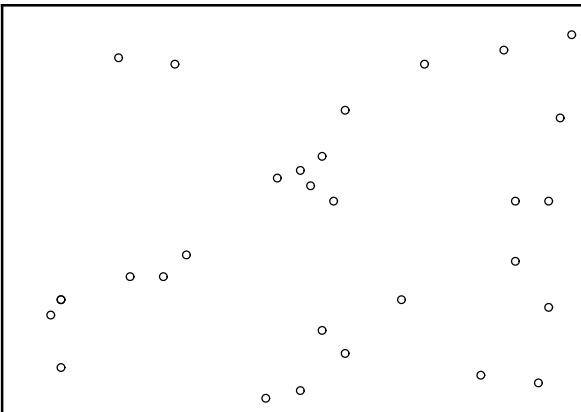
```
proc sgscatter data=fitness;  
matrix runpulse rstpulse maxpulse / diagonal=(histogram normal);  
run;quit;
```

RUNPULSE

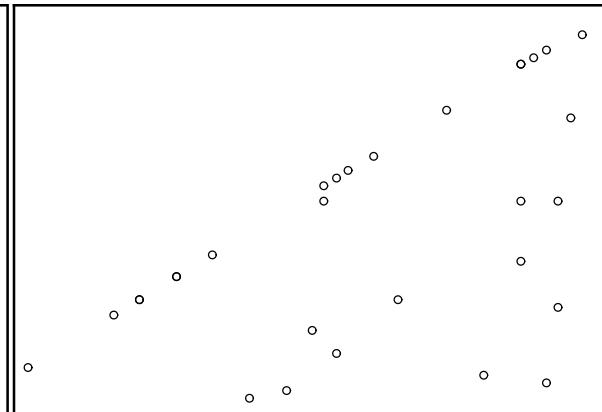
RUNPULSE

**RSTPULSE**

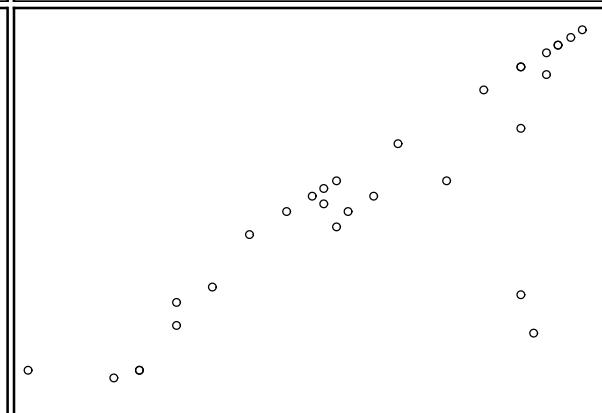
RSTPULSE

**MAXPULSE**

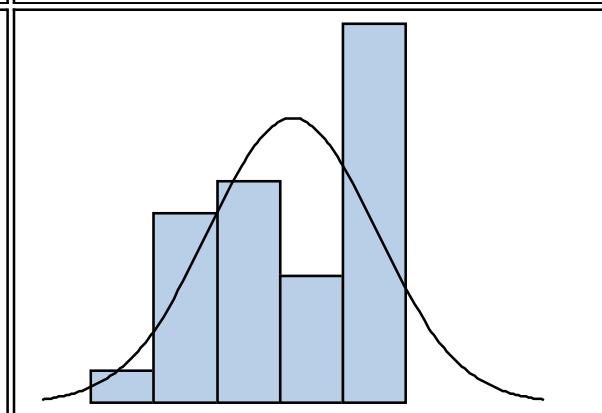
MAXPULSE



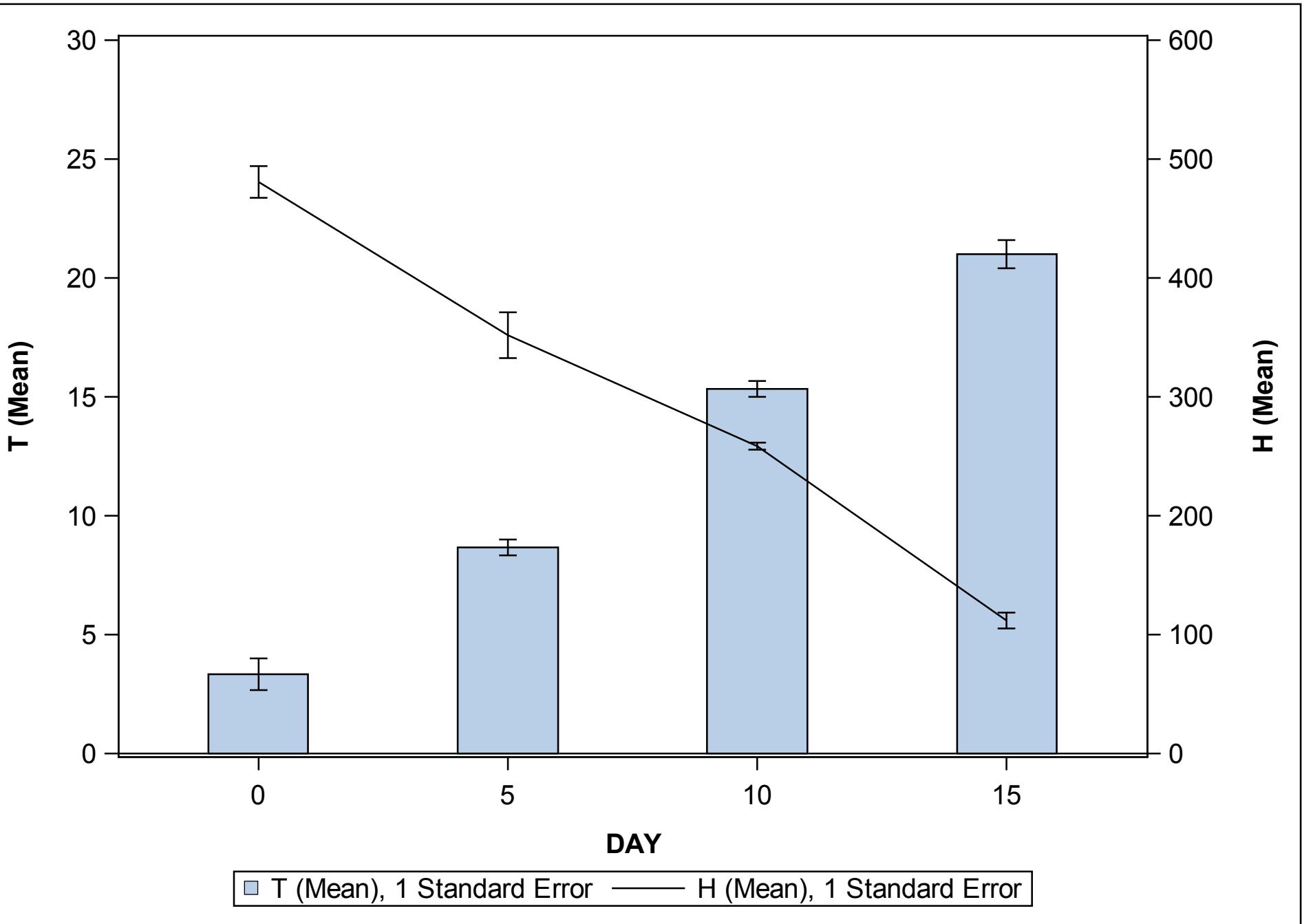
RSTPULSE



MAXPULSE

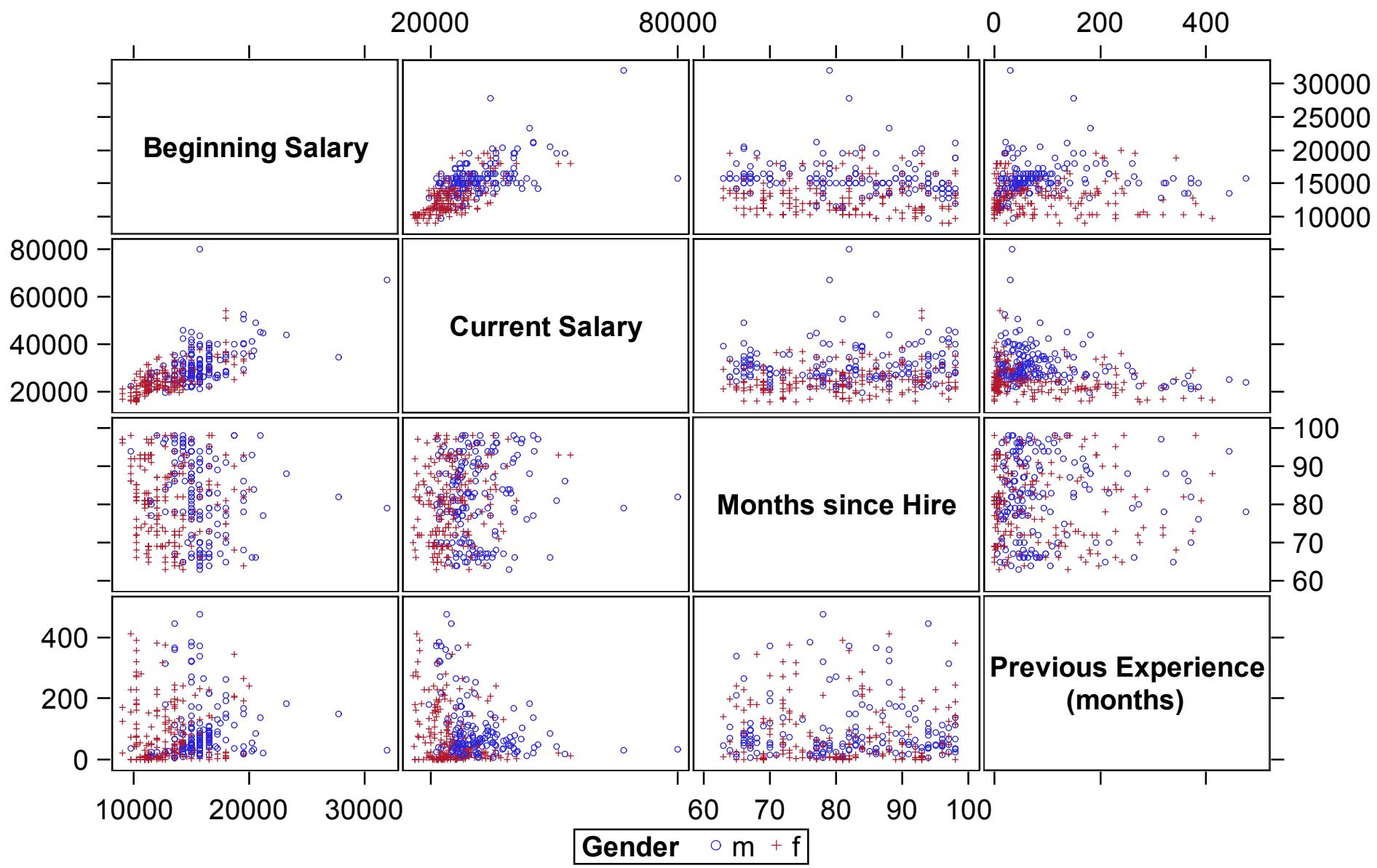


```
proc sgplot data=ex;
vbar day / response=t stat=mean limits=both limitstat=stderr barwidth=0.4 ;
vline day / response=h stat=mean limits=both limitstat=stderr y2axis;
yaxis min=0 max=30 ;
y2axis min=0 max=600 ;
run;quit;
```

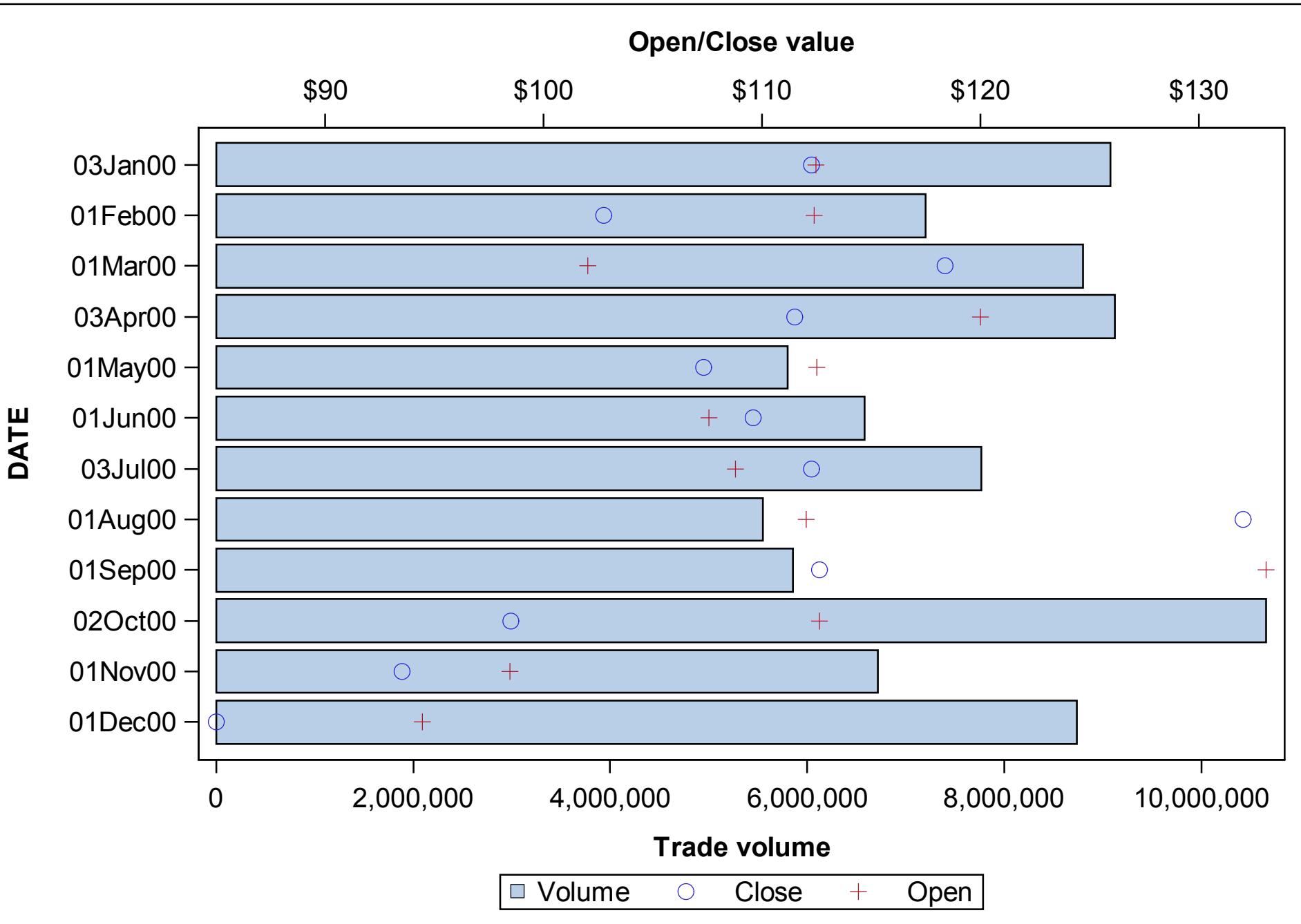


```
title "Scatterplot Matrix";  
title2 "Clerical Employees";  
proc sgscatter data=employee;  
where jobcat=1;  
matrix salbegin salary jobtime prevexp / group=gender;  
  
run;
```

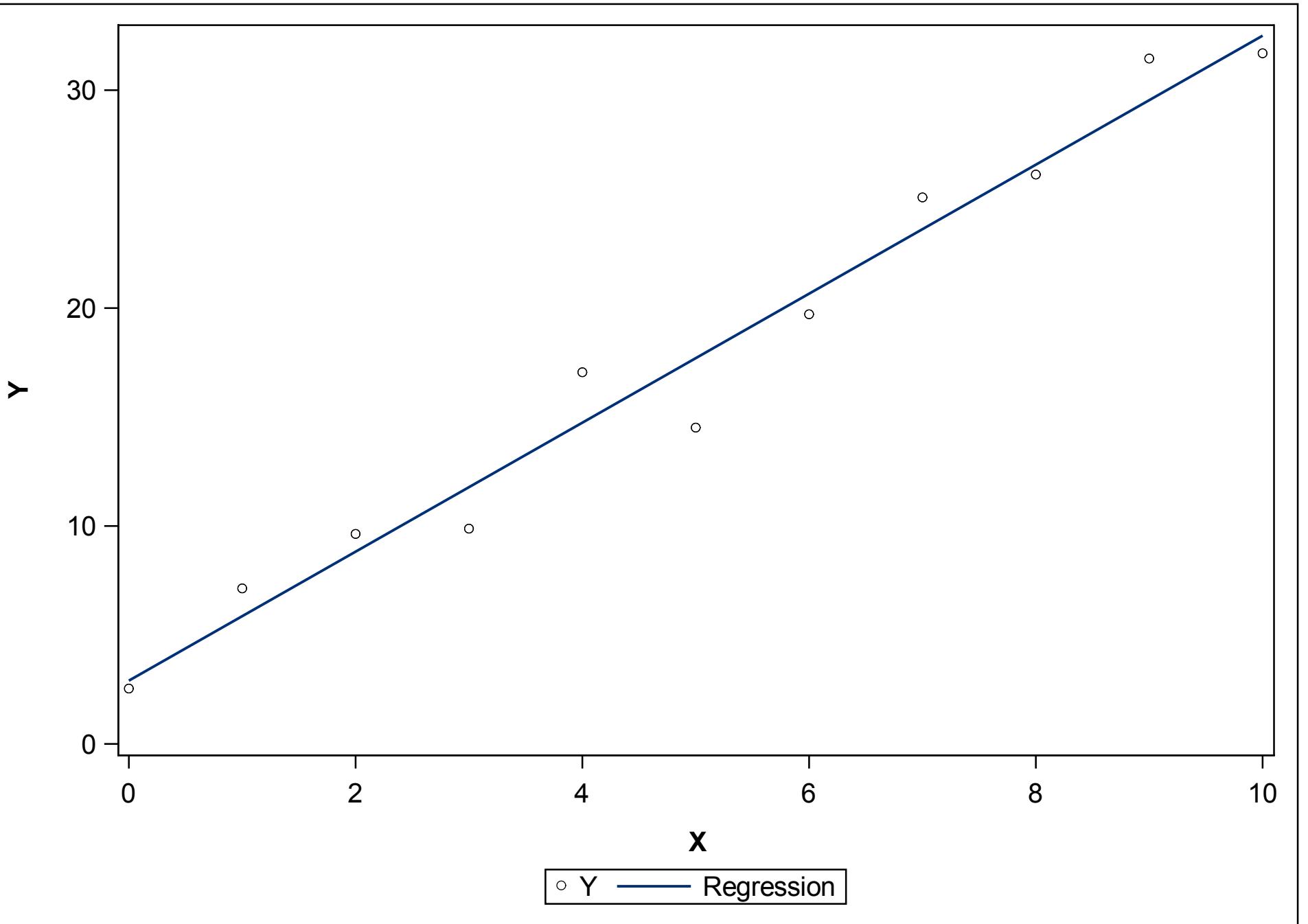
Scatterplot Matrix Clerical Employees



```
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;
```

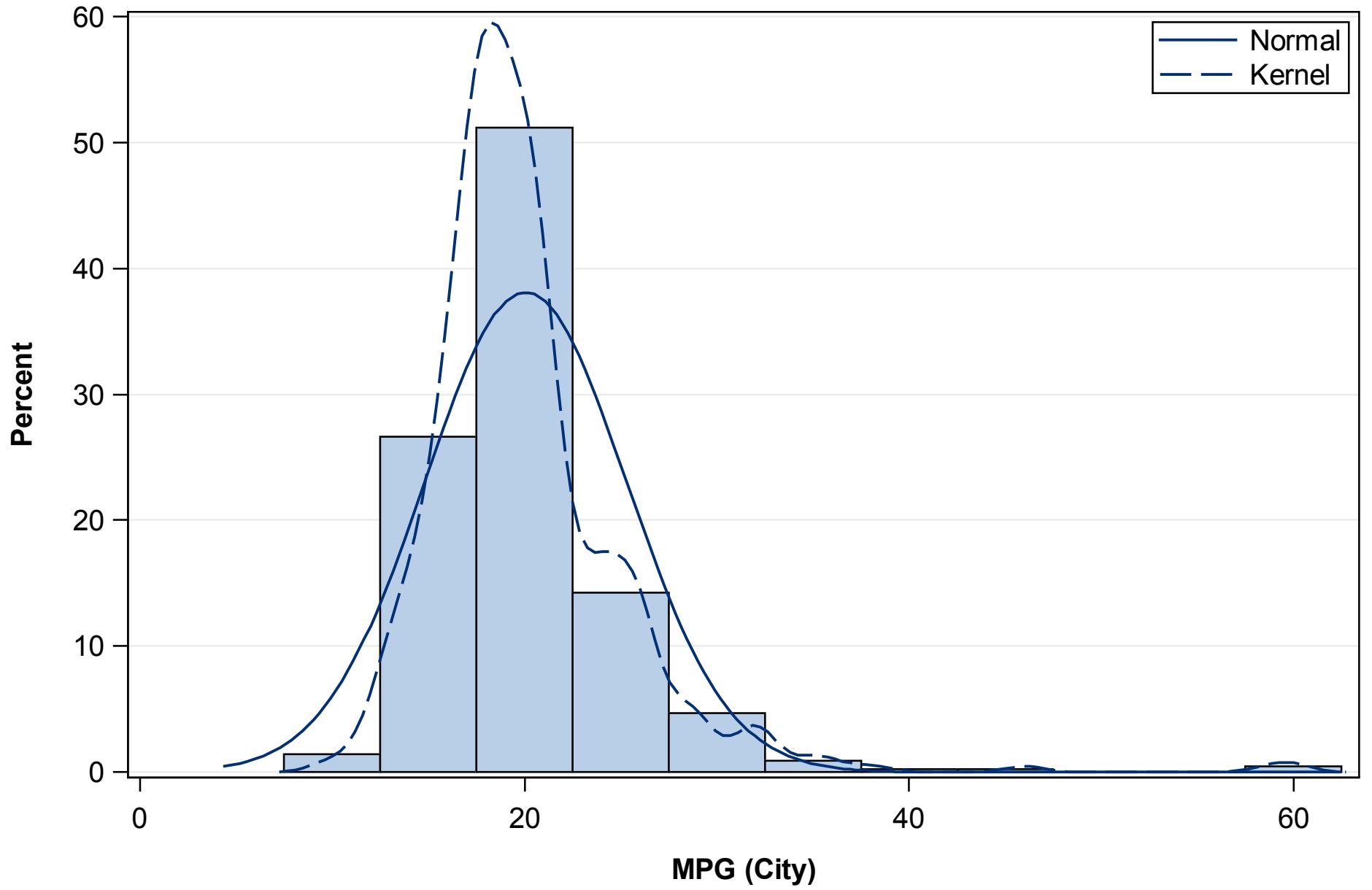


```
proc sgplot data=first_example;
scatter x=x y=y;
reg x=x y=y;
run;quit;
```



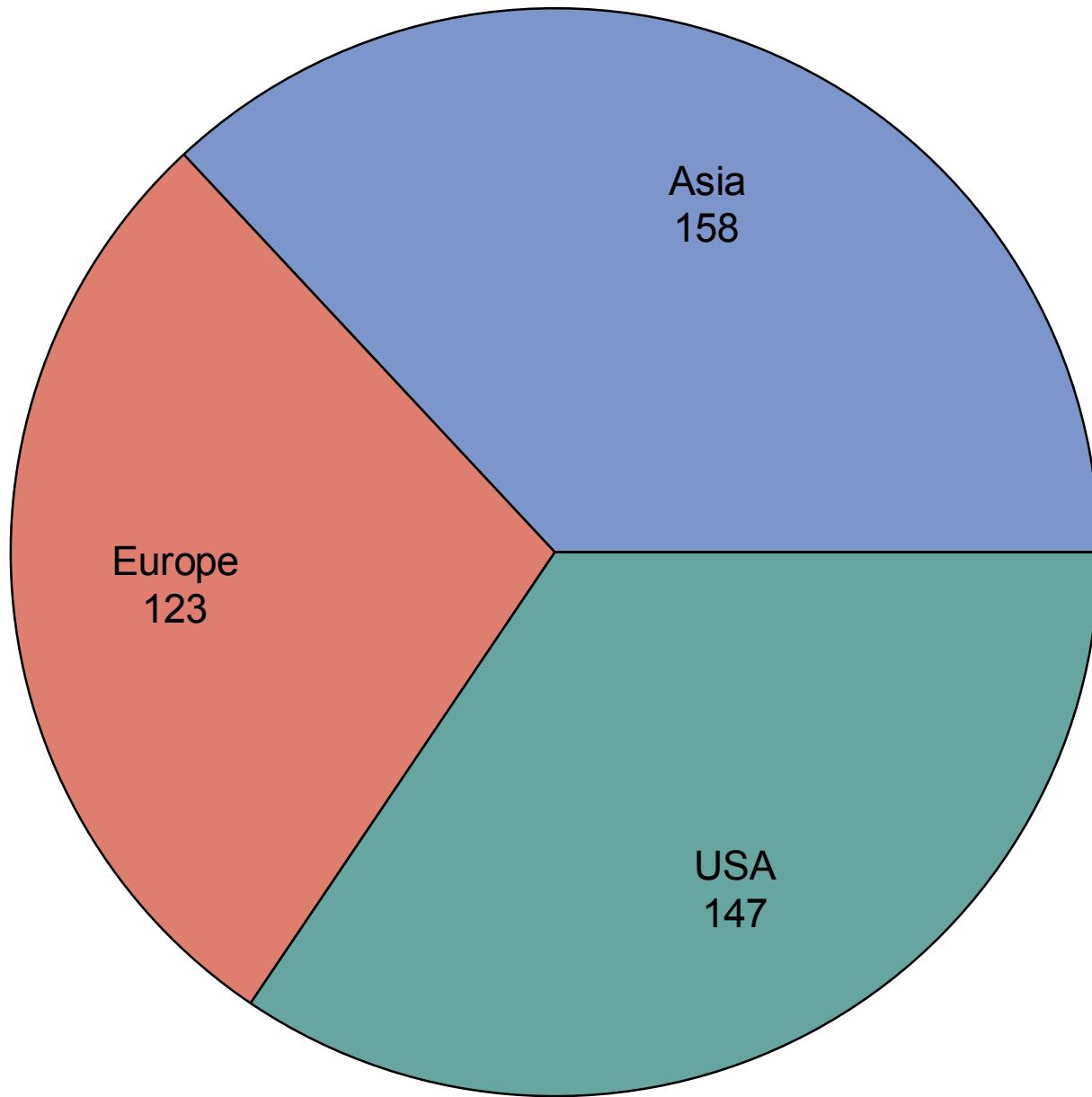
```
title "Distribution of Fuel Consumption";
proc sgplot data=sashelp.cars;
histogram mpg_city;
density mpg_city;
density mpg_city / type=kernel;
keylegend / location = inside
position=TopRight
across=1;
yaxis grid;
run;quit;
```

Distribution of Fuel Consumption



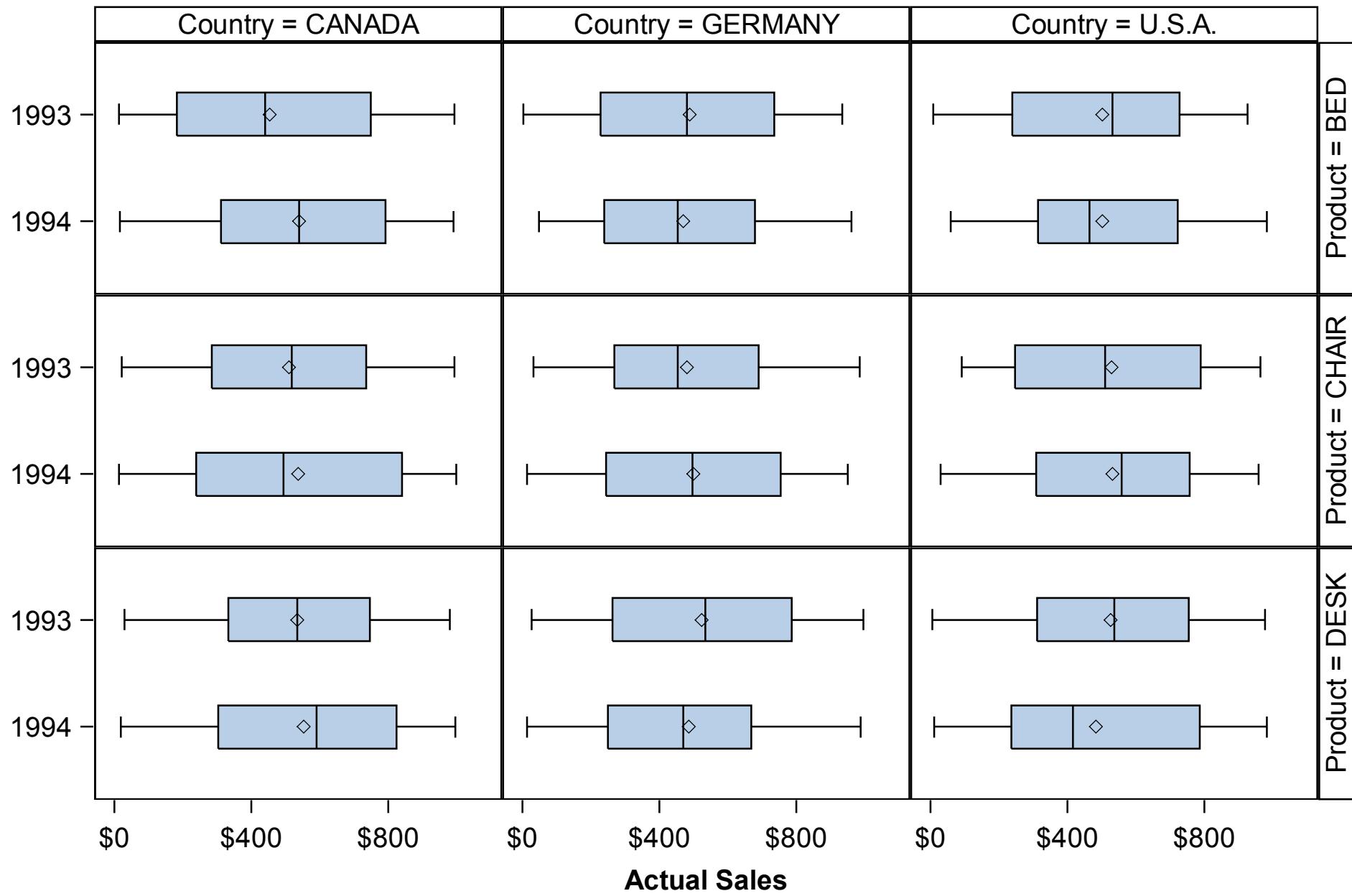
```
PROC TEMPLATE;
DEFINE STATGRAPH simplepie;
BEGINGRAPH;
ENTRYTITLE "SGRENDER Pie Chart" ;
LAYOUT REGION;
PIECHART CATEGORY=ORIGIN /
DATALABELLOCATION=INSIDE datalabelatrs=(size=15);
ENDLAYOUT;
ENDGRAPH;
END;
RUN;
PROC SGRENDER DATA=sashelp.cars
TEMPLATE=simplepie;
RUN;
```

SGRENDER Pie Chart

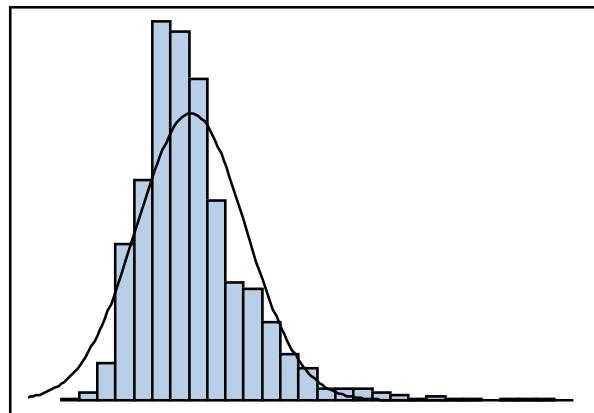
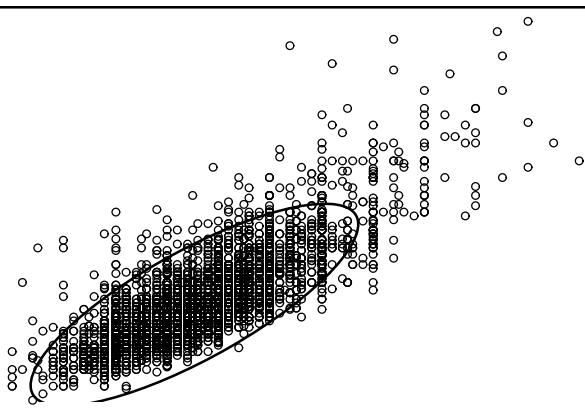
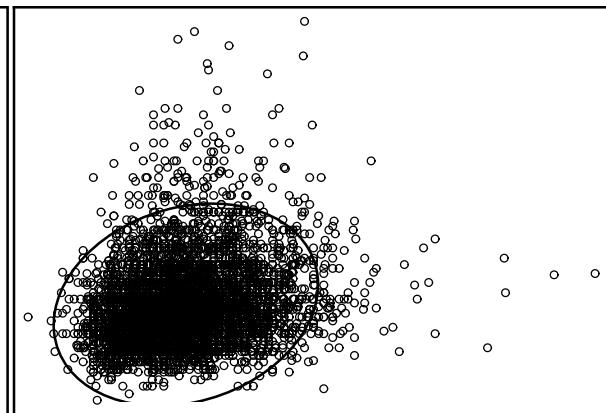
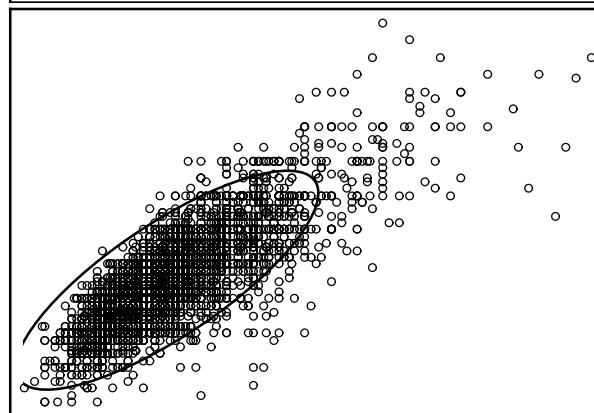
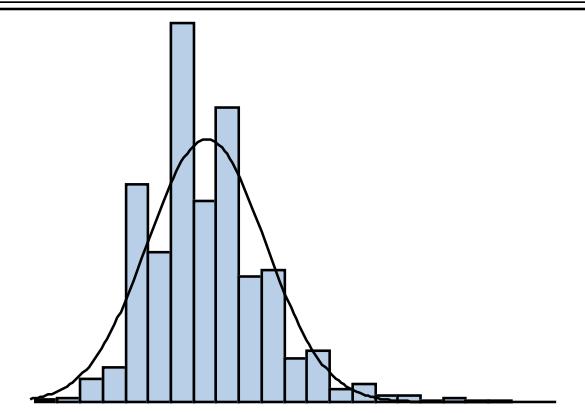
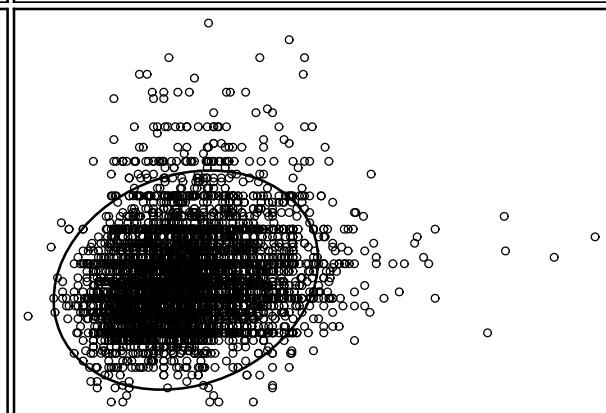


```
title "Yearly Sales Figures by Country and Product";
proc sgpanel data=sashelp.prdsale;
where product in ("BED","CHAIR","DESK");
panelby country product/
layout=lattice;
hbox actual/
category=year;
rowaxis display=(nolabel);
run;quit;
```

Yearly Sales Figures by Country and Product



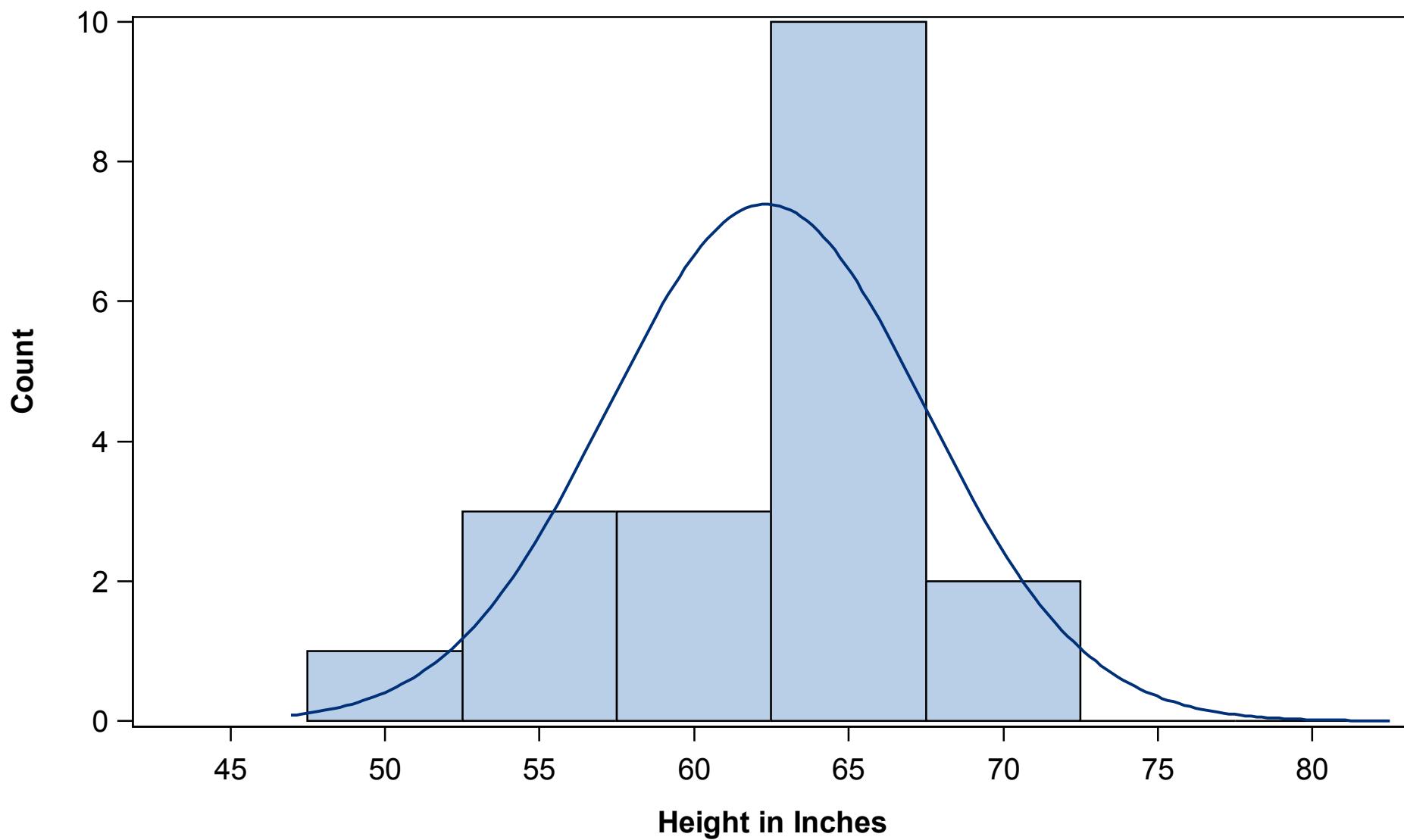
```
proc sgscatter data=sashelp.heart;
matrix systolic diastolic
cholesterol /
ellipse=(alpha=0.05 type=predicted)
diagonal=(histogram normal);
run;quit;
```

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 / textatrs=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;
```

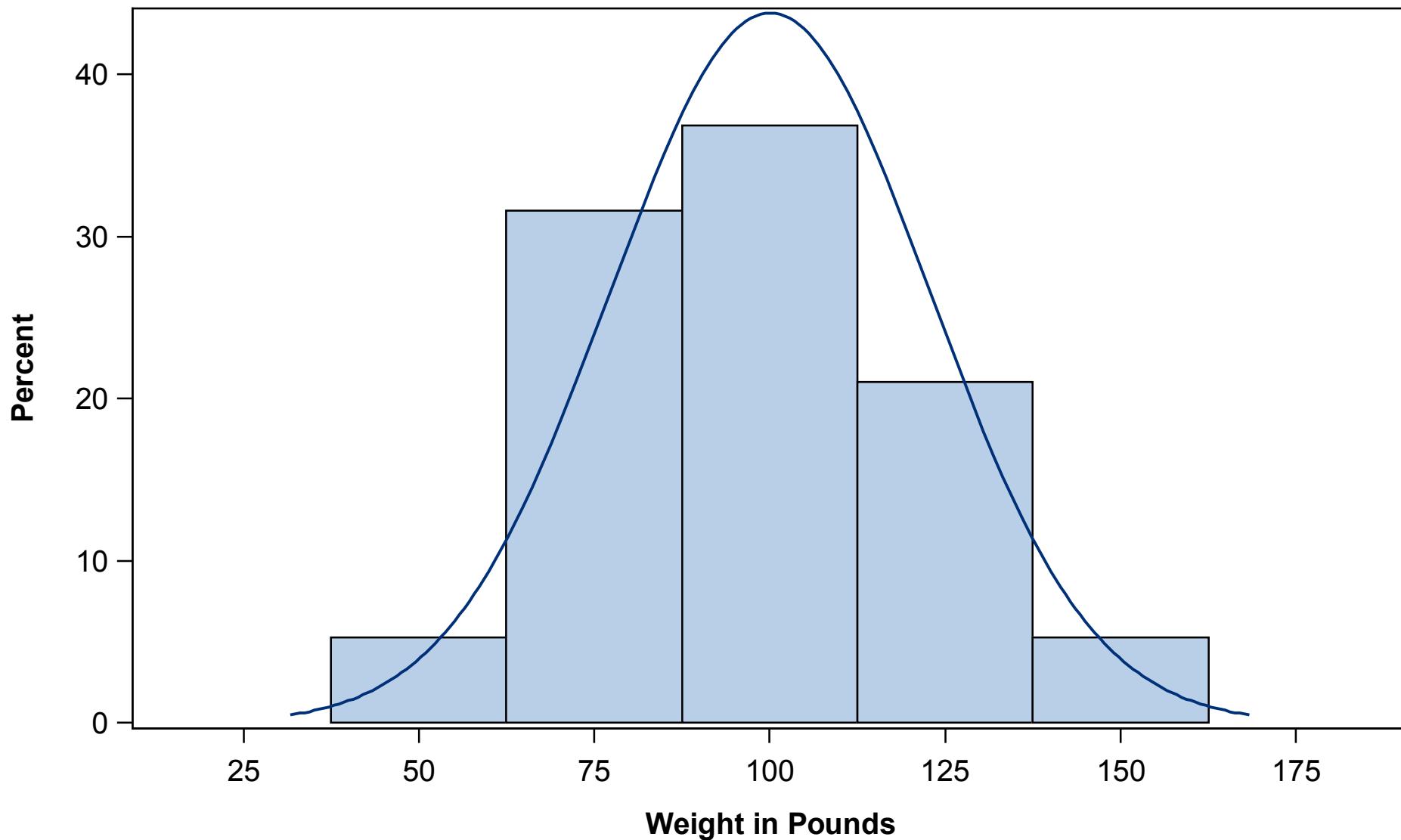
Histogram of Height with Normal Distribution



Created: 20NOV2013

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

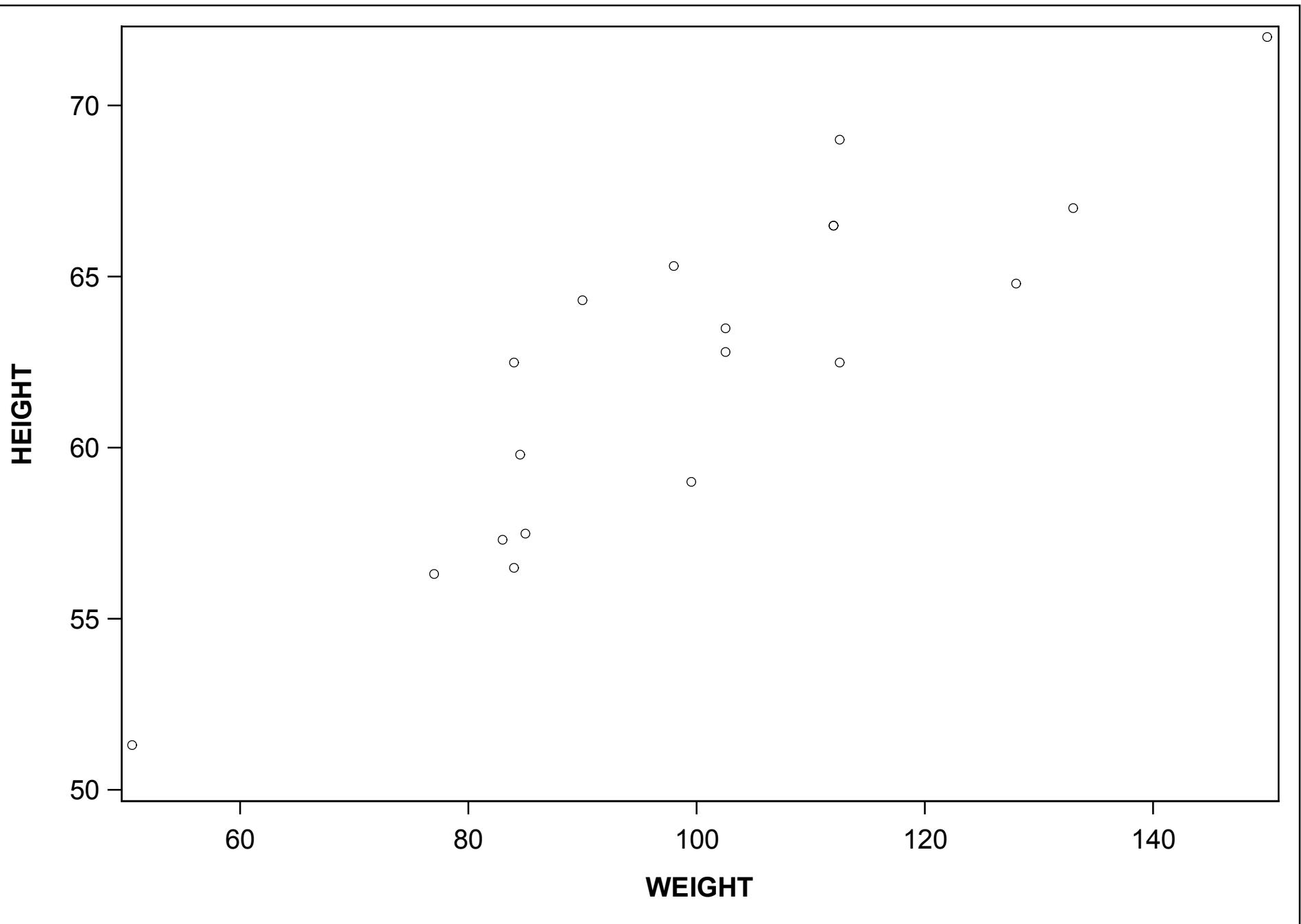
Histogram of Weight with Normal Distribution



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;
```



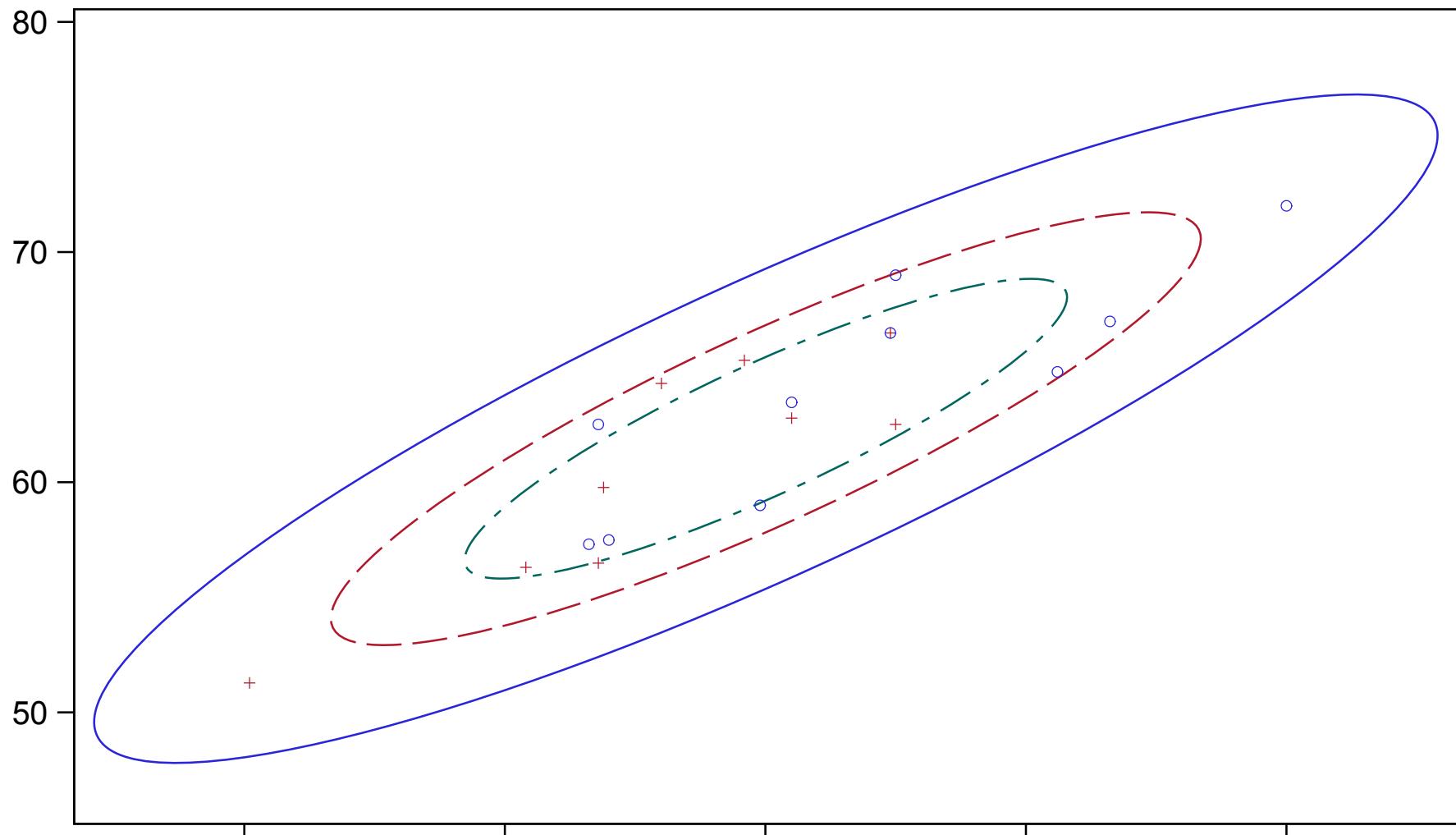
example-> 080

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

HEIGHT

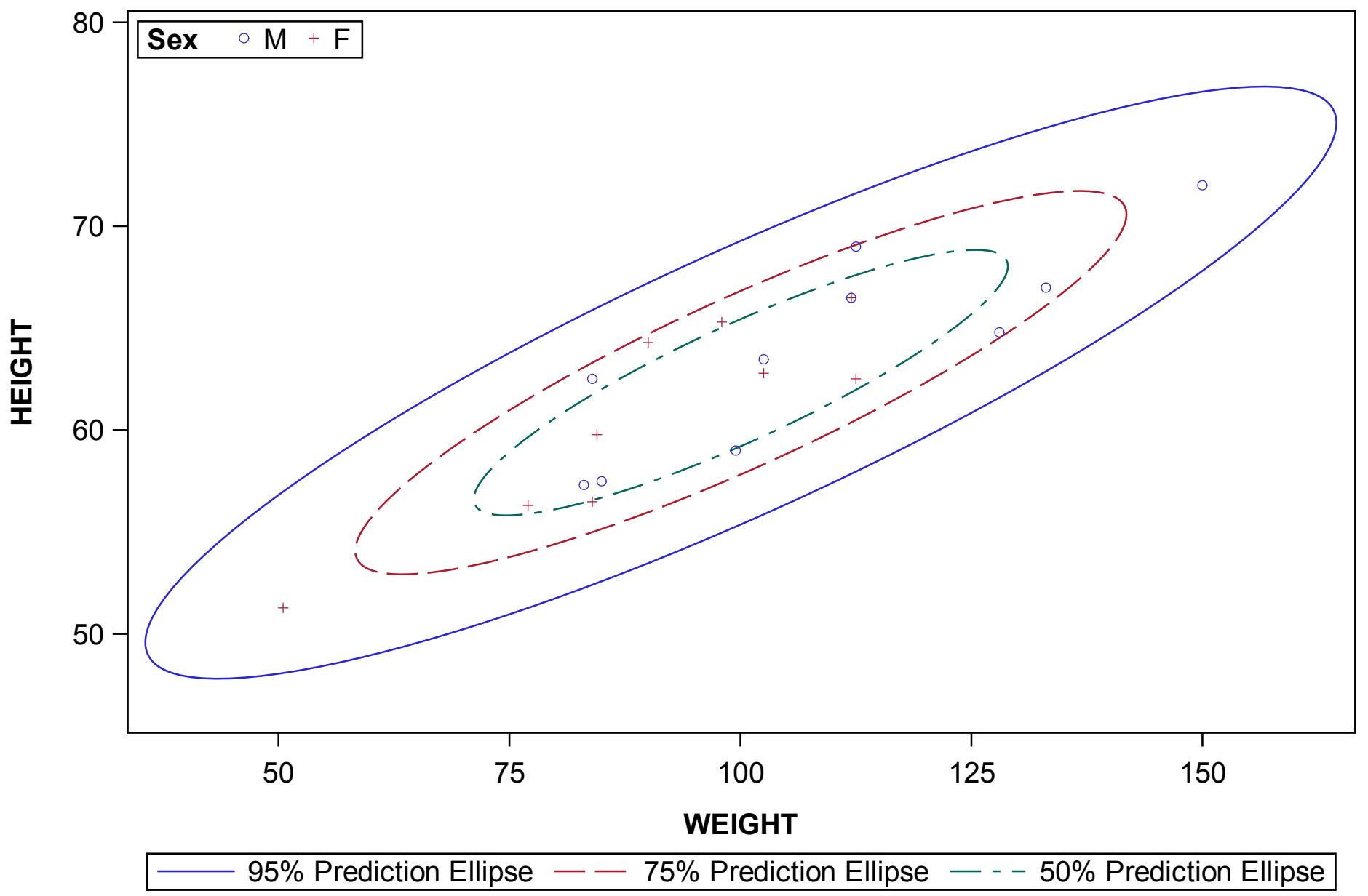


WEIGHT

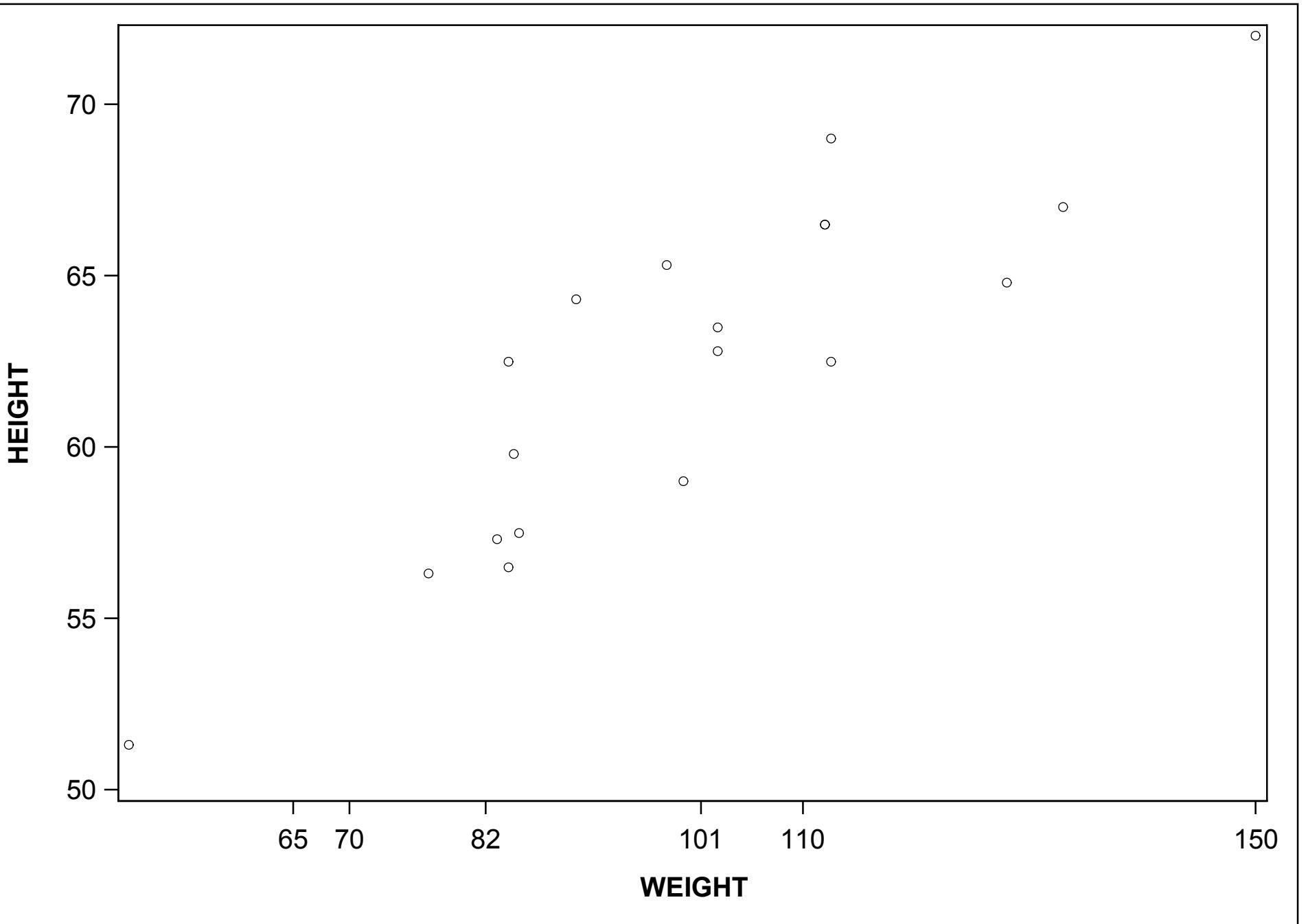
SEX ○ M + F

```
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;
```

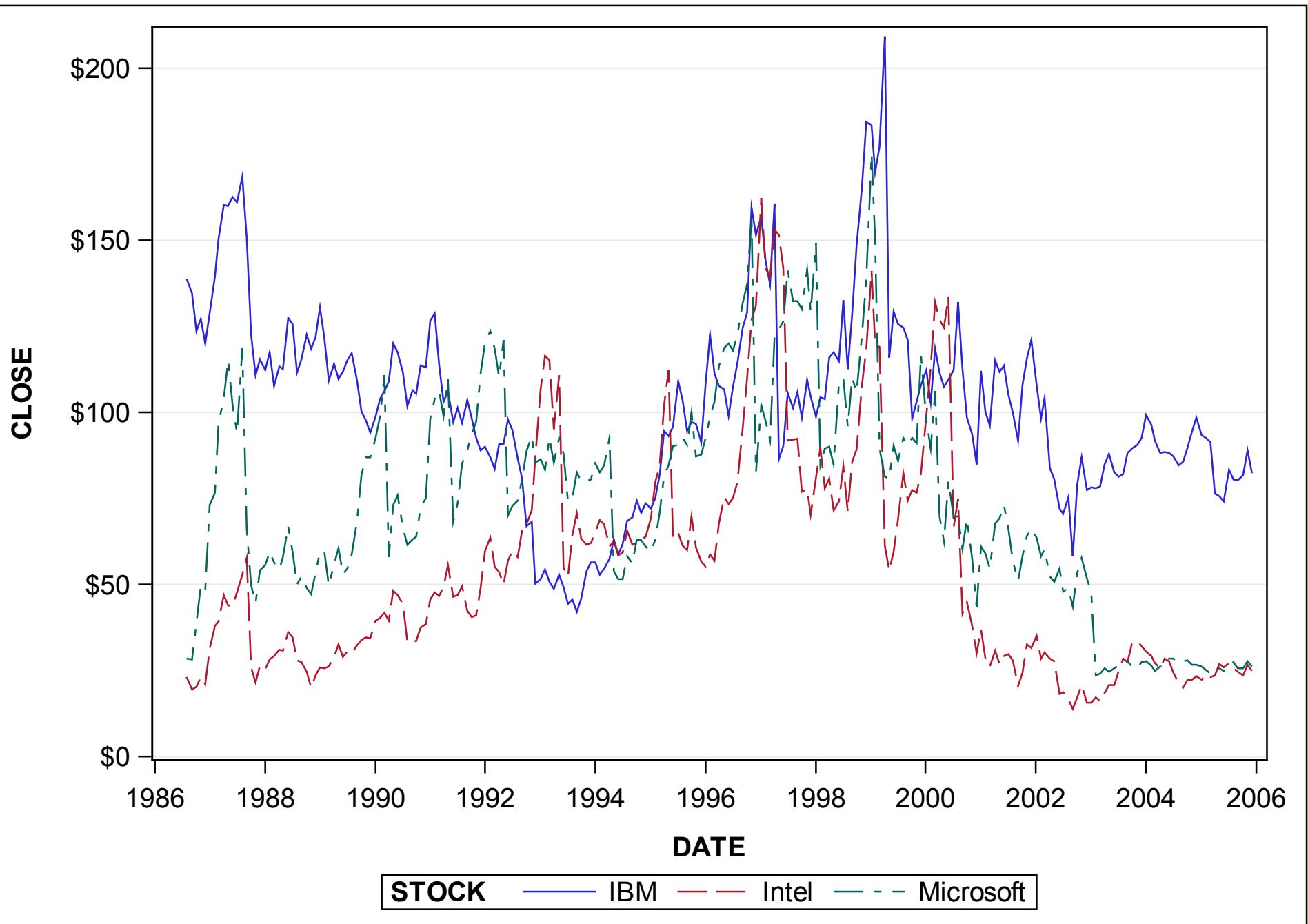
With Legend



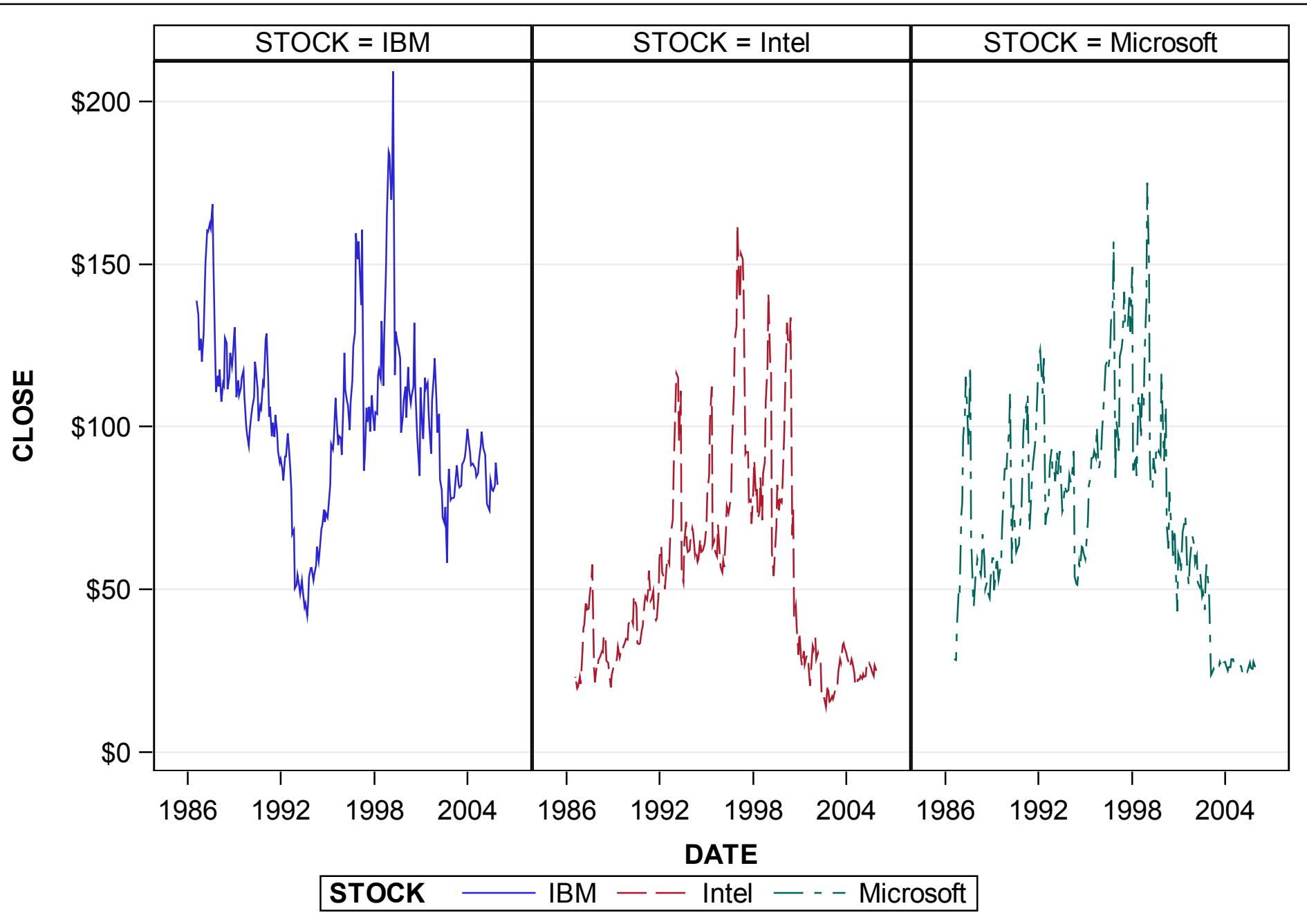
```
proc sgplot data=sashelp.class;
xaxis values=(65,70,82,101,110,150) valueshint;
scatter x=weight y=height;
run;
```



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



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

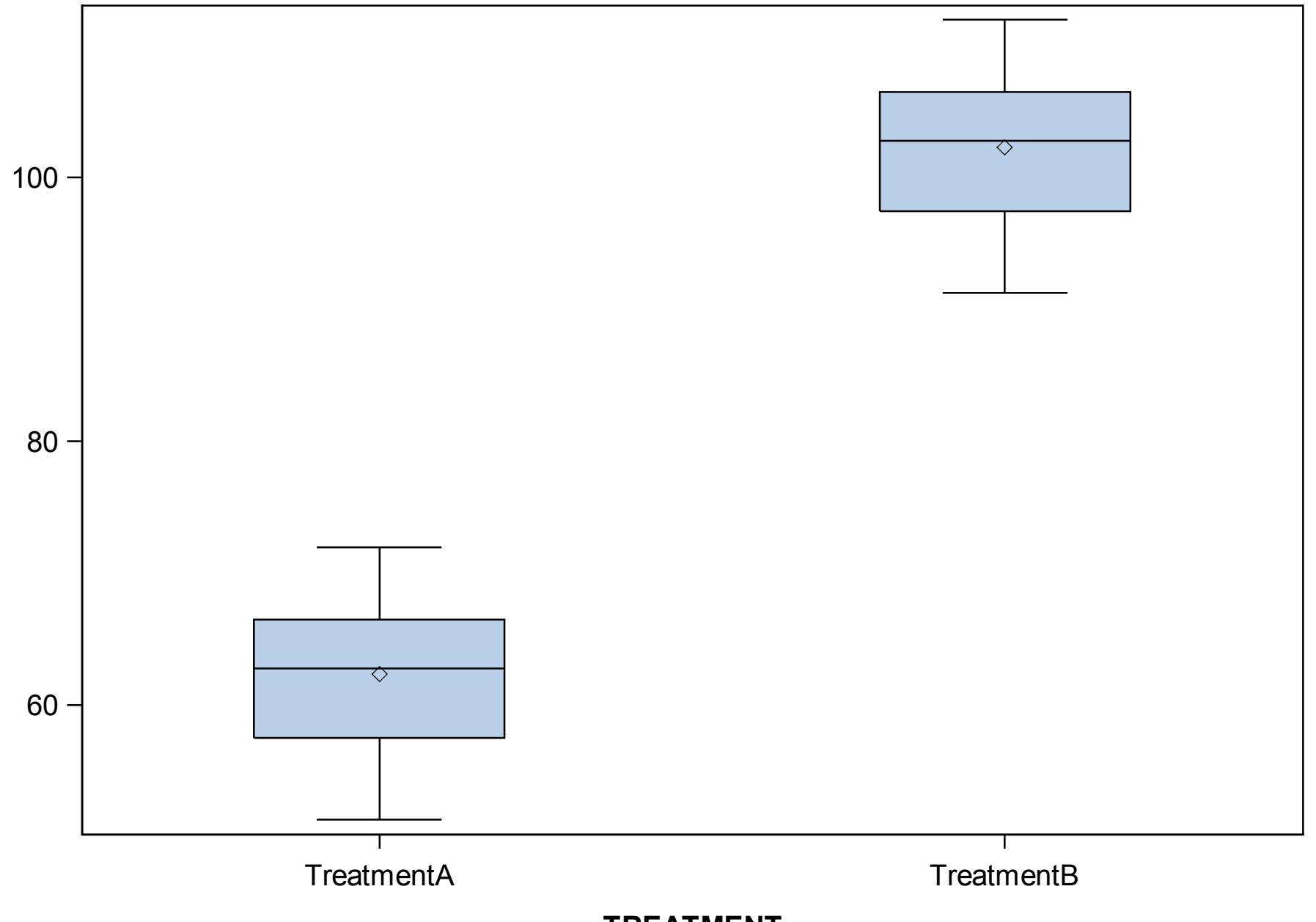


example-> 090

Advanced 2

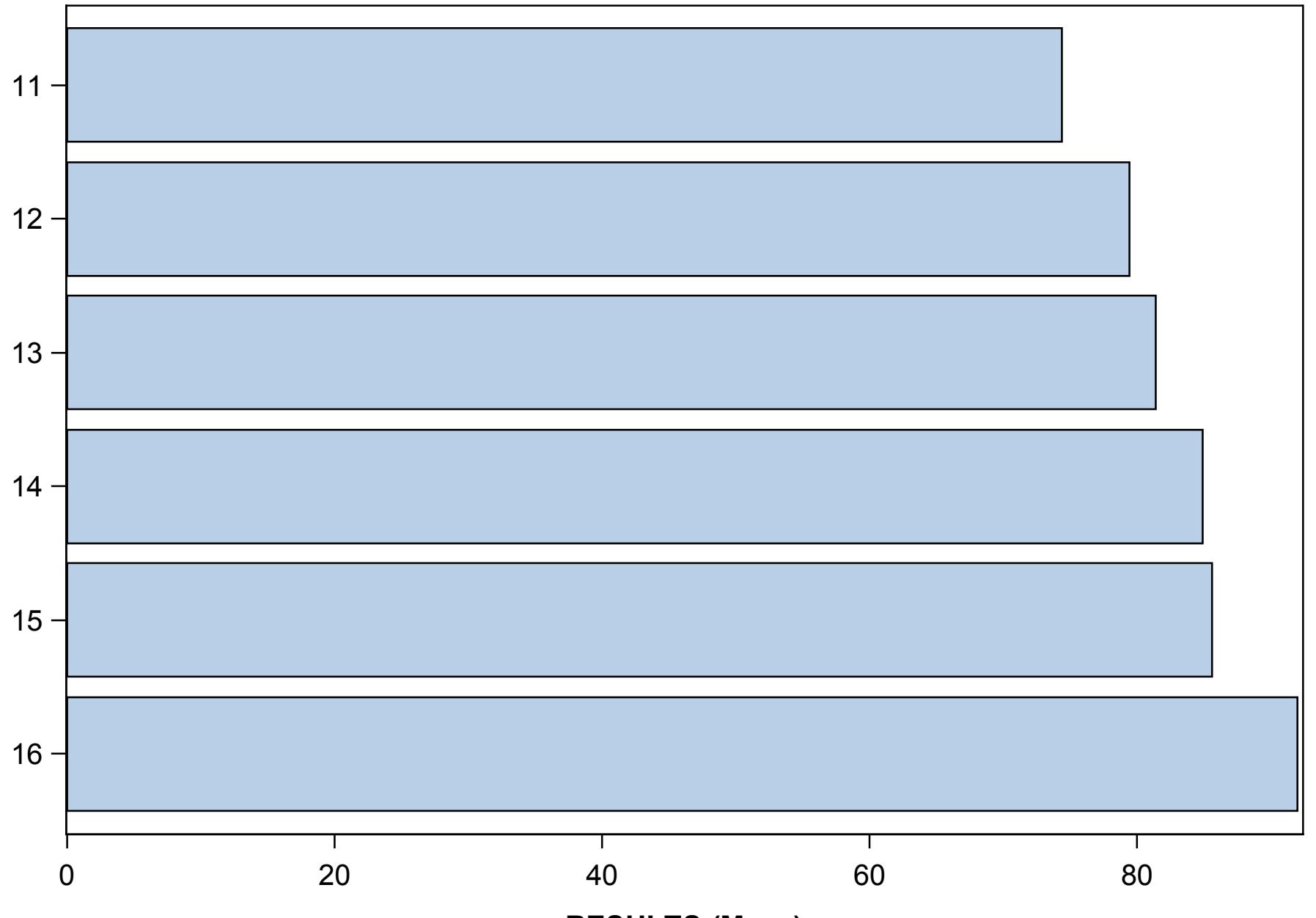
```
proc sgplot data=boxplots;  
vbox results / category=treatment;  
run;quit;
```

RESULTS

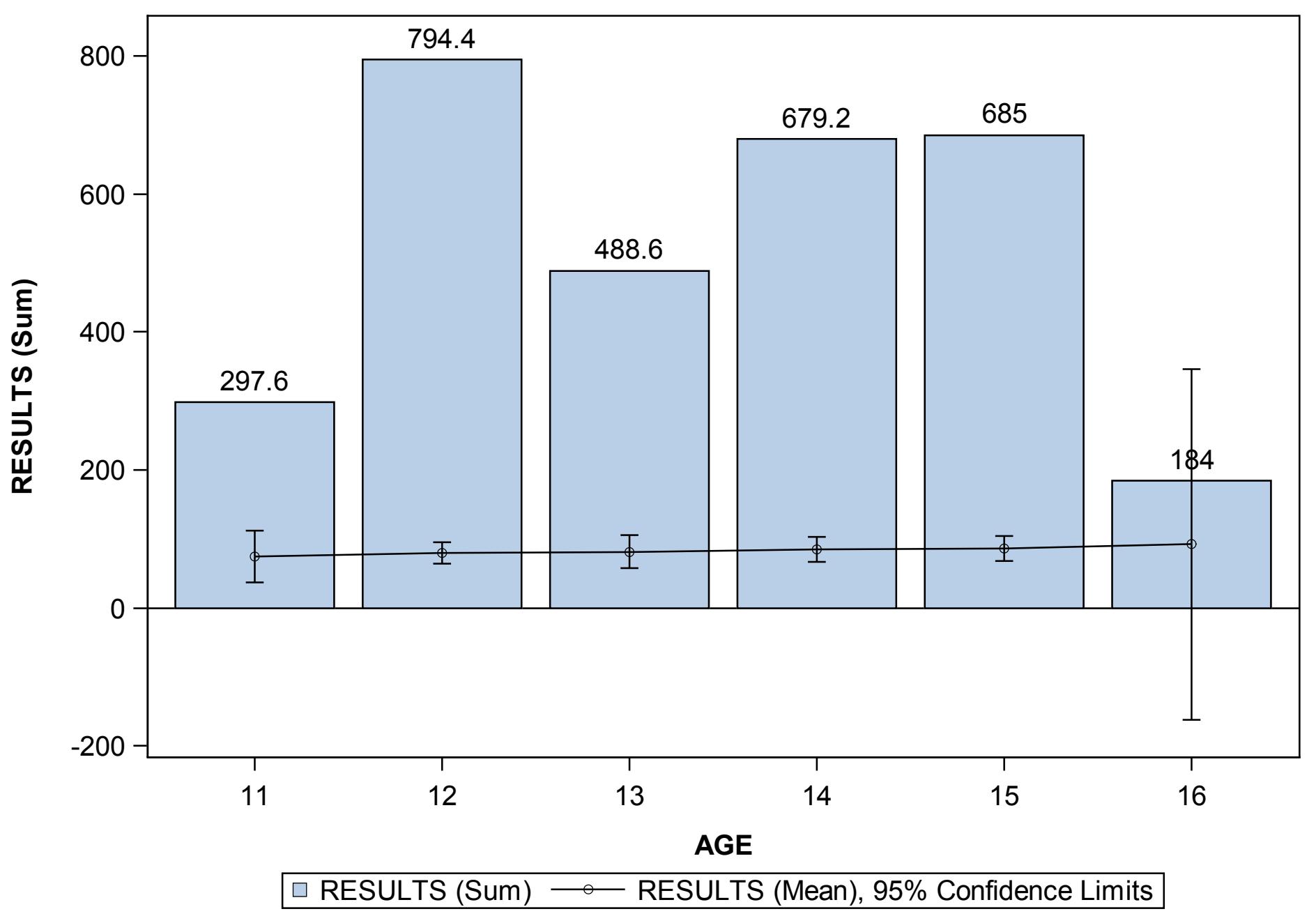


```
proc sgplot data=boxplots;  
hbar age / response=results stat=mean;  
run;quit;
```

AGE



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



```
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

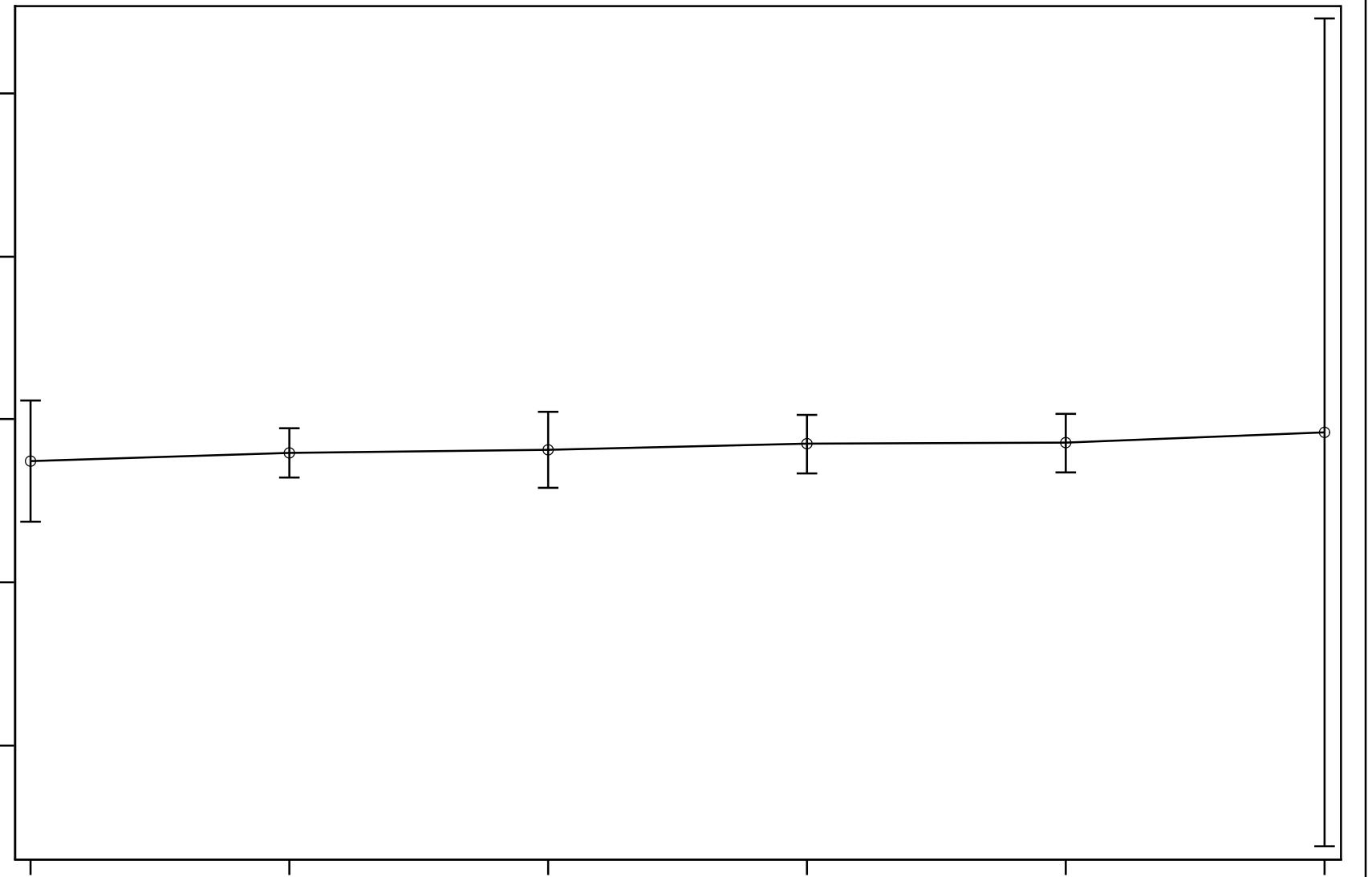
14

15

16

AGE

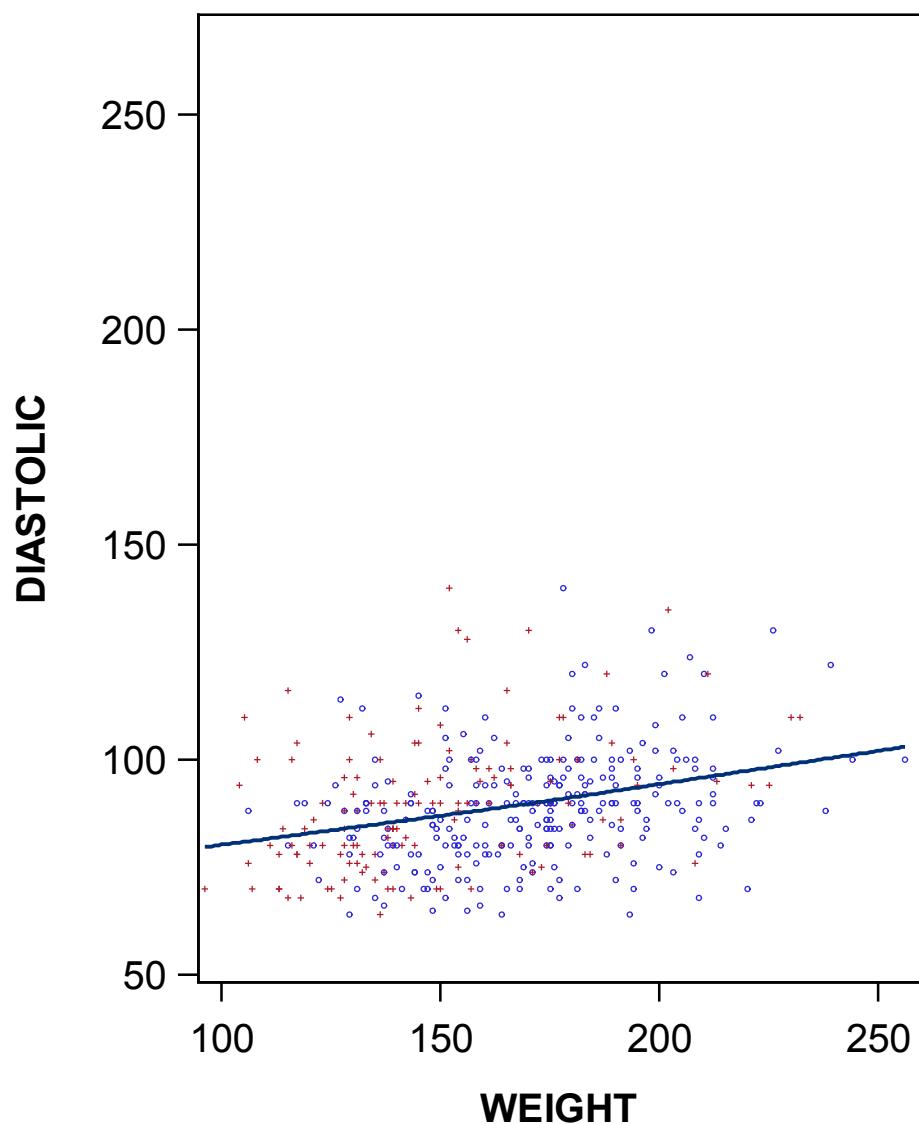
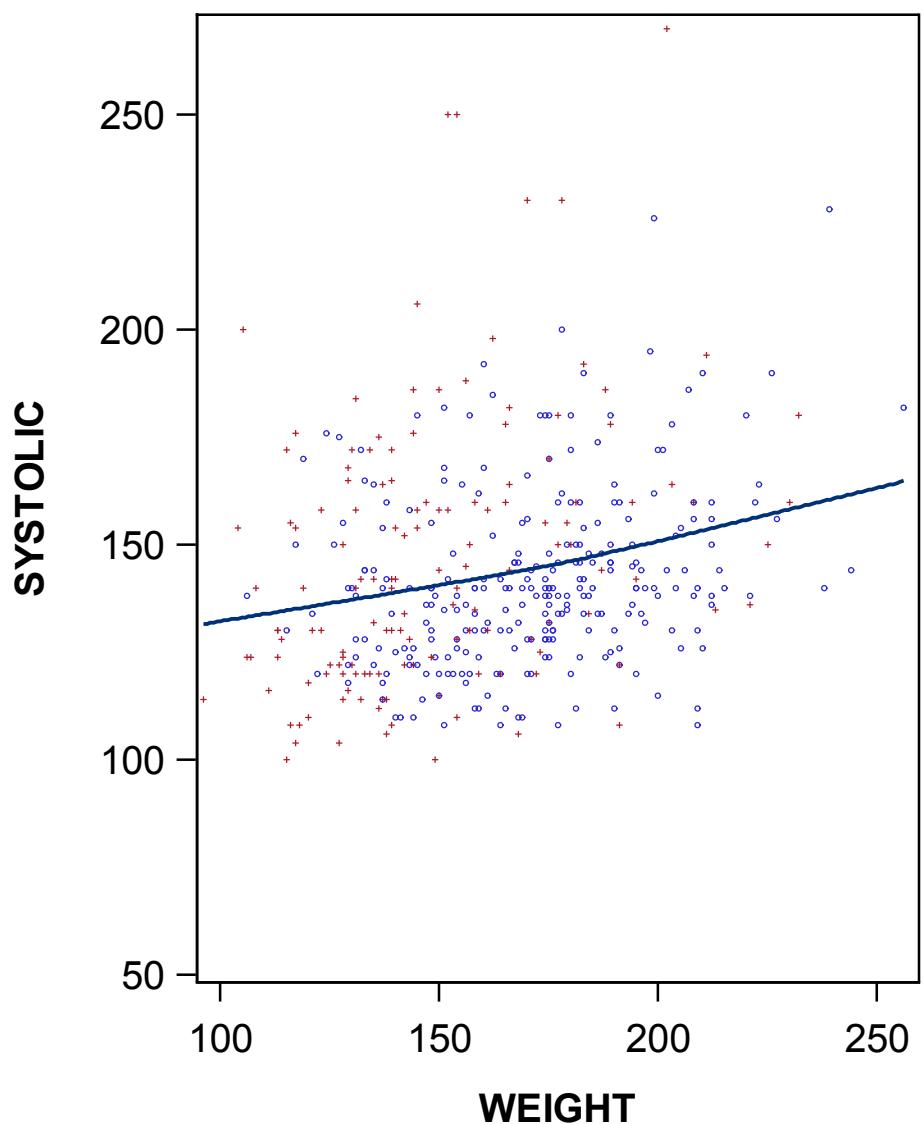
—○— RESULTS (Mean), 95% Confidence Limits



```
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

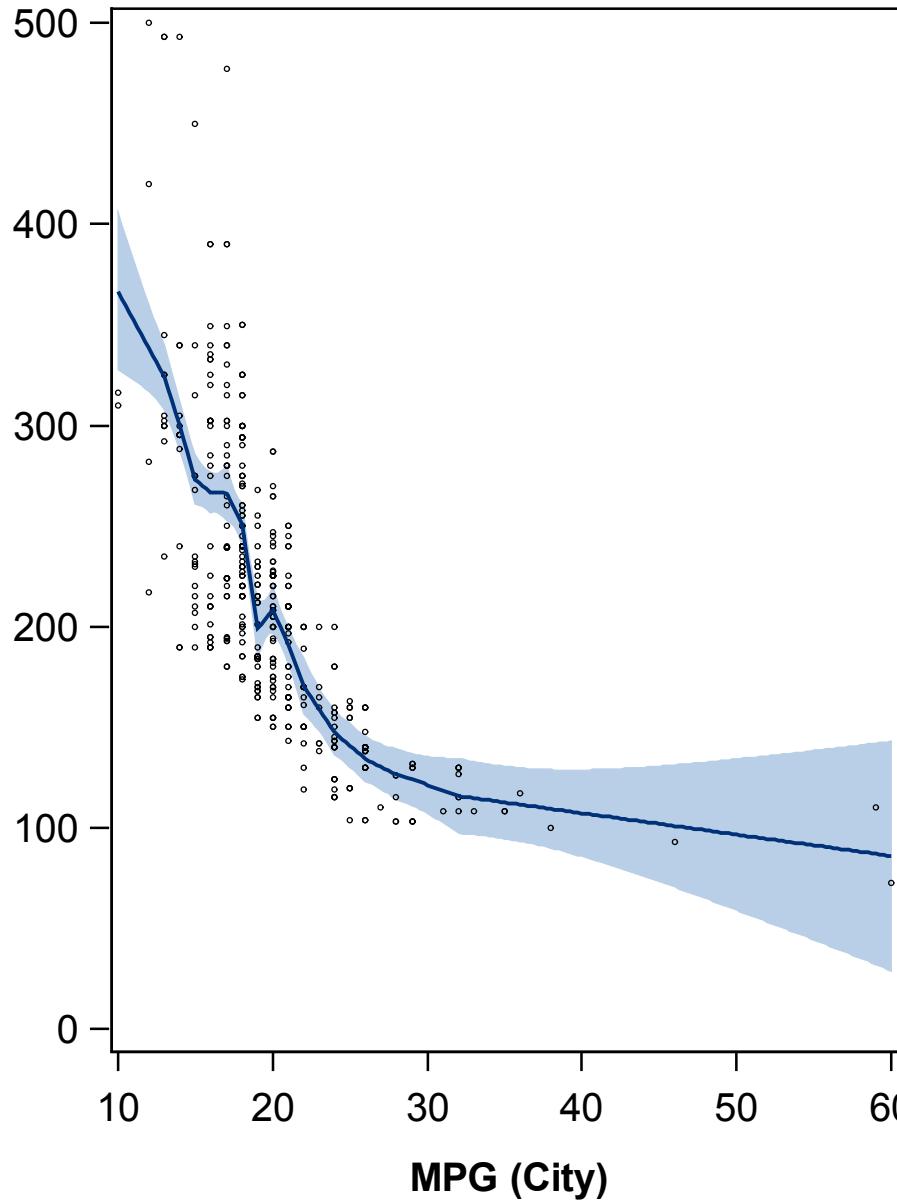
for ages 50-59



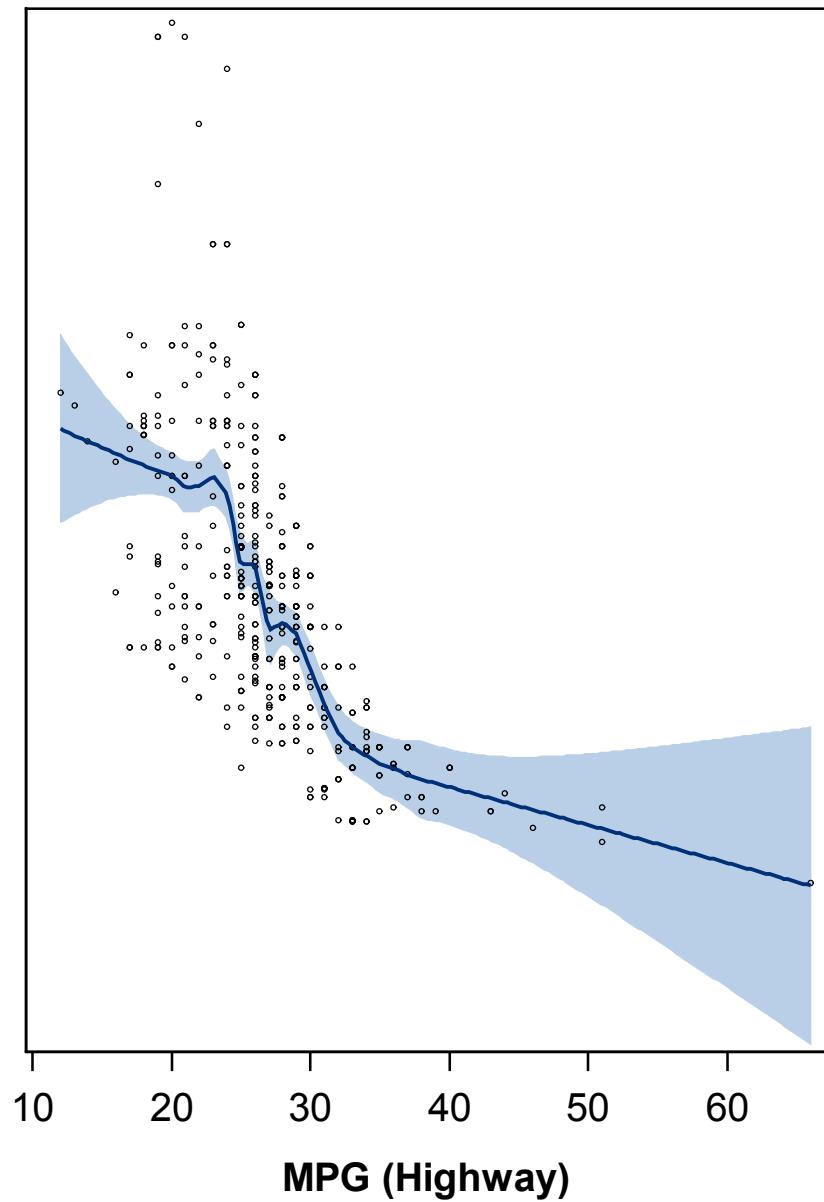
```
title1 "Comparison of Vehicle Attributes";  
proc sgscatter data=sashelp.cars;  
compare y=horsepower x=(mpg_city mpg_highway)  
/ markerattrs=(size=3) loess=(clm) spacing=10;  
run;
```

Comparison of Vehicle Attributes

HORSEPOWER



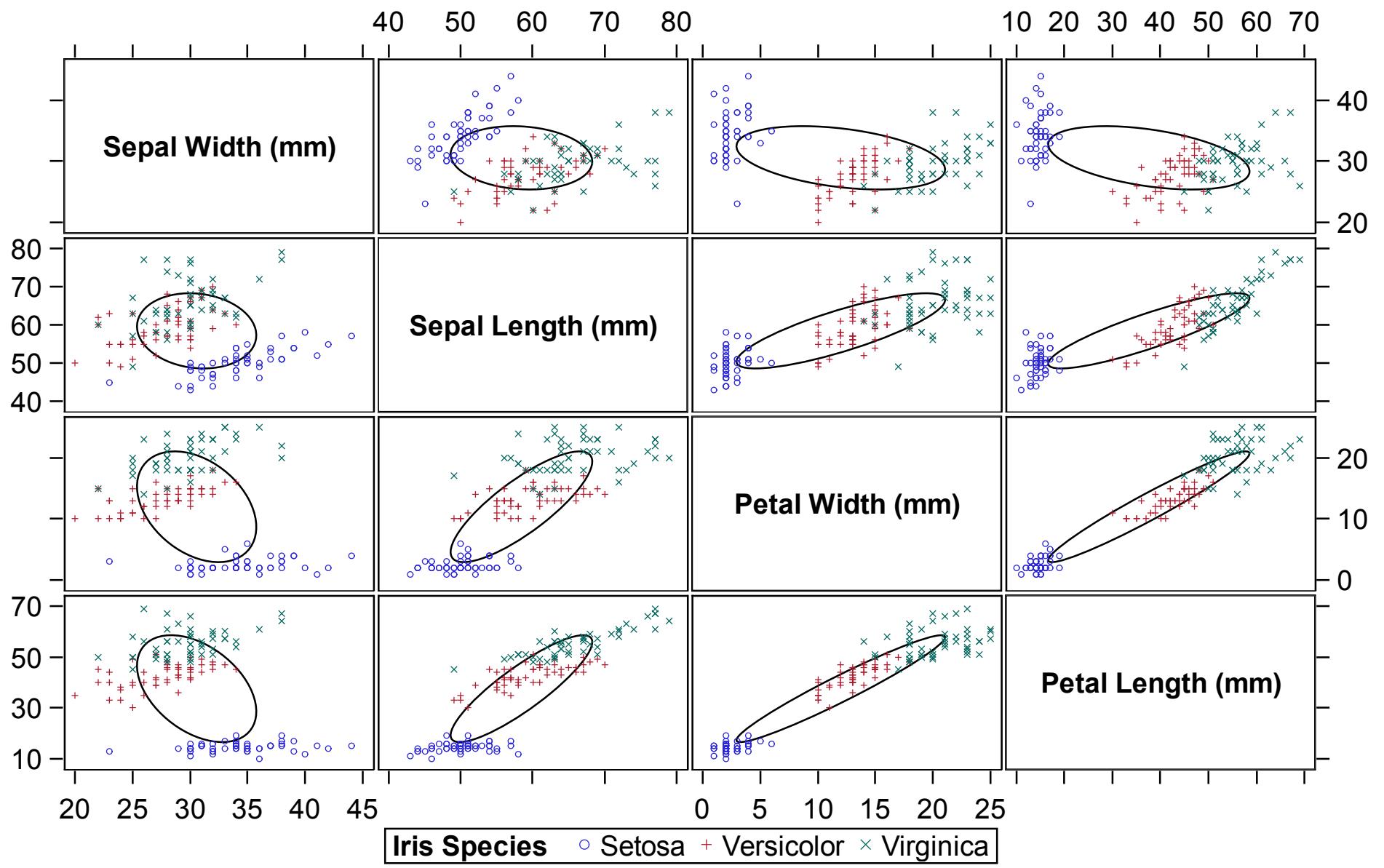
MPG (City)



MPG (Highway)

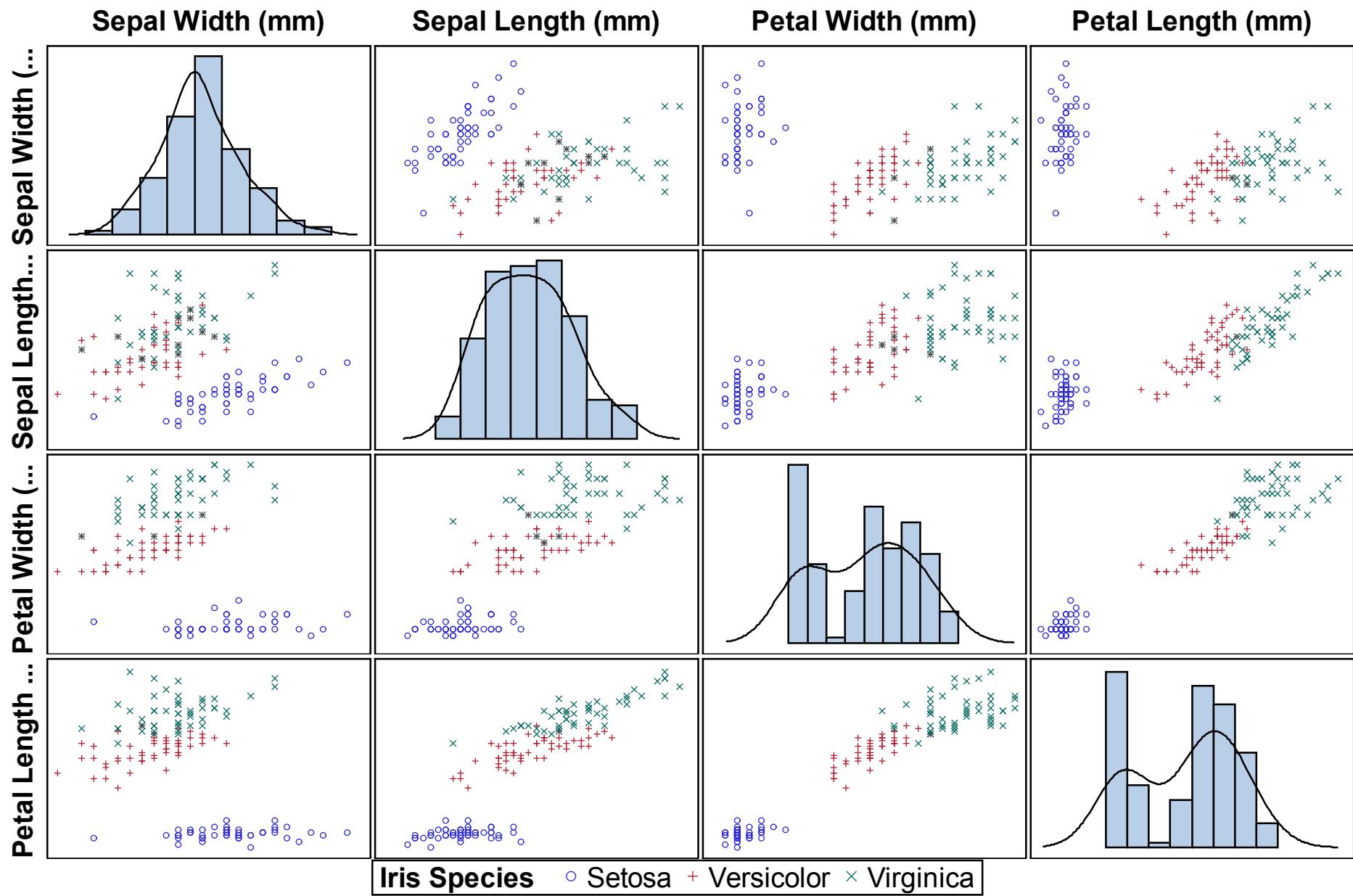
```
title1 "Sepal and Petal Sizes in Iris Species";  
title2 "with a 50% prediction ellipse";  
proc sgscatter data=sashelp.iris;  
matrix sepalwidth sepallength petalwidth petallength  
/ group=species ellipse=(alpha=.5);  
run;
```

Sepal and Petal Sizes in Iris Species with a 50% prediction ellipse

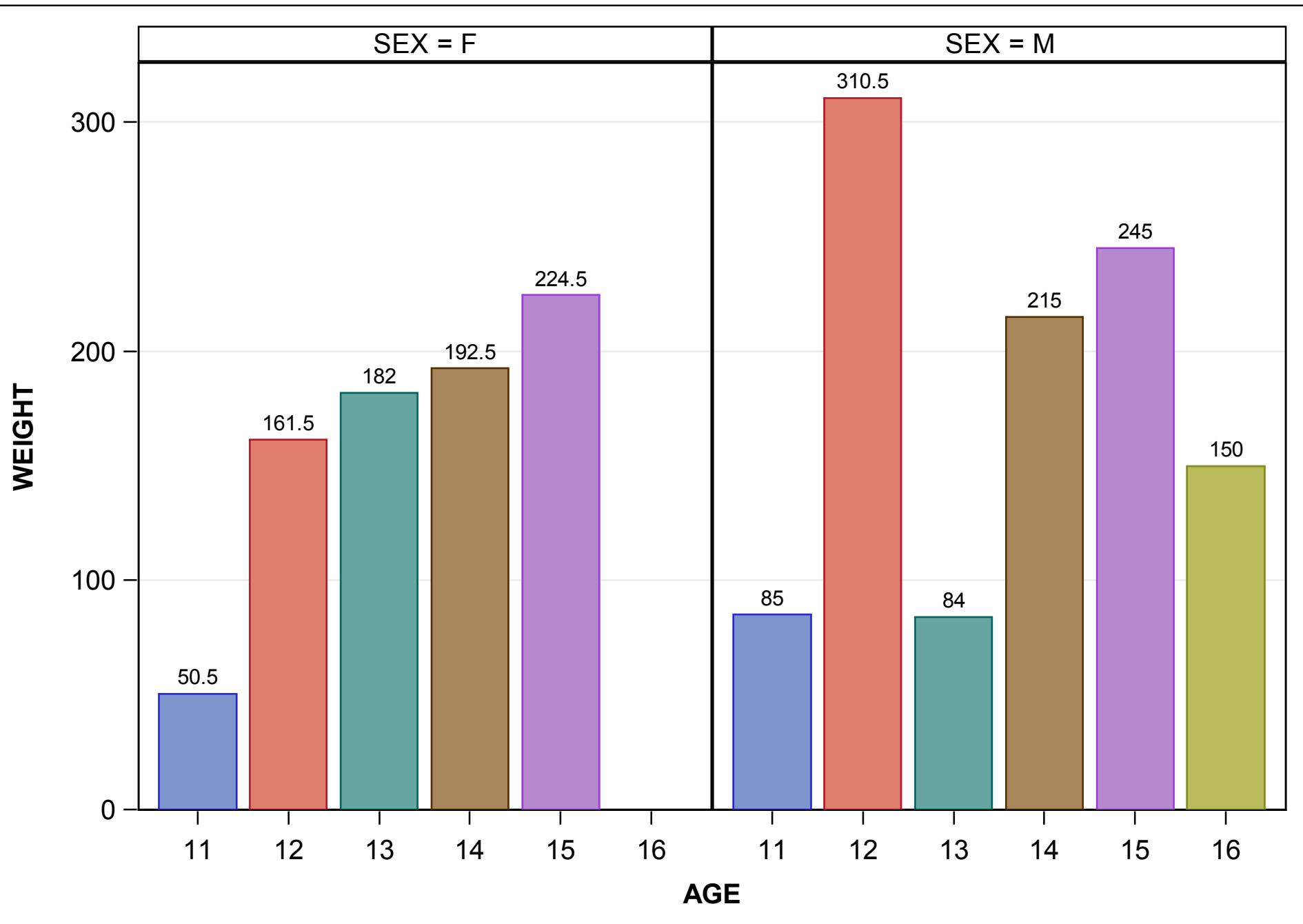


```
title1 "Sepal and Petal Sizes in Iris Species";  
proc sgscatter data=sashelp.iris;  
matrix sepalwidth sepallength petalwidth  
petallength / group=species  
diagonal=(histogram kernel);  
run;
```

Sepal and Petal Sizes in Iris Species



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



```
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

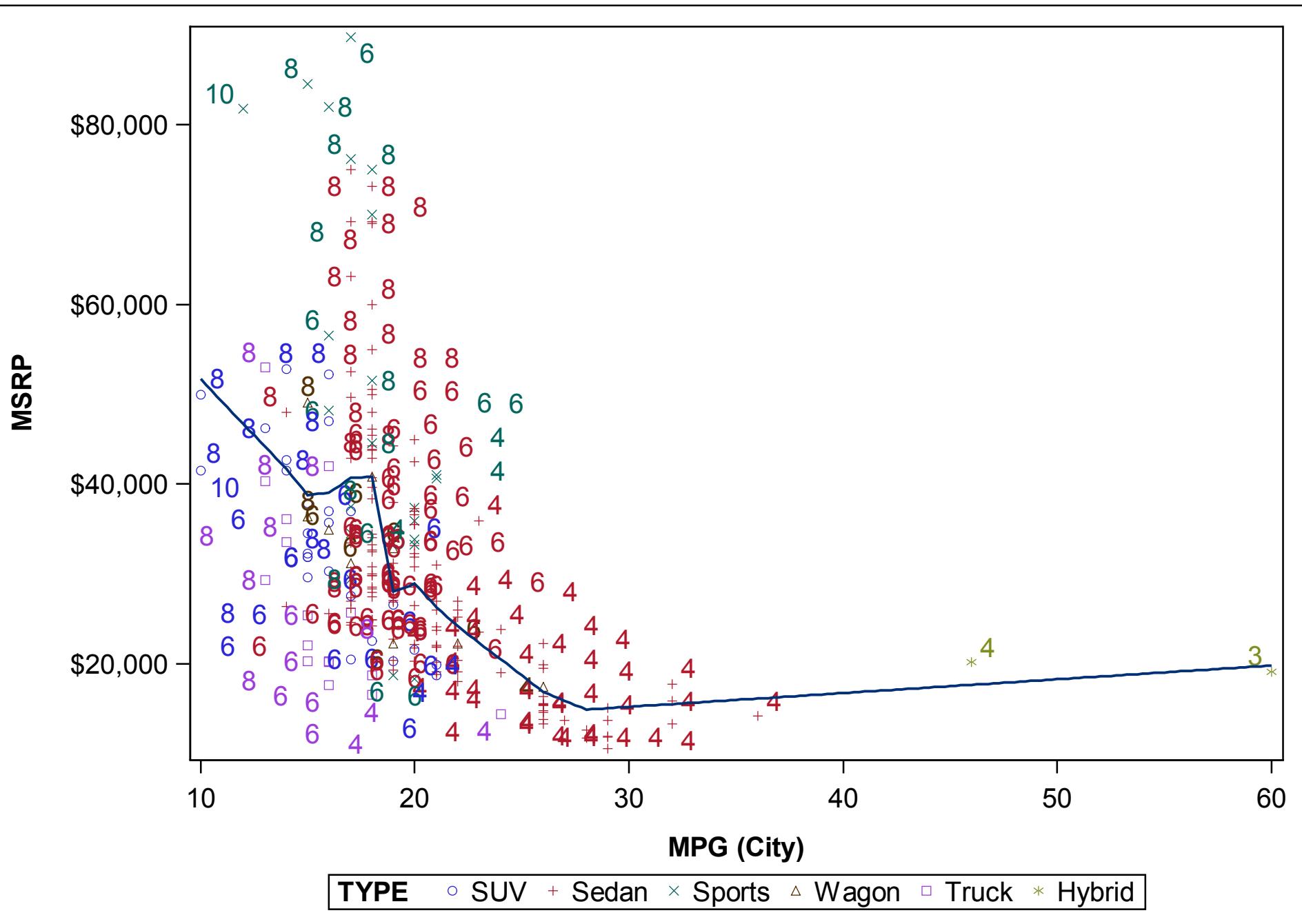
15

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;
```

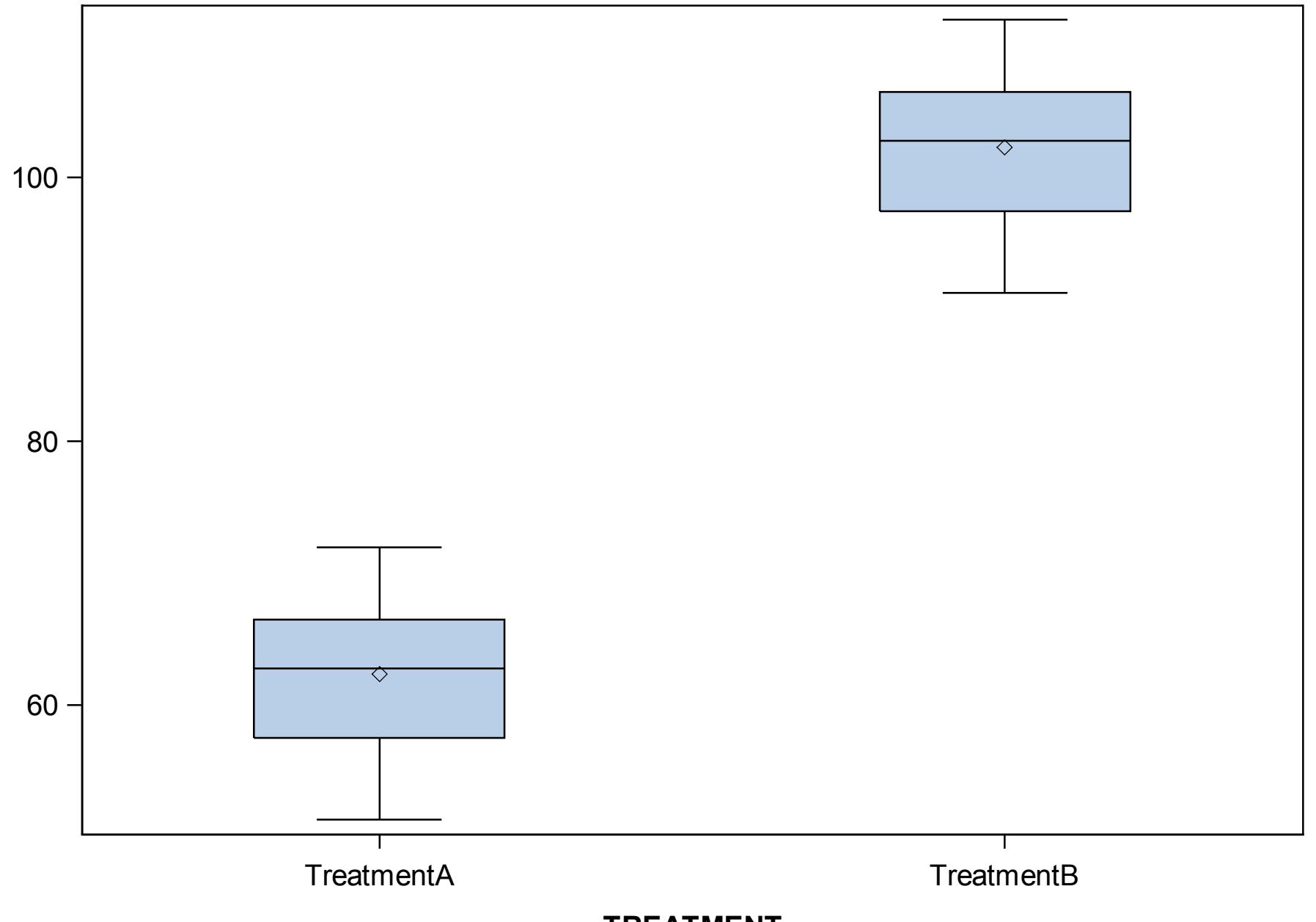


example-> 100

Advanced 3

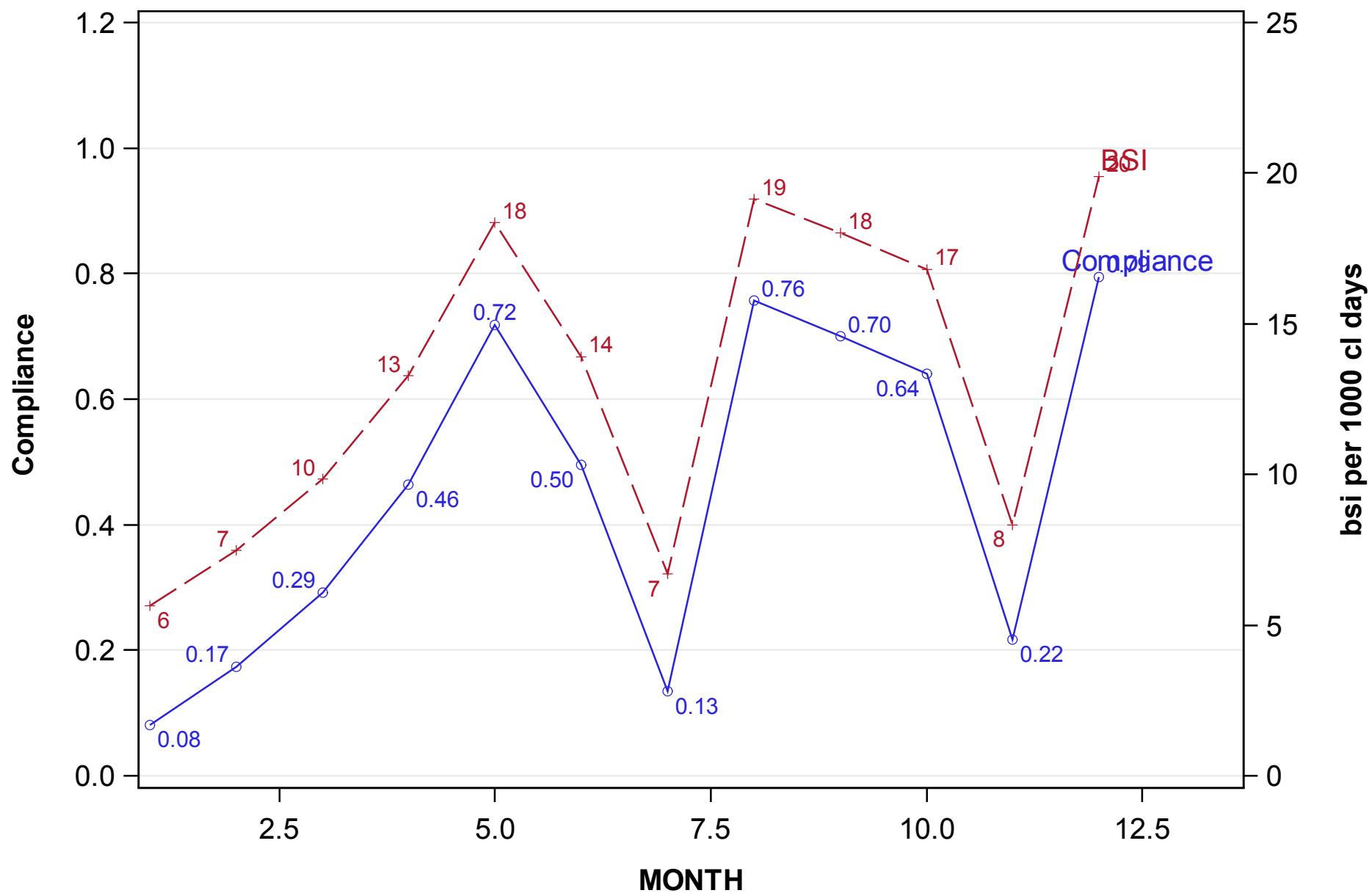
```
proc sgplot data=boxplots;  
vbox results / category=treatment;  
run;quit;
```

RESULTS

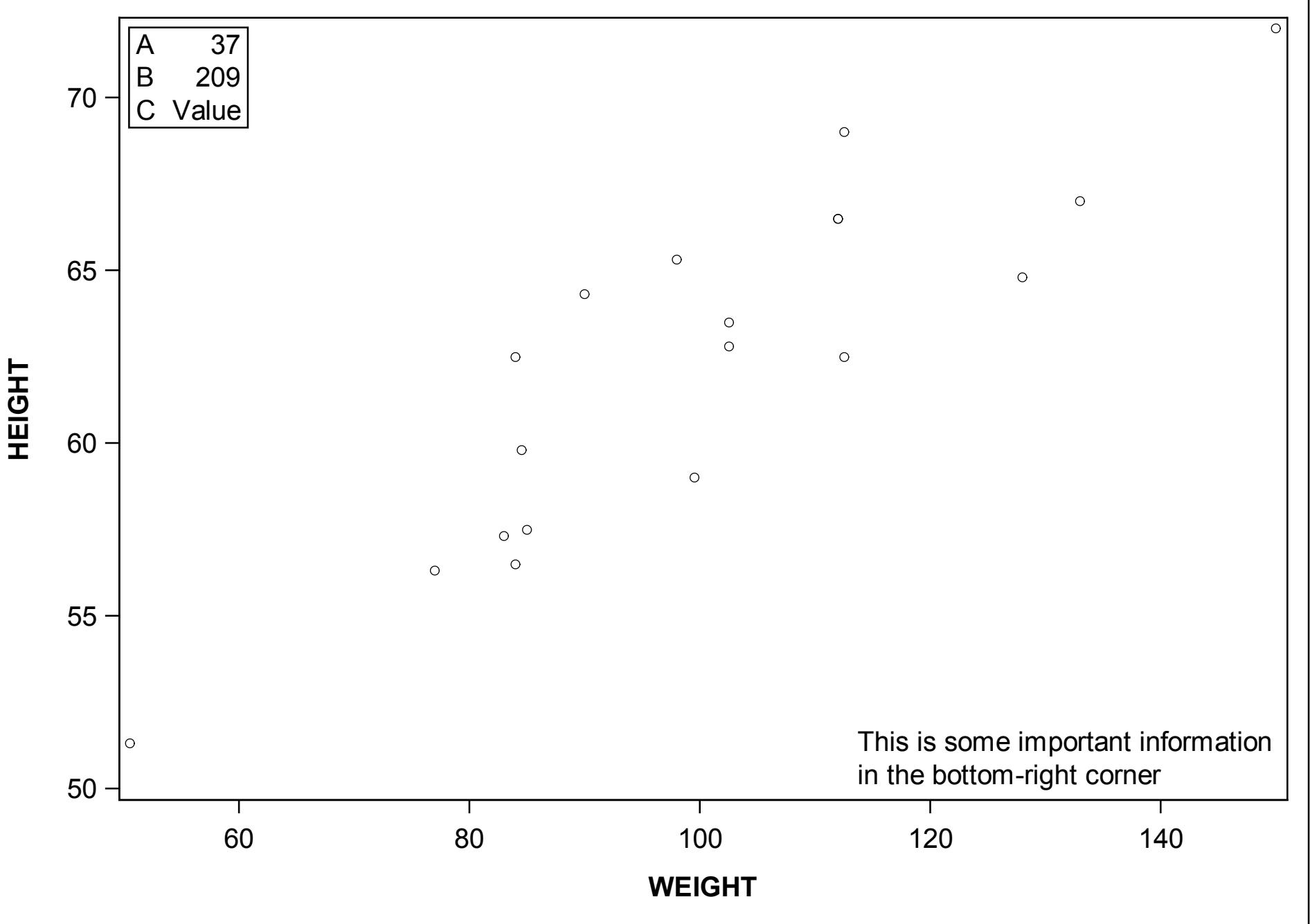


```
title1 "CL Bundle Compliance & CL Infection Rate";
proc sgplot data=compliance;
format bsi 3. compliance 5.2;
series y=Compliance x=month / markers
curvelabel="    Compliance" curvelabelloc=inside datalabel ;
series y=BSI x=month / y2axis markers
curvelabel="    BSI" curvelabelloc=inside datalabel;
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;
```

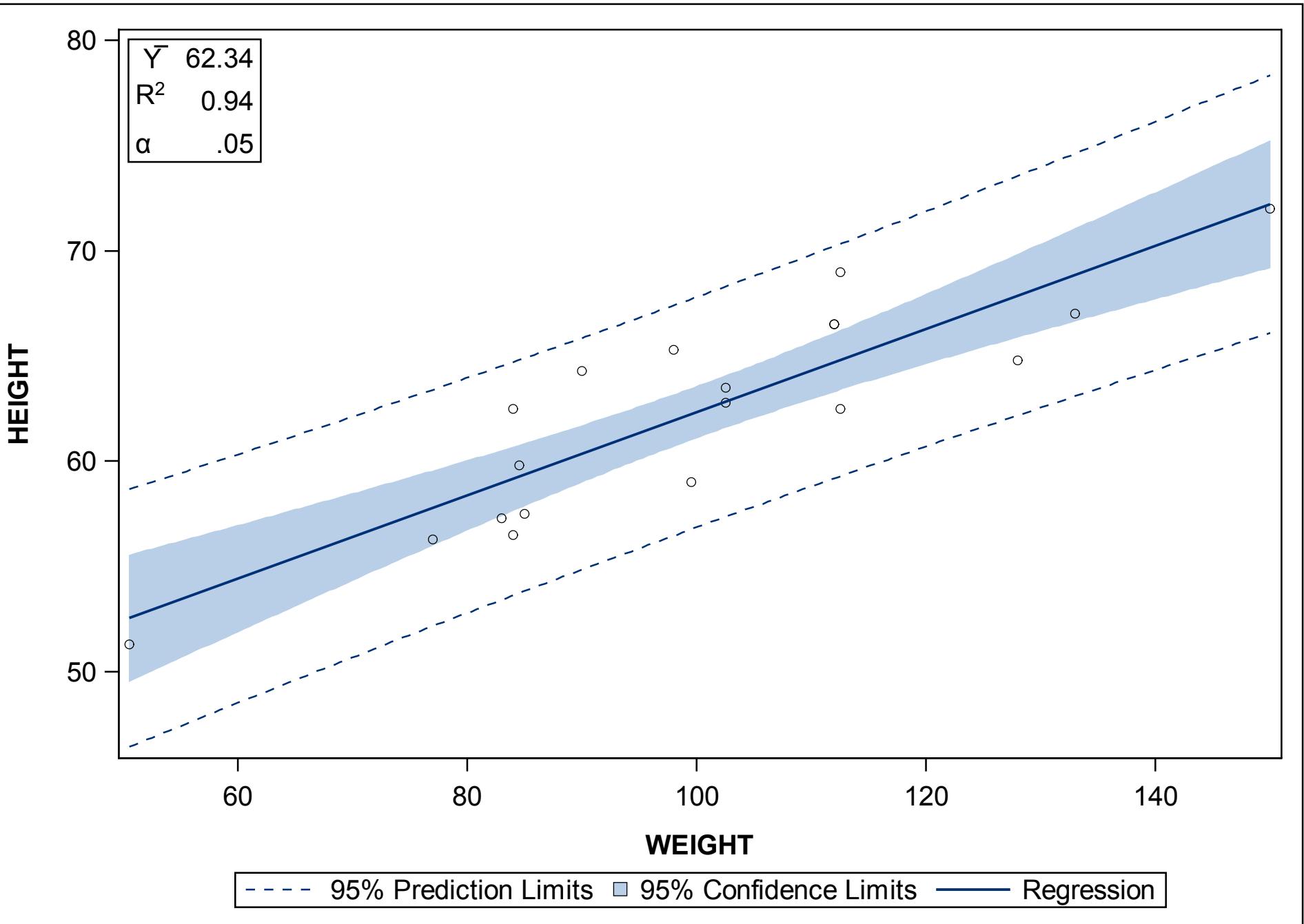
CL Bundle Compliance & CL Infection Rate



```
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;
```



```
*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;
```



```
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

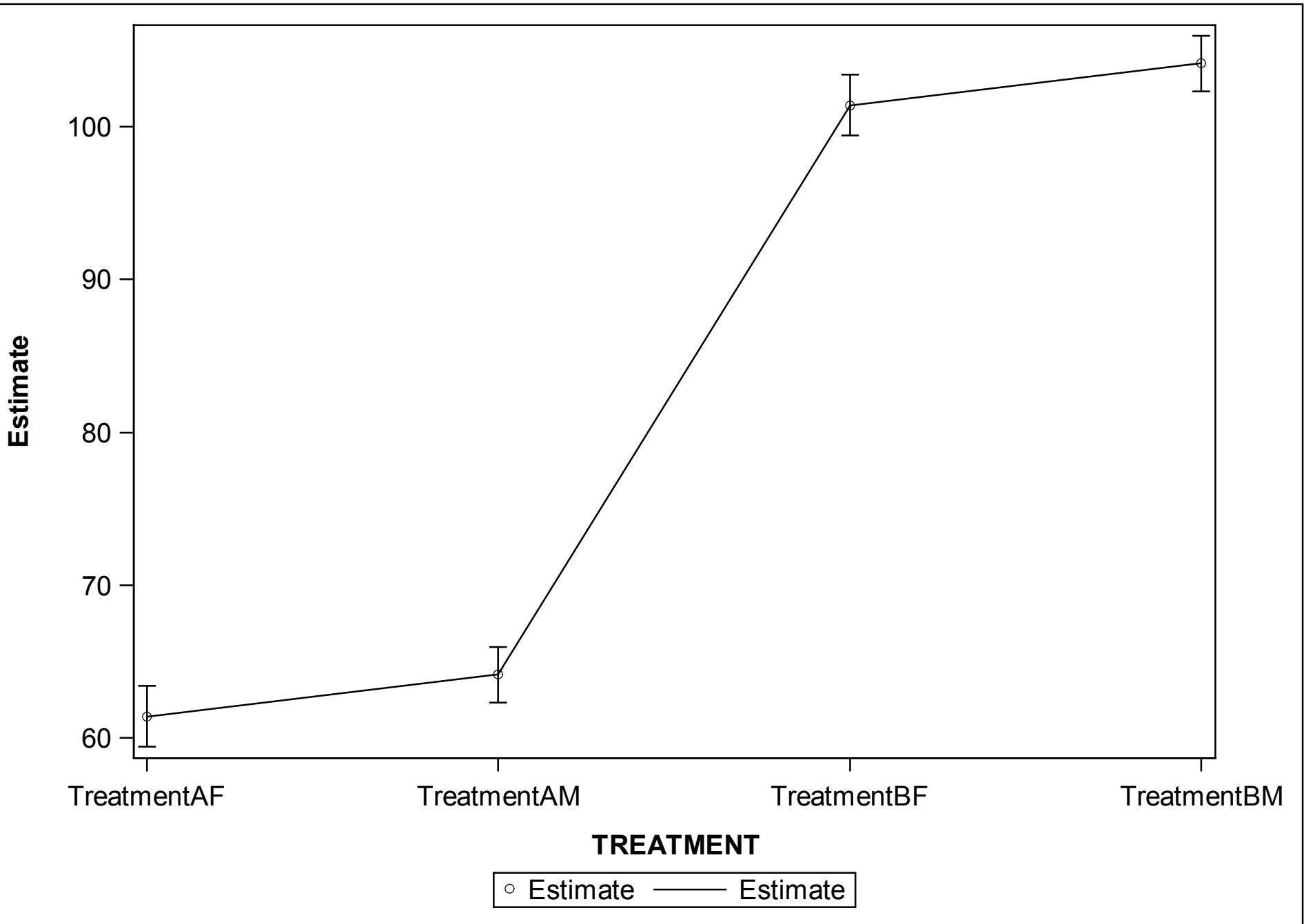
Number of Observations	
Number of Observations Read	38
Number of Observations Used	38
Number of Observations Not Used	0

Covariance Parameter Estimates	
Cov Parm	Estimate
Residual	7.4107

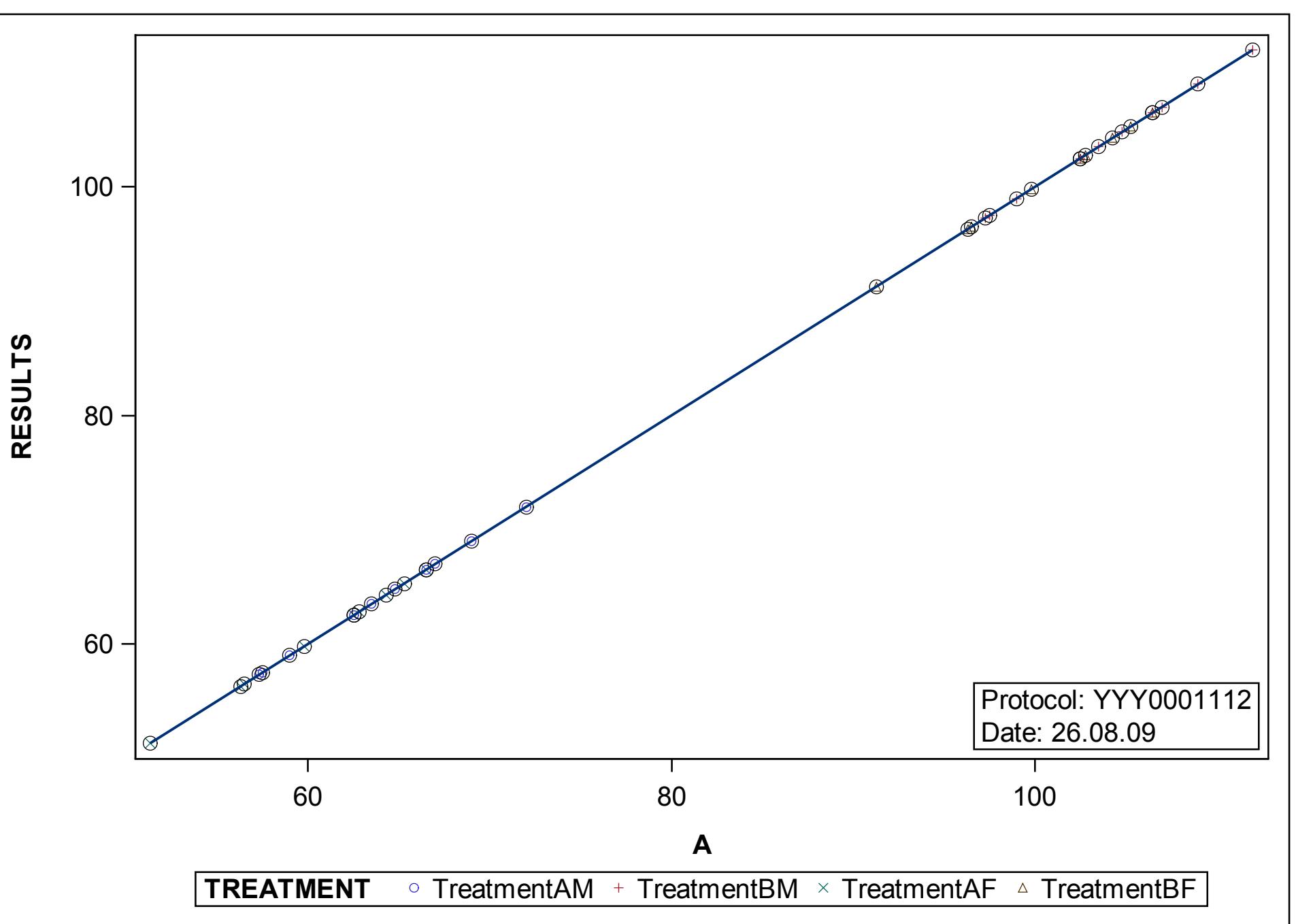
Fit Statistics	
-2 Res Log Likelihood	156.0
AIC (smaller is better)	158.0
AICC (smaller is better)	158.1
BIC (smaller is better)	159.4

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

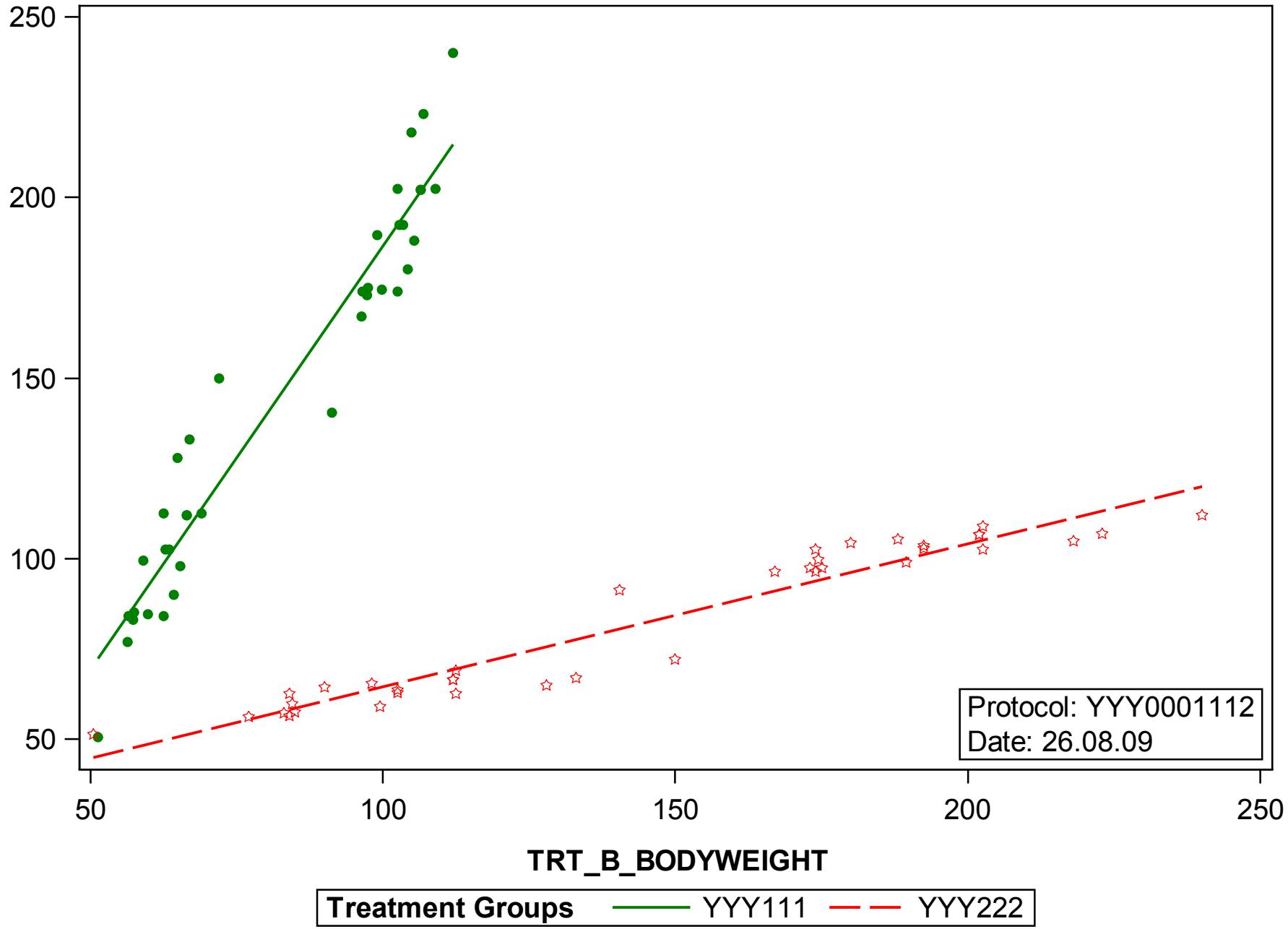


```
proc sgplot data = addtrt;
scatter x = a y = results / group= treatment;
reg x = a y = Results / markerattrs= (size= 10);
inset"Protocol: YYY0001112" "Date: 26.08.09"
/ position= bottomright BORDER;
run;
```



```
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;
```

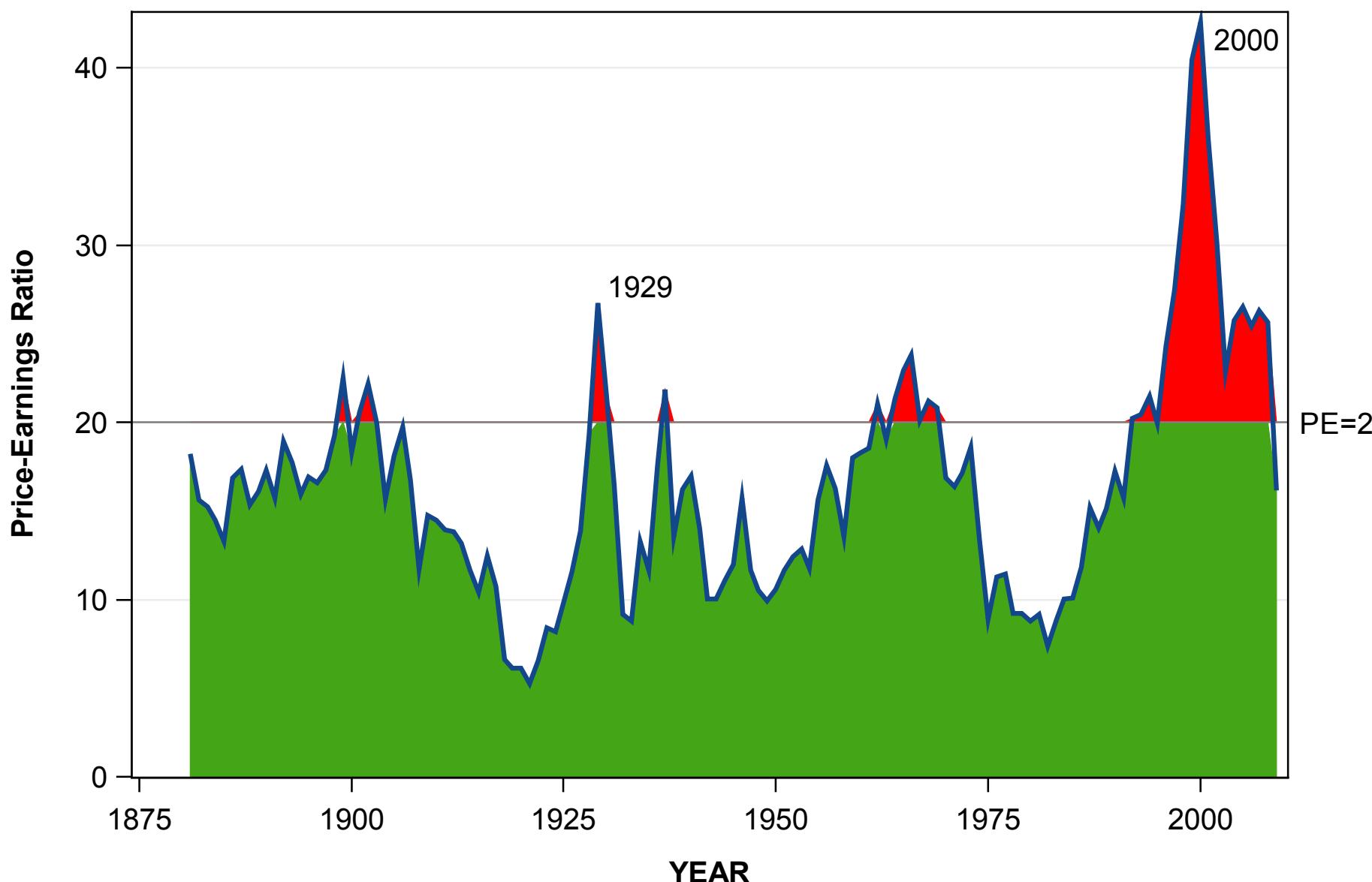
TRT_B_RESULTS



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

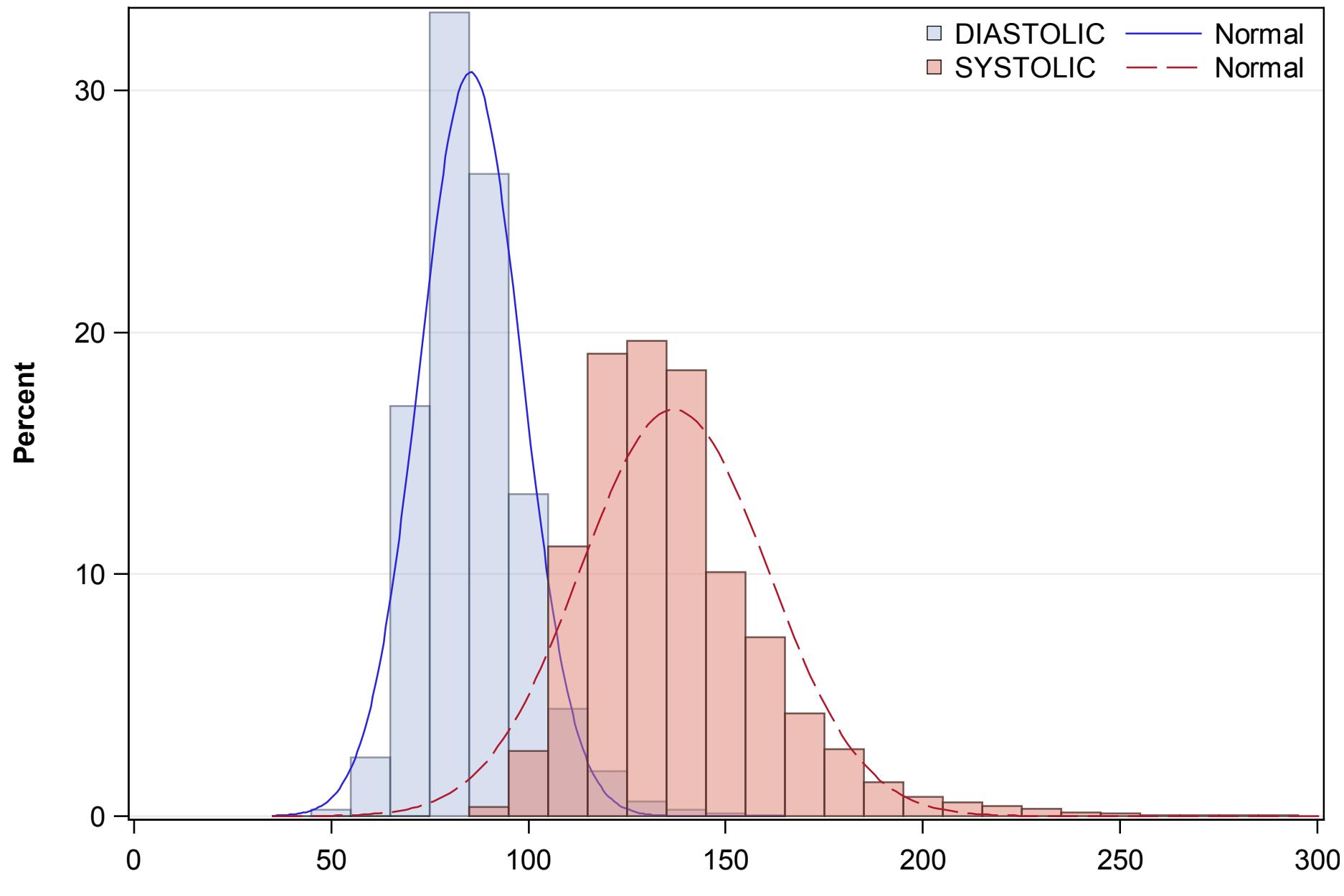


Source: Robert J. Shiller

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;
```

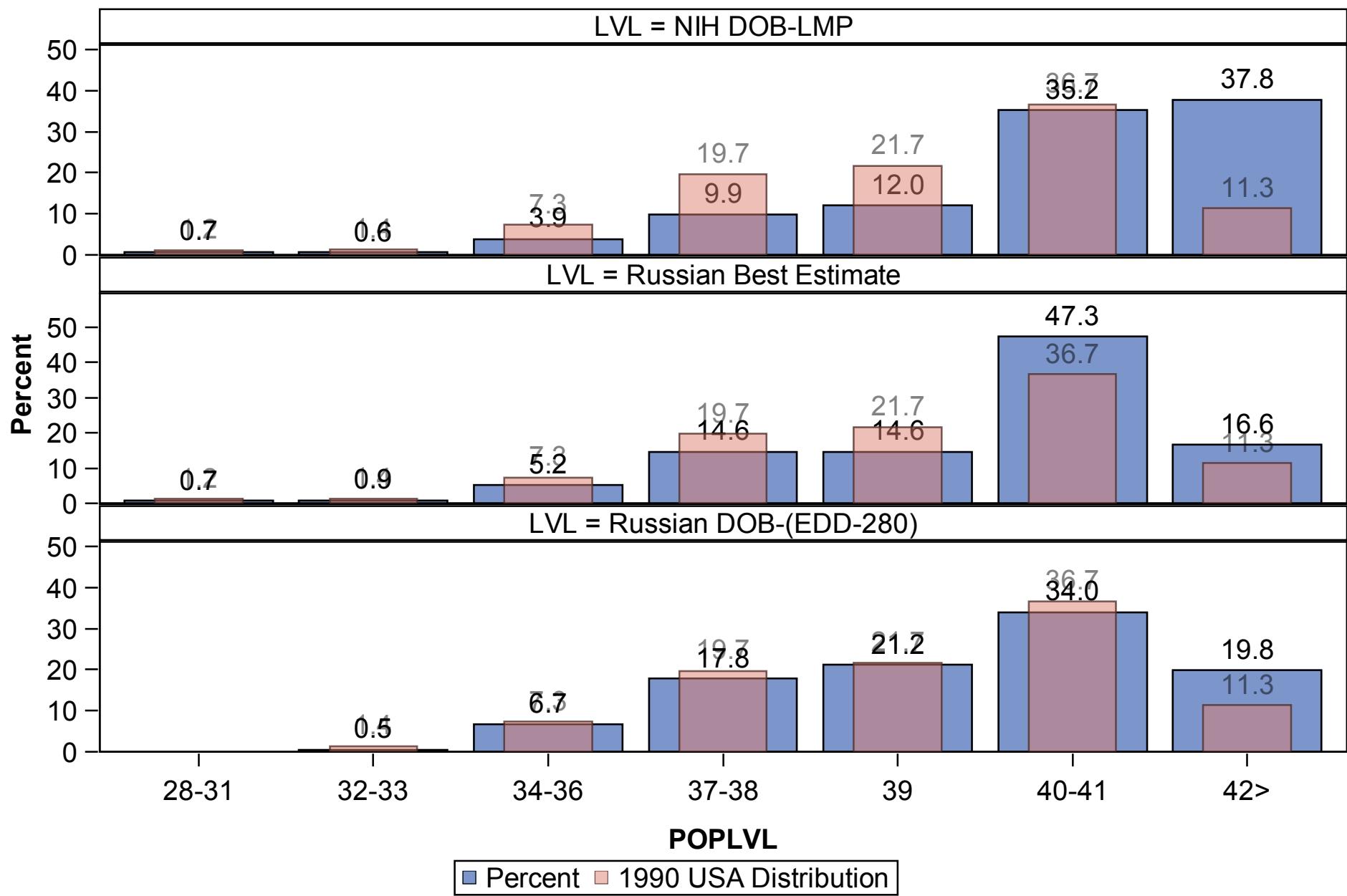
Distribution of Blood Pressure



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;
```

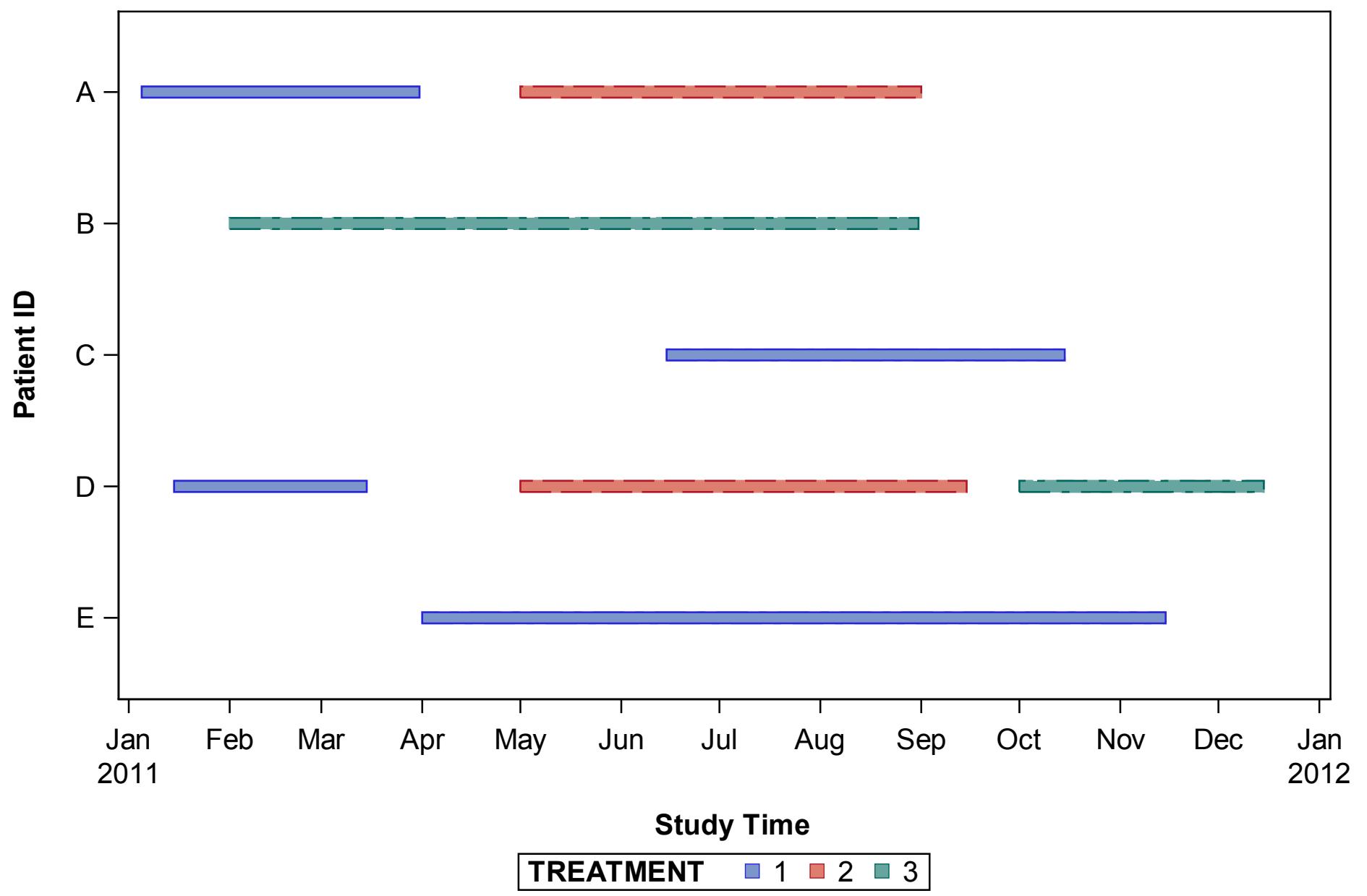
Distribution of births, by gestational age for US(1990) and Chernobyl Mothers(1986)



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;
```

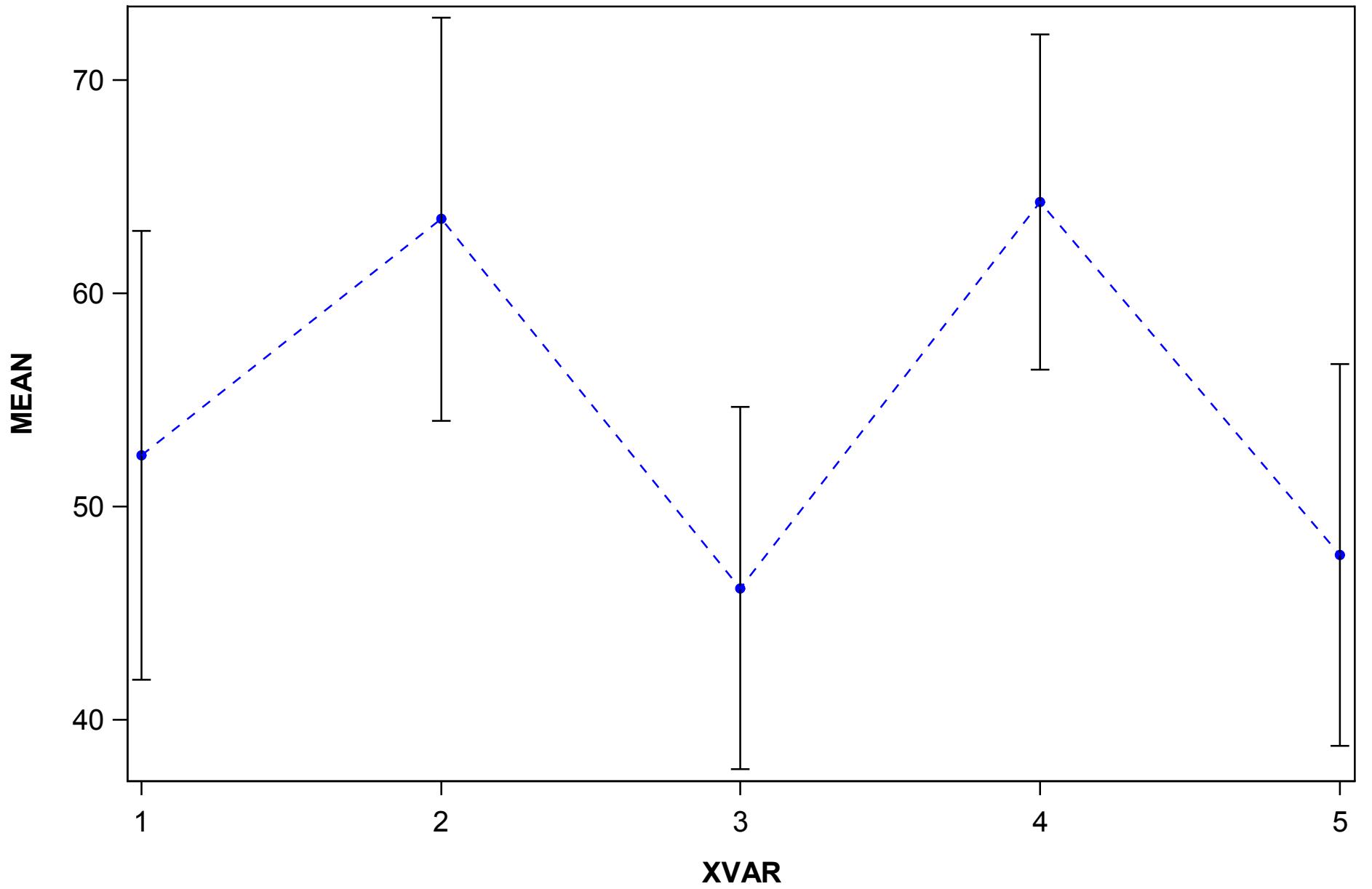
Treatment Time Line by Patient



example-> 170

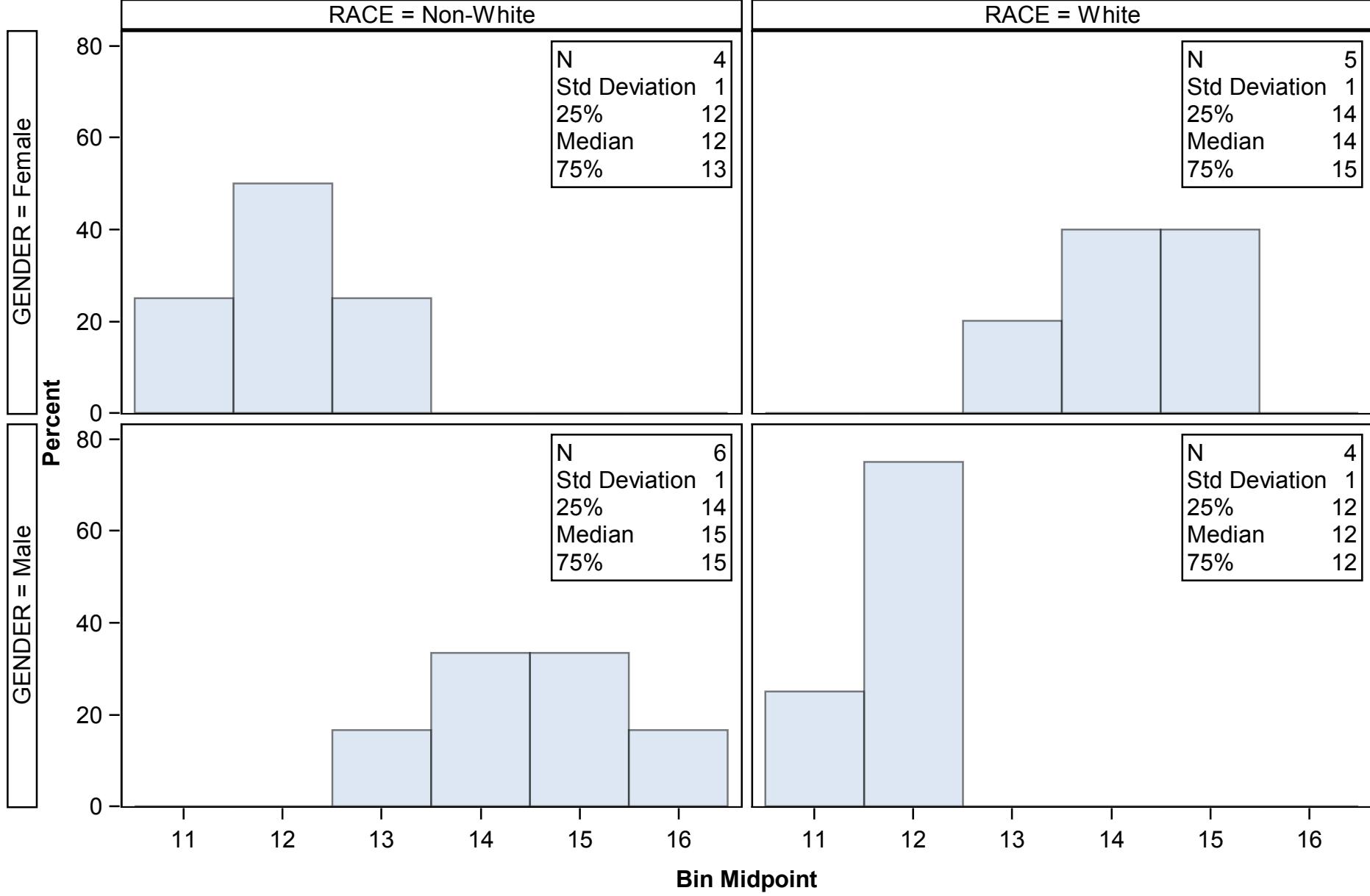
```
proc sgplot data=reshape noautolegend;
scatter x=xvar y=mean / yerrorlower=lower
yerrorupper=upper
markerattrs=(color=blue symbol=CircleFilled);
series x=xvar y=mean / lineattrs=(color=blue pattern=2);
title1 "Plot Means with Standard Error Bars from Calculated Data";
run;
```

Plot Means with Standard Error Bars from Calculated Data



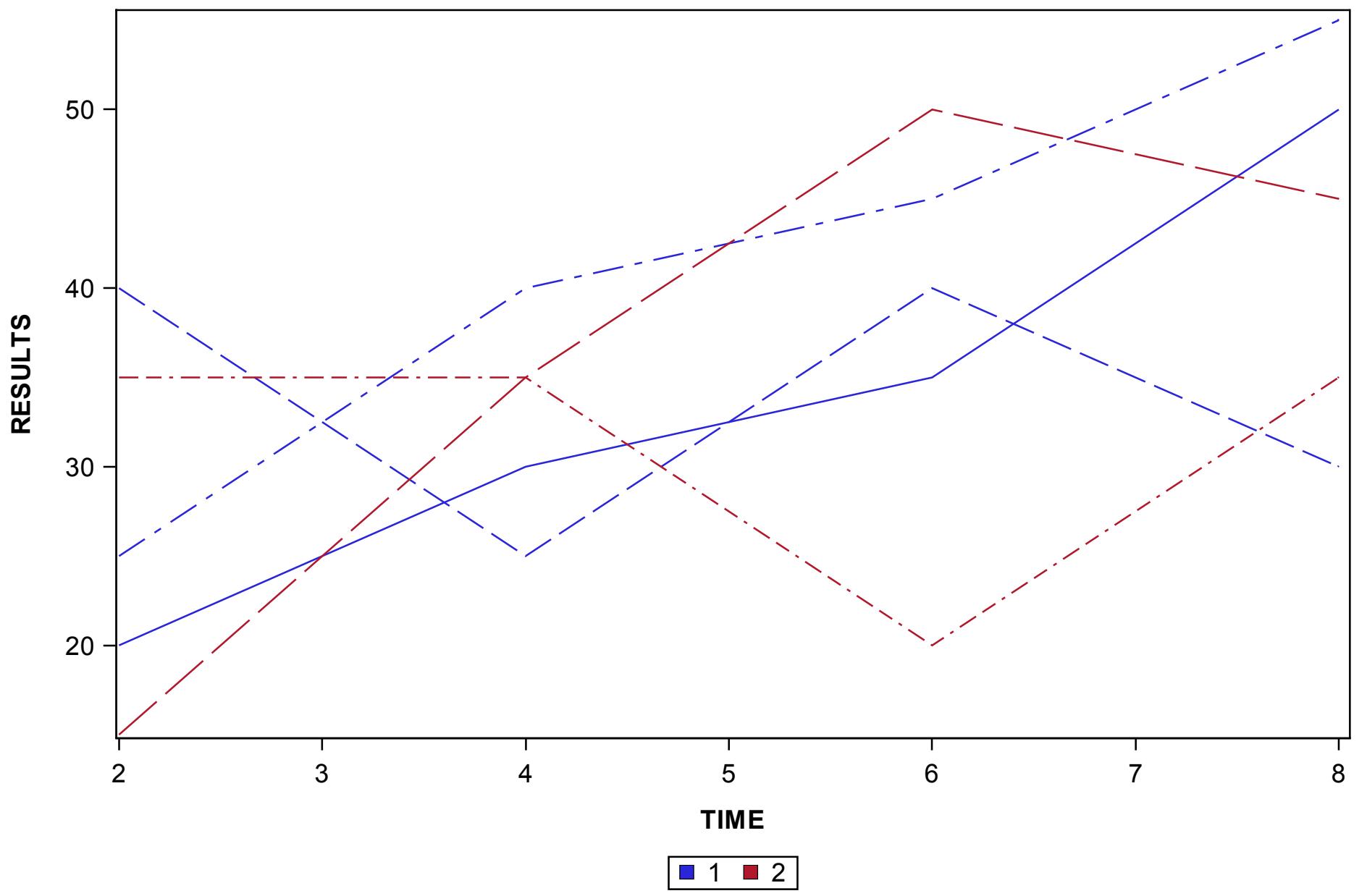
```
data fixage(keep=Gender Age Race);
length Gender $12;
set sashelp.class;
if sex="M" then Gender="Male";
else Gender="Female";
if mod(_n_,2)=0 then Race="White      ";
else race="Non-White";
run;
proc univariate data=fixage noprint;
axis1 order=10 to 18 by 2;
label Age="" ; **Age Histogram";
class 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



```
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



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
7,725,965 - 10,219,603

1,966,814 - 4,147,901
10,419,049 - 43,064,189

4,205,747 - 7,252,331
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 cbback=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)

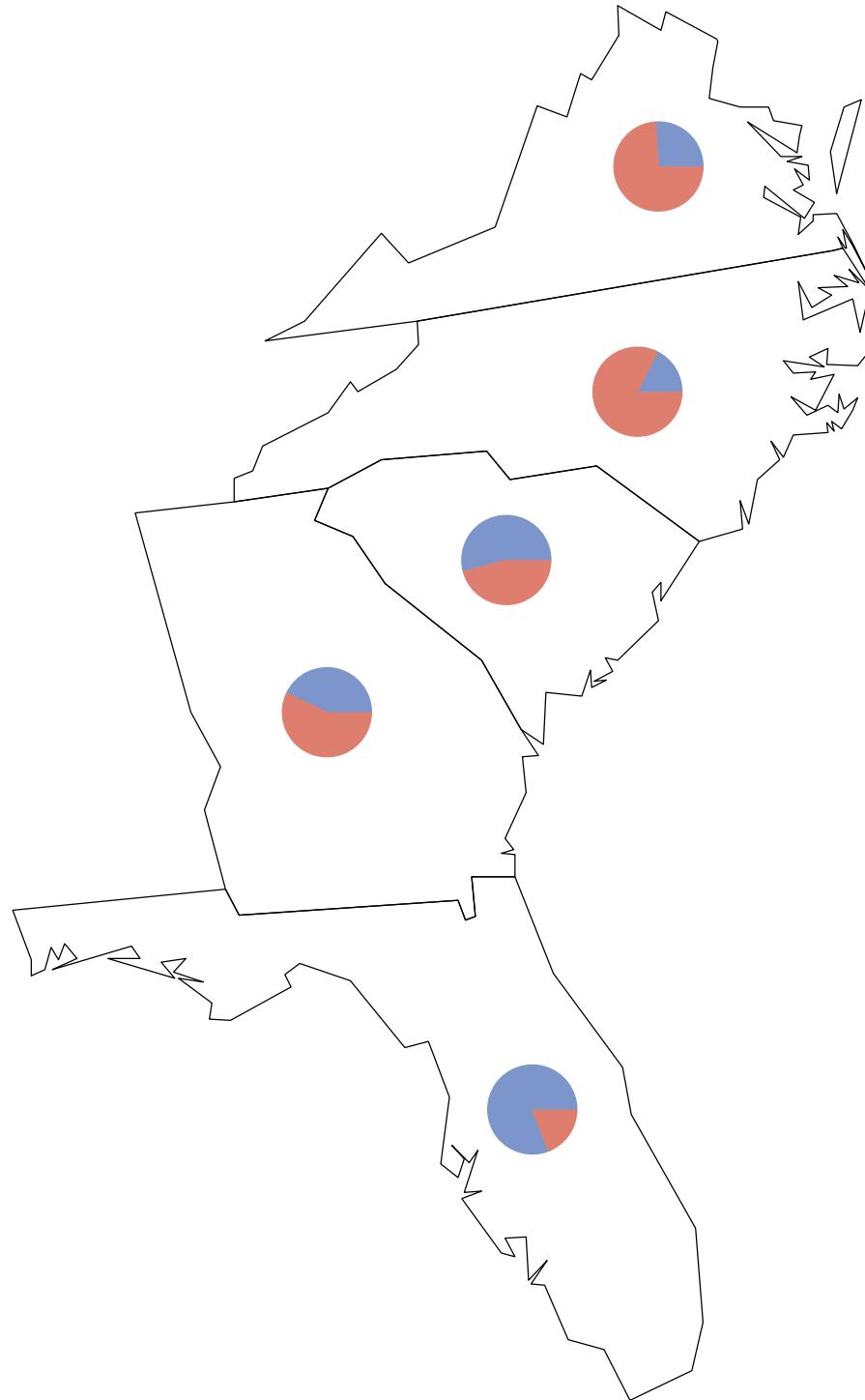


U.S. Census Division Map (after GREMOVE)



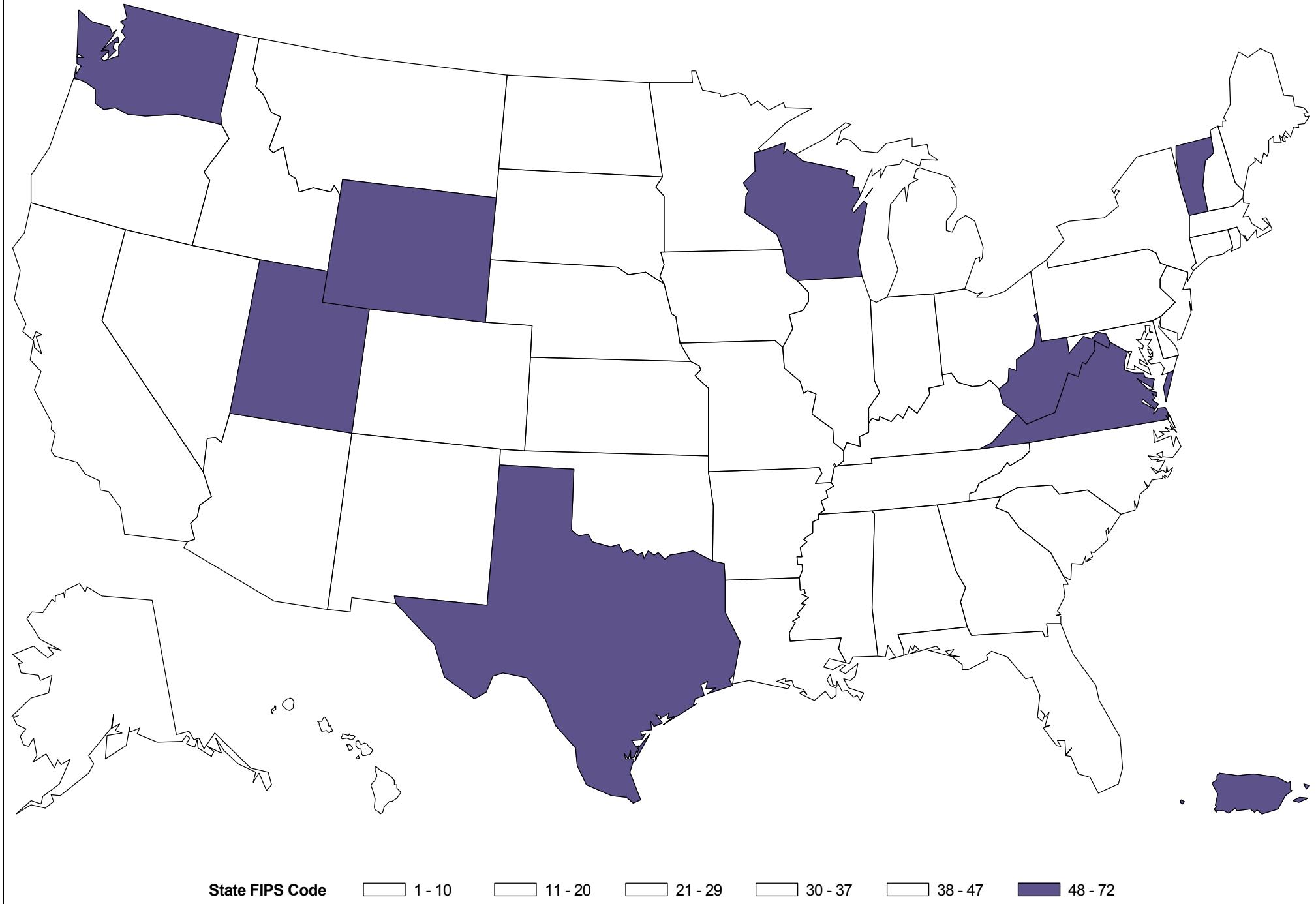
```
goptions reset=all cback=white border htitle=12pt htext=10
proc freq data=shares noprint;weight num;
tables state*vendor / outpct out=freq;run;
data anno;
merge freq(in=a) maps.uscenter;
by state;if a;
xsys="2"; /* X and Y coordinate system */
ysys="2";
when="a"; /* Apply the annotation after */
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.colormap;
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.colormap;
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

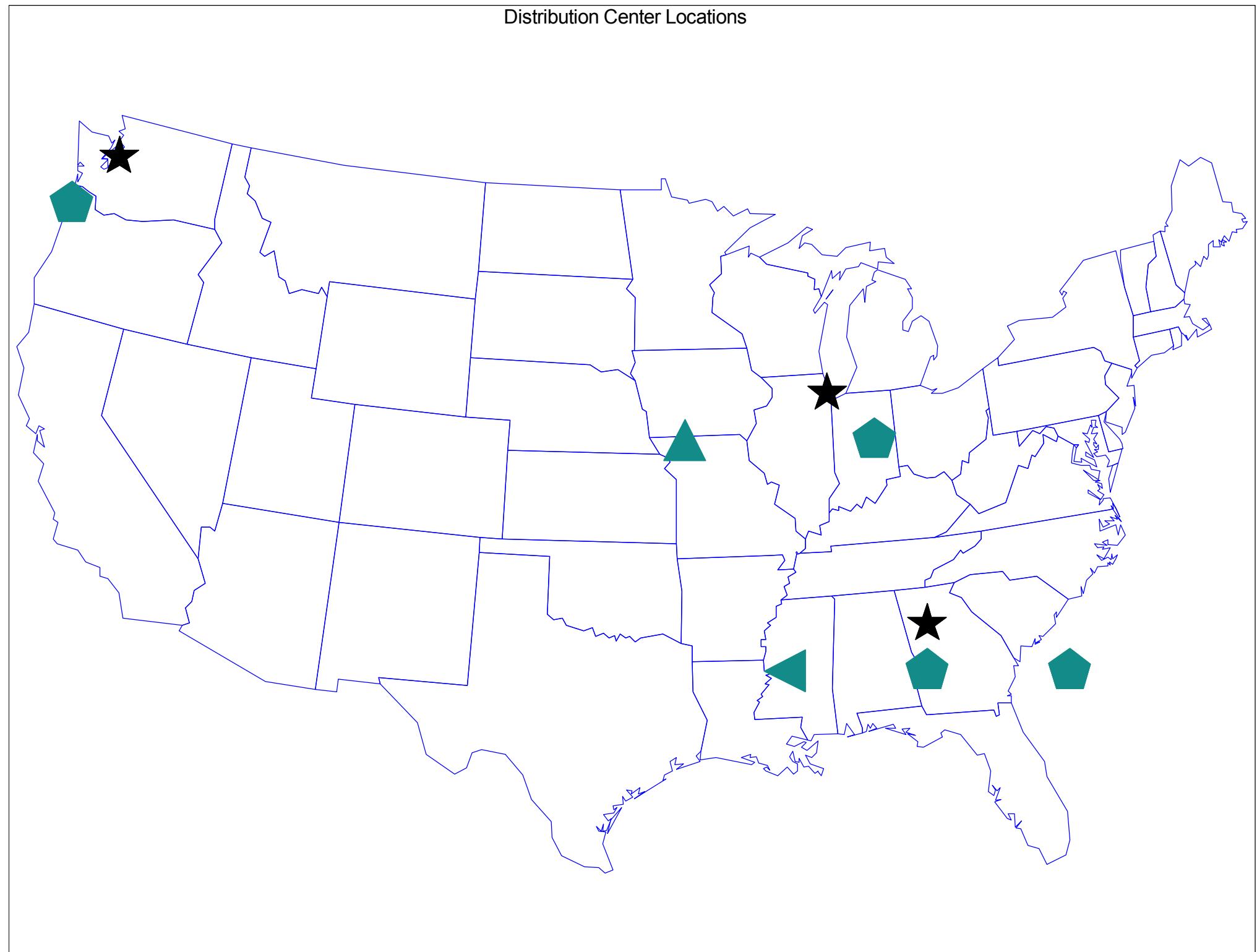


Africa after PROC GREMOVE



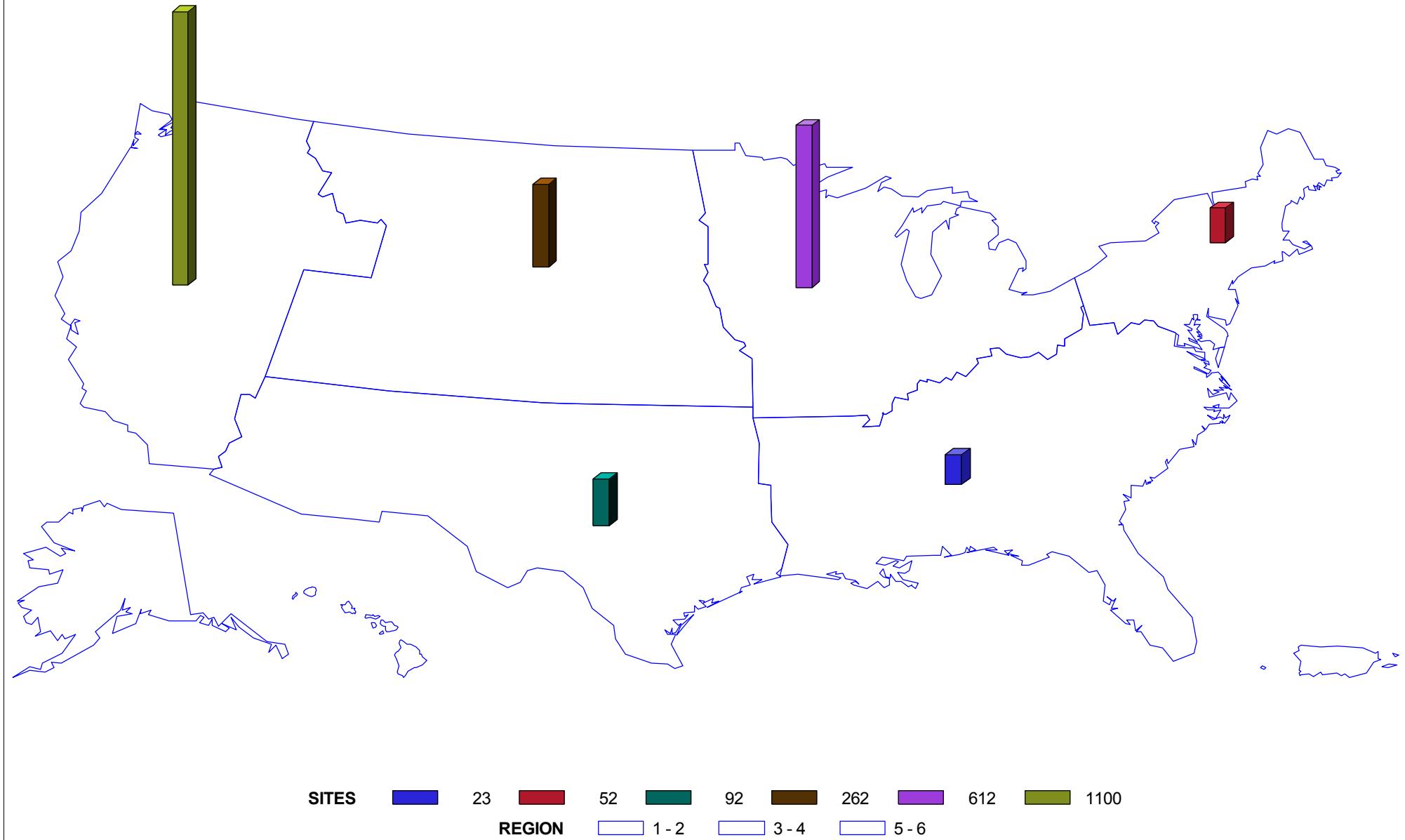
```
data lower48;
set maps.us;
if state ne stfips("AK");
if state ne stfips("HI");
if state ne stfips("PR");
run;
data citystar/* Create the Annotate data set*/
length function color $ 8 position $ 1
text $ 20 style $ 30;
retain xsys ysys "2" hsys "3" when "a";
set maps.uscity(keep=x y city state);
if (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



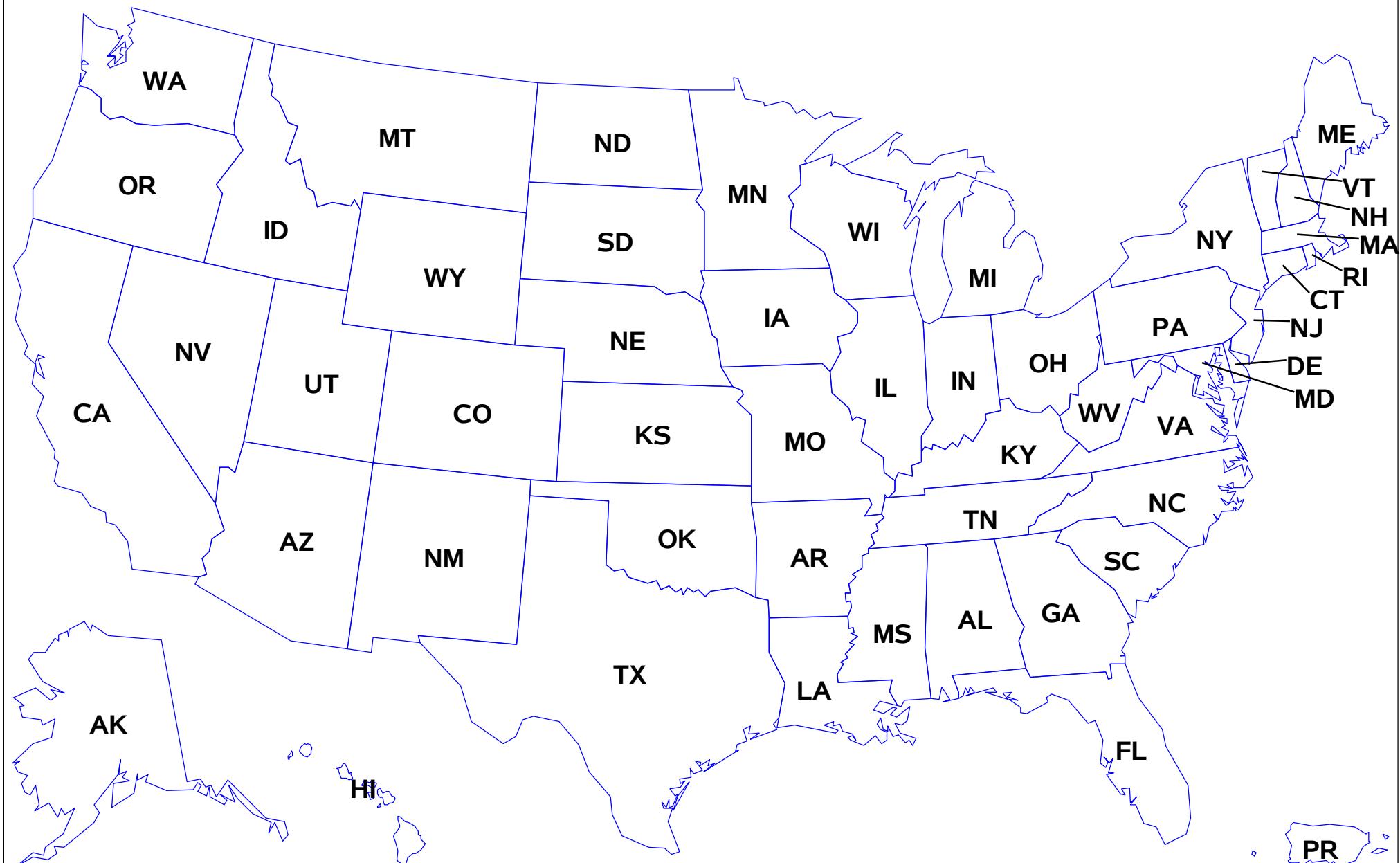
```
data sites;input Region Sites @@;
cards4;
1 1100 2 262 3 92 4 612 5 23 6 52
.....
run;
data states1 /* Create map data set STATES1 by adding */;
set maps.us; /* REGION to the US map data set */;
select;
when (state=53 or state=41 or state=16 or state=32 or state=06
or state=02 or state=15) region=1; /* 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



```
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)

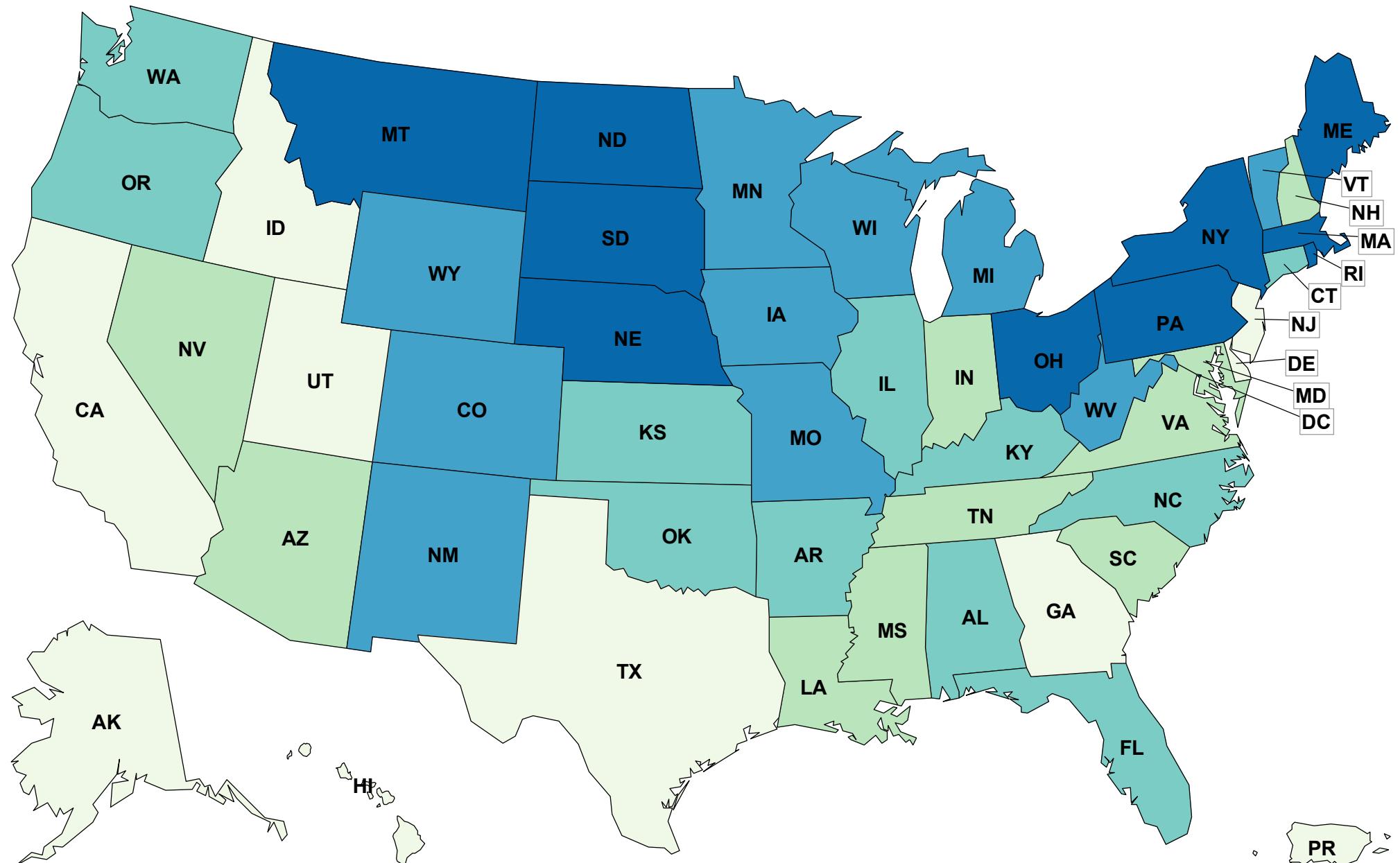
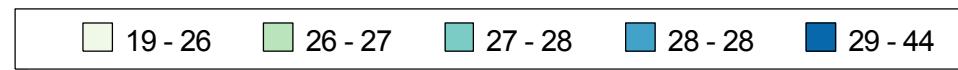
Cost Reports

Acxiom household

Census

2010 Census SF1 Percent Single Households by State.

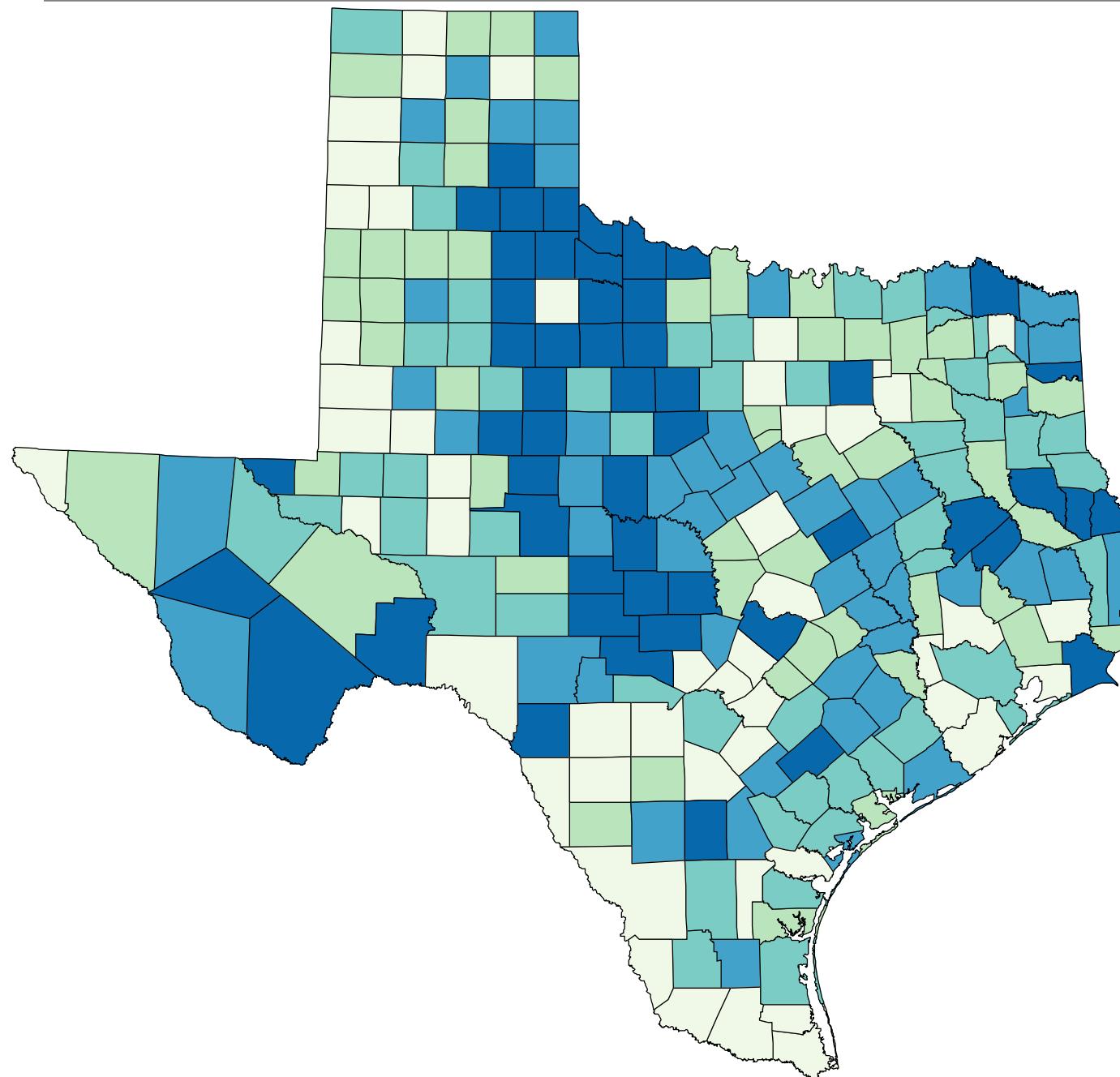
2010 Census SF1 Percent Single Households by State



2010 Census Percent Single Person Households Texas Counties

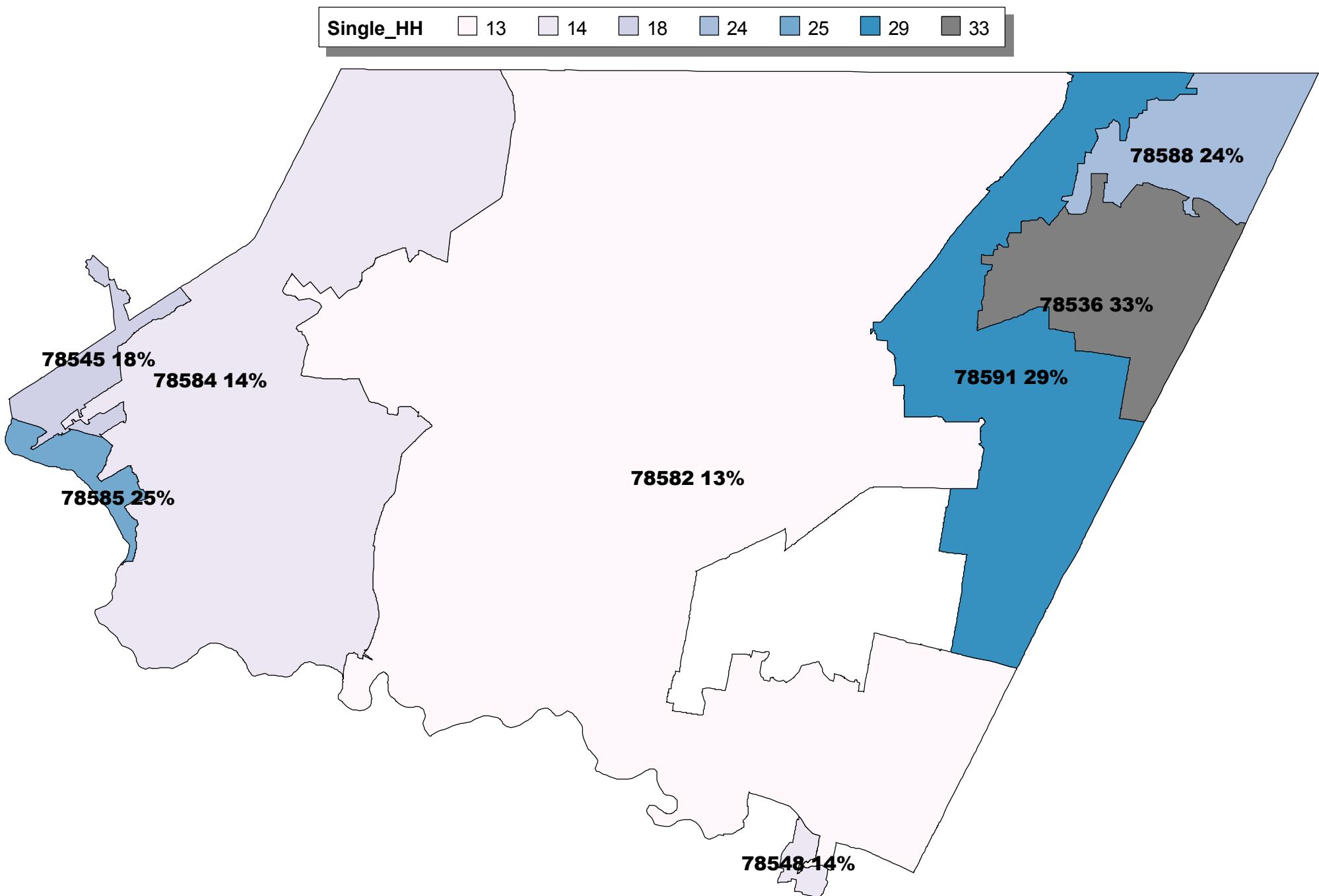
2010 Census SF1 Percent Single Households Texas Counties

Single_HH 13.4 - 21.7 21.8 - 24.3 24.4 - 26.1 26.1 - 28.0 28.0 - 37.2



2010 Census Percent Single Person Households Starr County(TX)
Proc gremove would exclude Zcta areas outside the county

Percent Single PersonHouseholds Starr County(TX) by Zcta
Percent Single Households



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 hierarchical

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

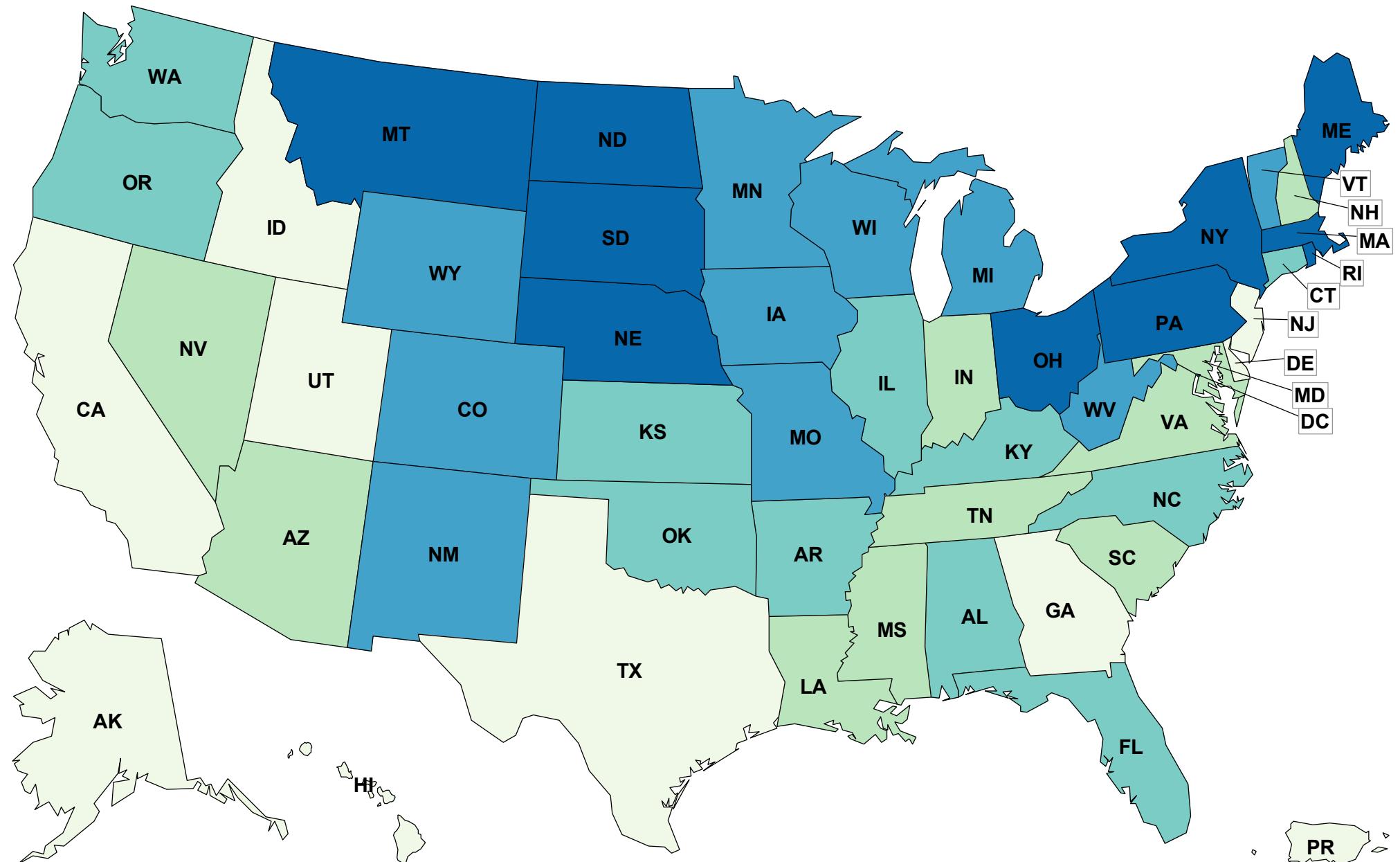
```
data sf1statemap;
  set mta.ums_sf1state(
    rename=stab=state
    keep=stab H13I1 H13I2);
  Single_HH=100*H13I2/H13I1;
;run;quit;
```

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)

Single_HH

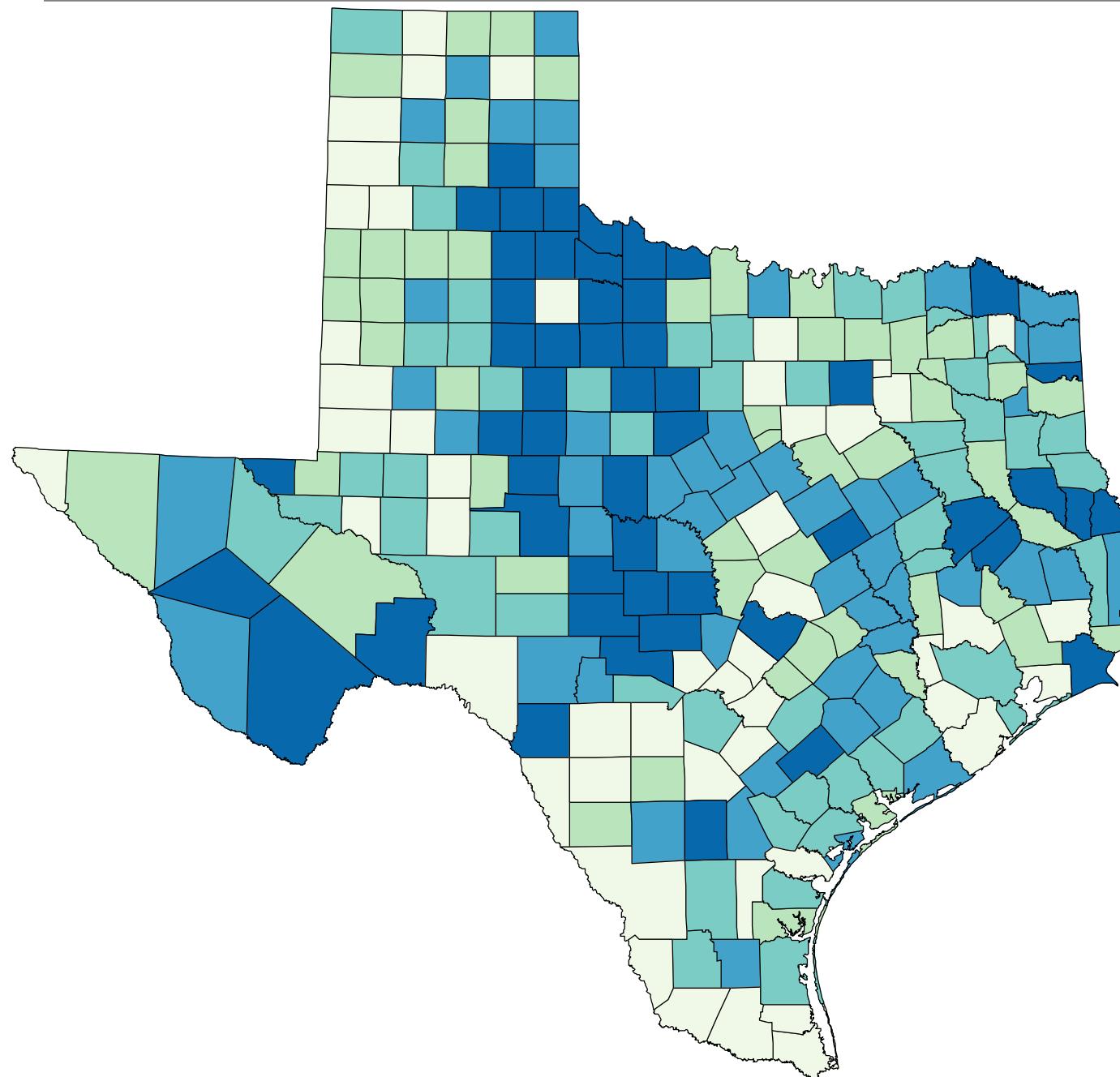
13.4 - 21.7

21.8 - 24.3

24.4 - 26.1

26.1 - 28.0

28.0 - 37.2



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 tabulation 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 multiple 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 identify 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 delivery, 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;

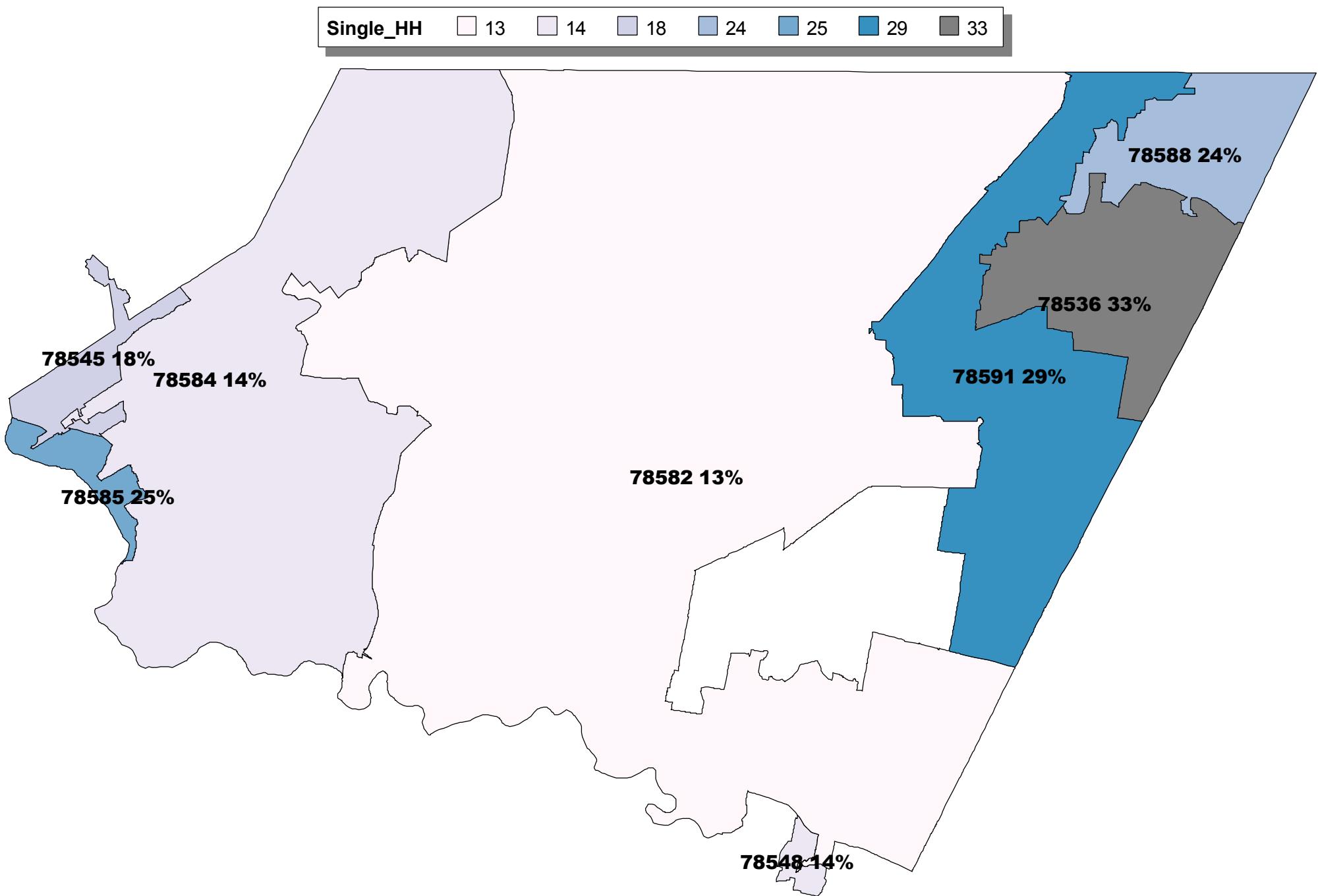
MAPLABEL (subzipsrt, subzipdat, anno, zcta,
zcta5,font=Arial Black,color=black, size=2, hsys=3);

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 = cffff7fb;
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 Households



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

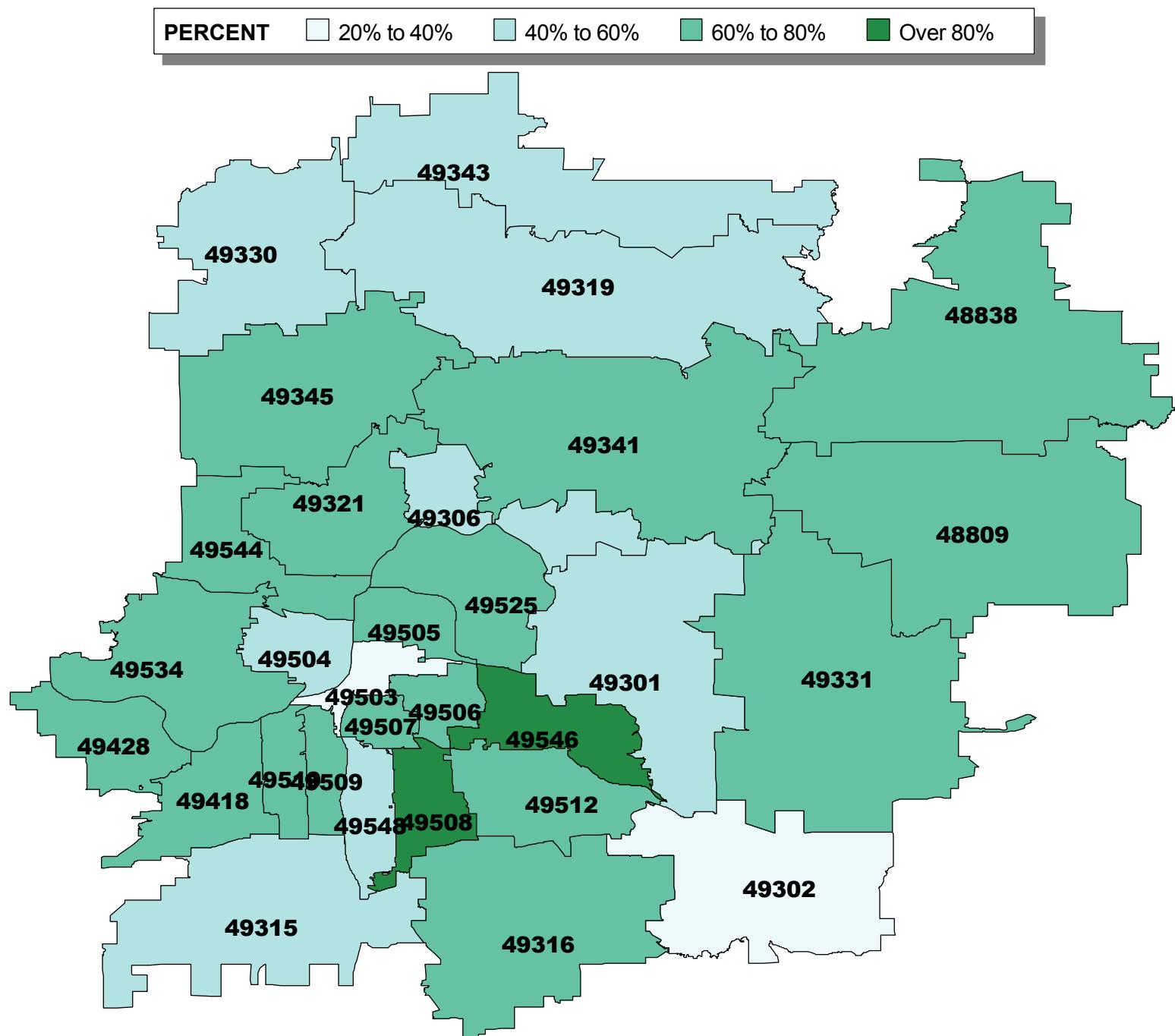
Agenda

- 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

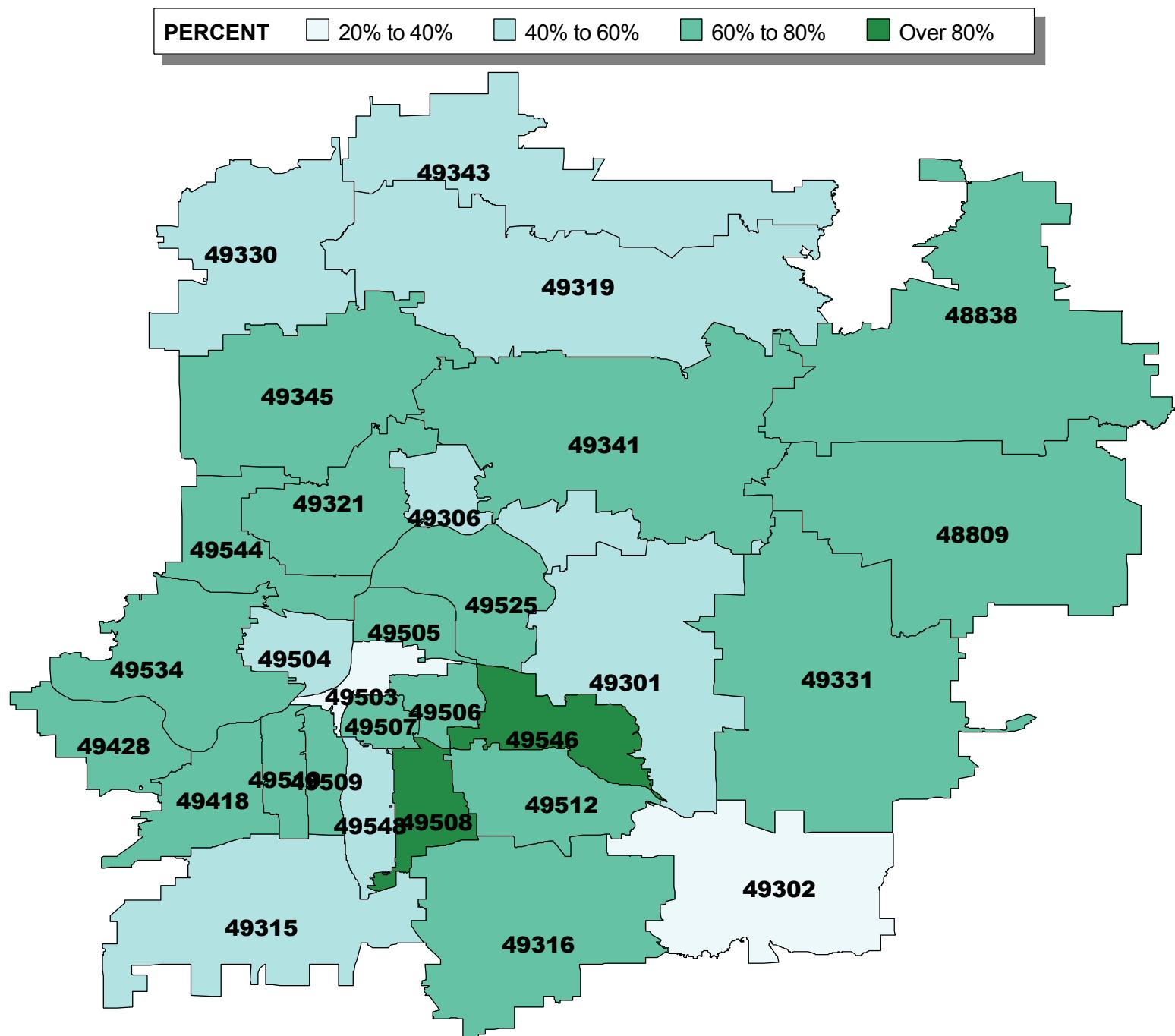
```
PROC FORMAT;  
VALUE PercentGroup  
48 <- 49 = "20% to 40% "  
49 <- 50 = "40% to 60% "  
50 <- 52 = "60% to 80% "  
52 <- HIGH = "Over 80% ";  
RUN;  
  
@ANNOMAC;  
@MAPLABEL ( subzipsrt, subzipnro, anno, zcta5,  
zcta5,font=Arial Black,color=black, size=2, hsys=3);
```

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_Intzip_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

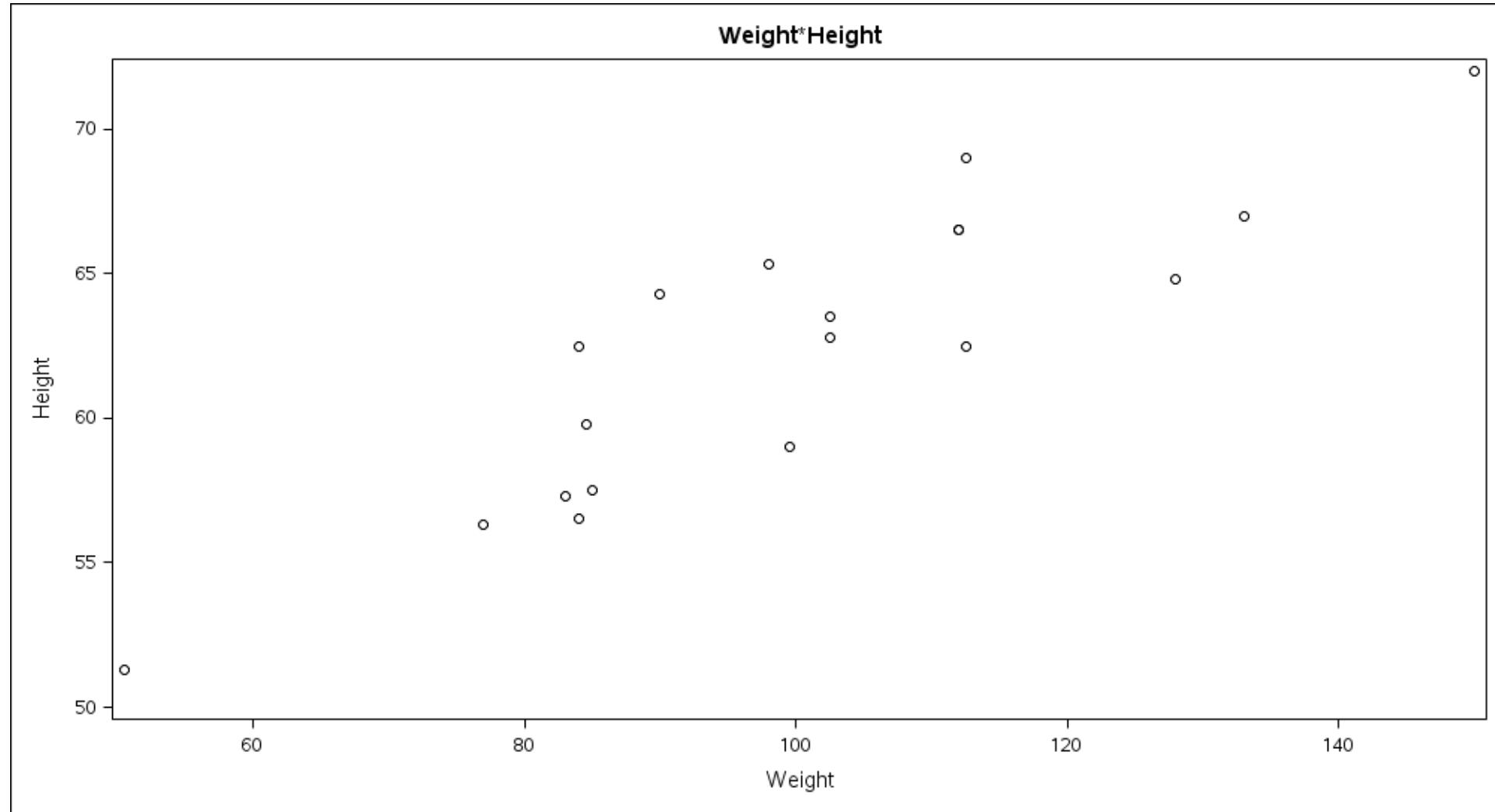
CHARTS

CHART TYPE	SLIDE #	CHART TYPE	SLIDE #
SCATTER	3	TEXT	123
LINE	14	NEEDLE	128
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SCATTER CHARTS

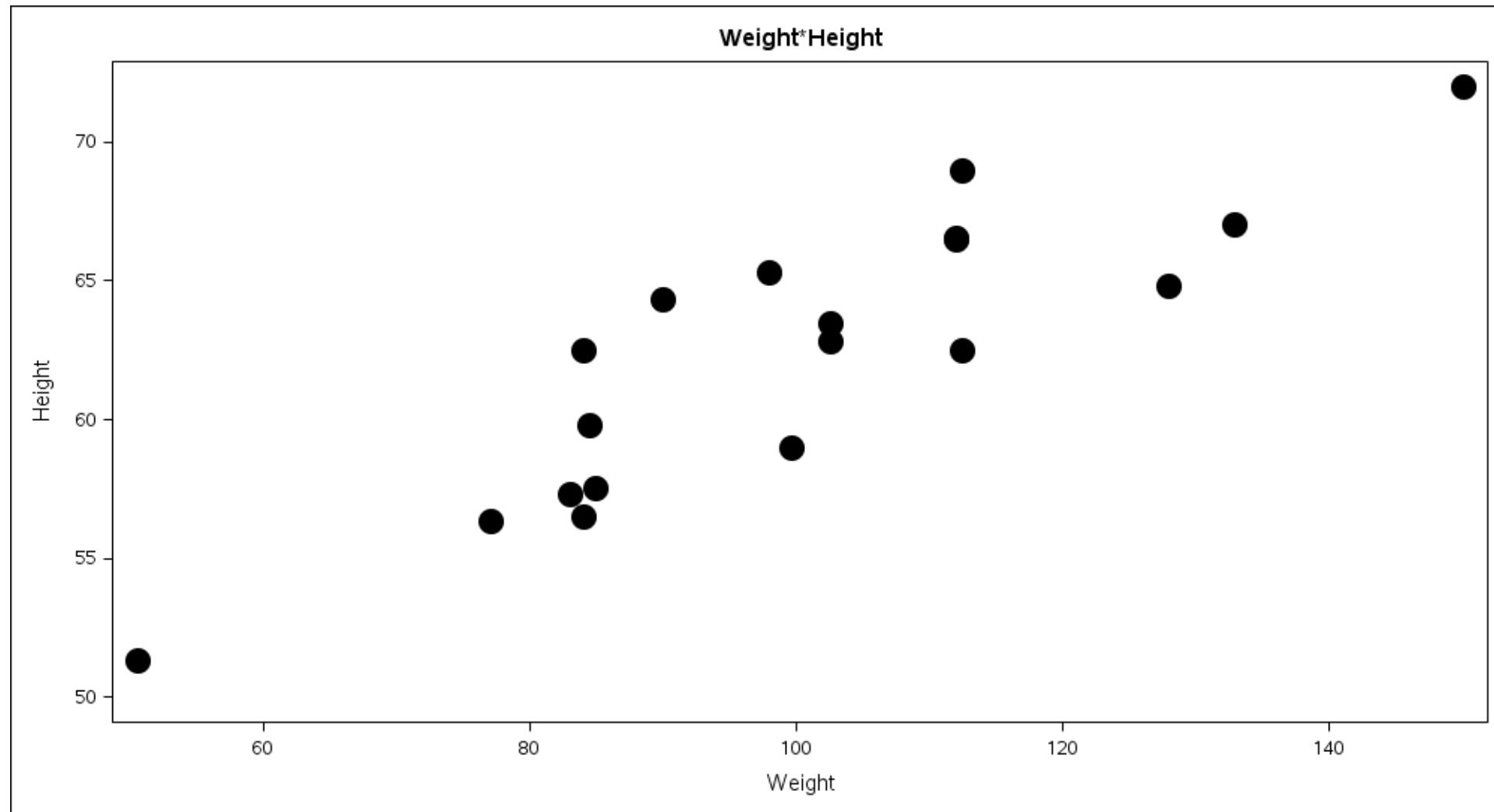
SCATTER CHARTS: EXERCISE 1

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



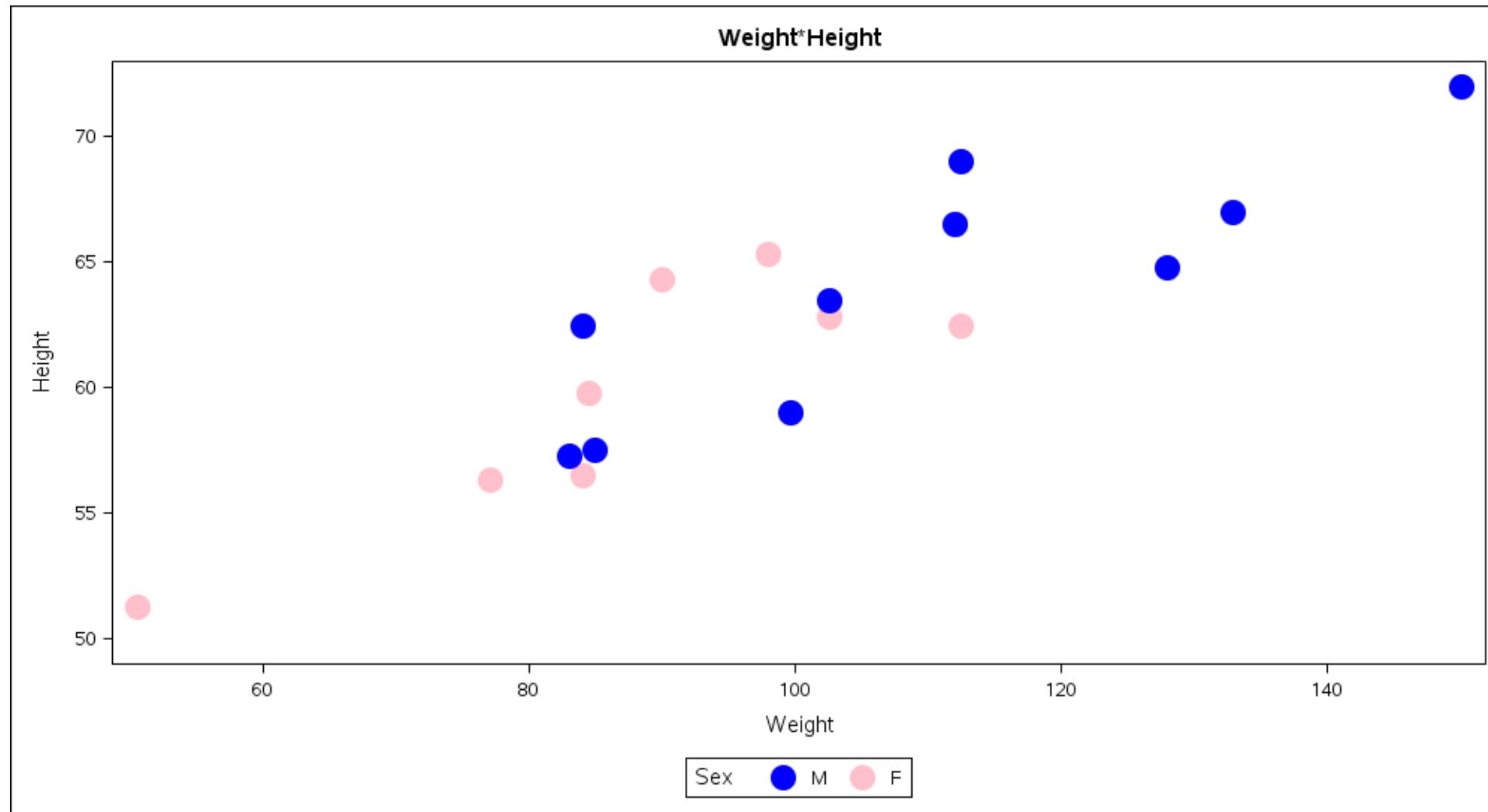
SCATTER CHARTS: EXERCISE 2

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



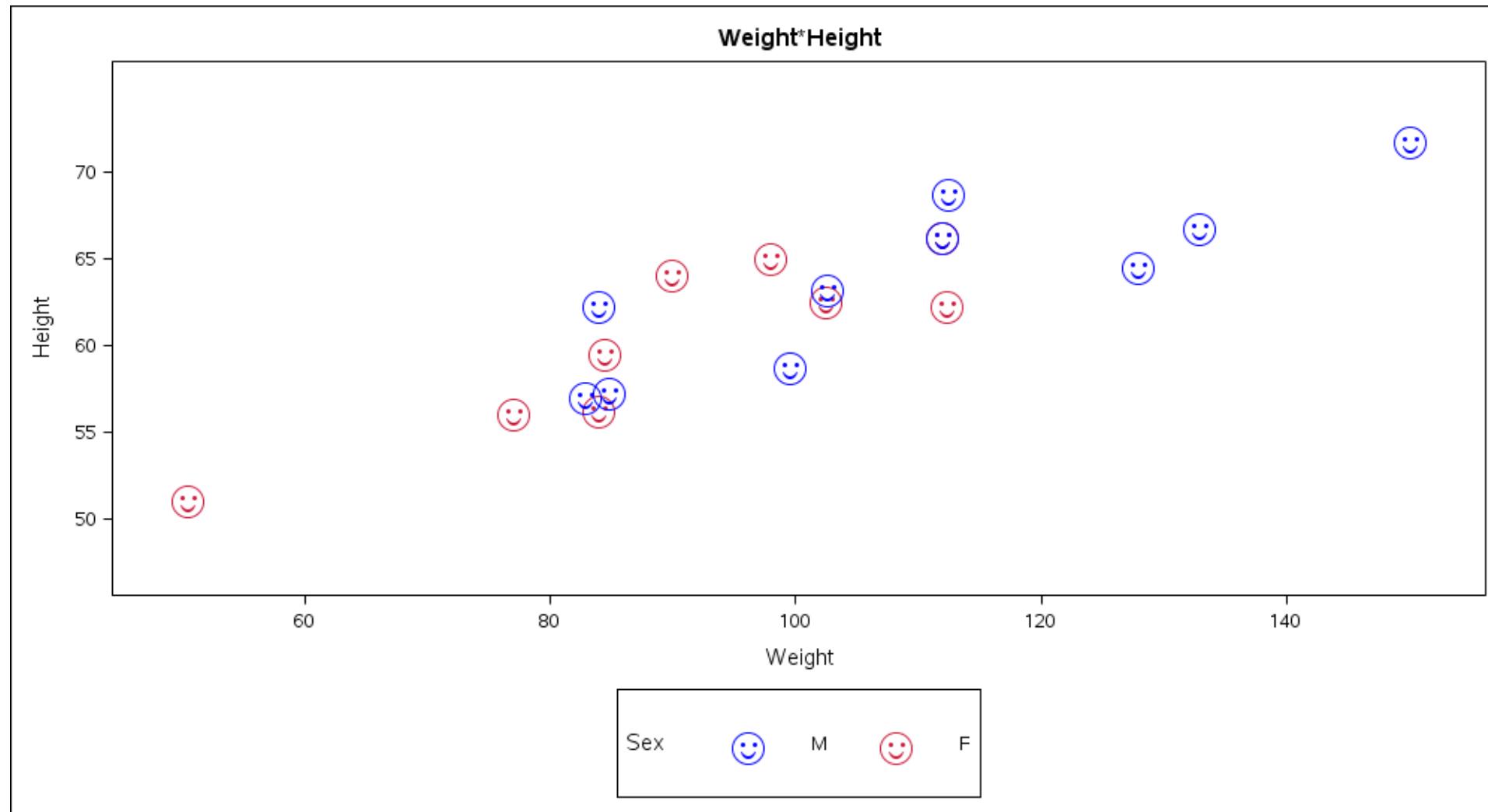
SCATTER CHARTS: EXERCISE 3

```
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;
```



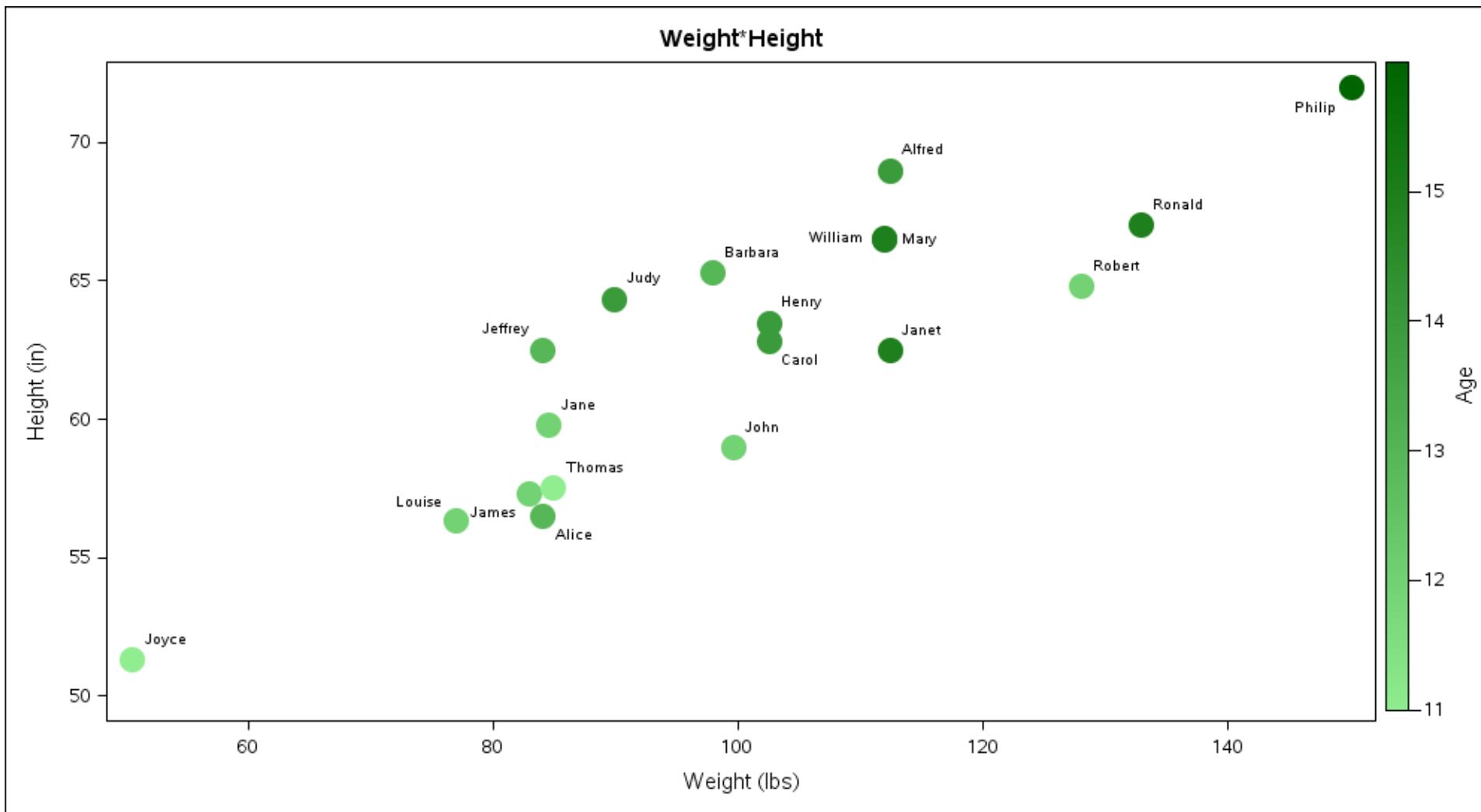
SCATTER CHARTS: EXERCISE 4

```
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;
```



SCATTER CHARTS: EXERCISE 5

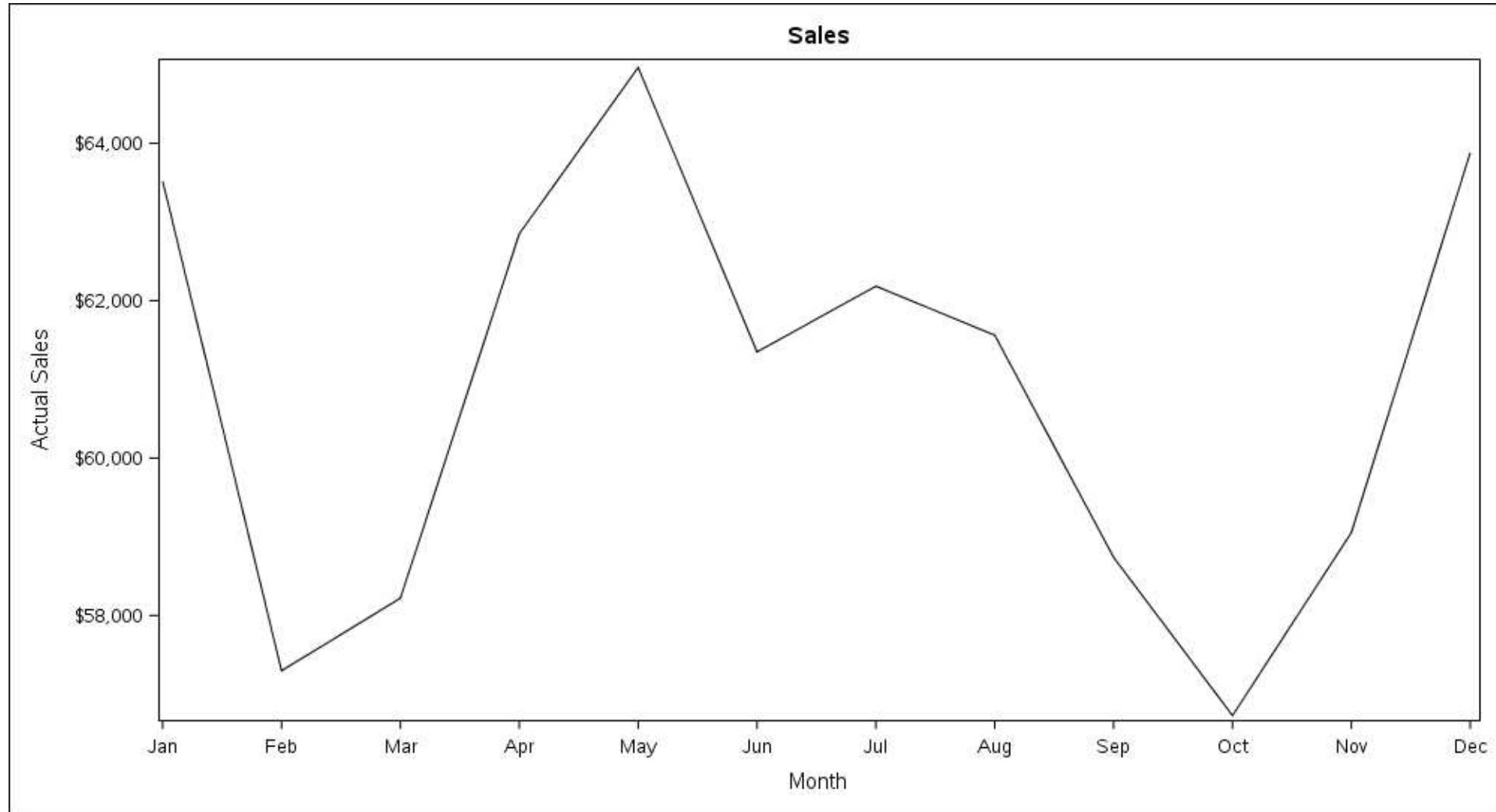
```
proc sgplot data=sashelp.class;
title "Weight*Height";
scatter x=weight y=height /
    markerattrs=(size=12pt symbol=circlefilled)
    jitter
    colorresponse=age
    colormodel=(lightgreen darkgreen)
    datalabel=name datalabelattrs=(color=black);
xaxis label="Weight (lbs)";
yaxis label="Height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



LINE CHARTS

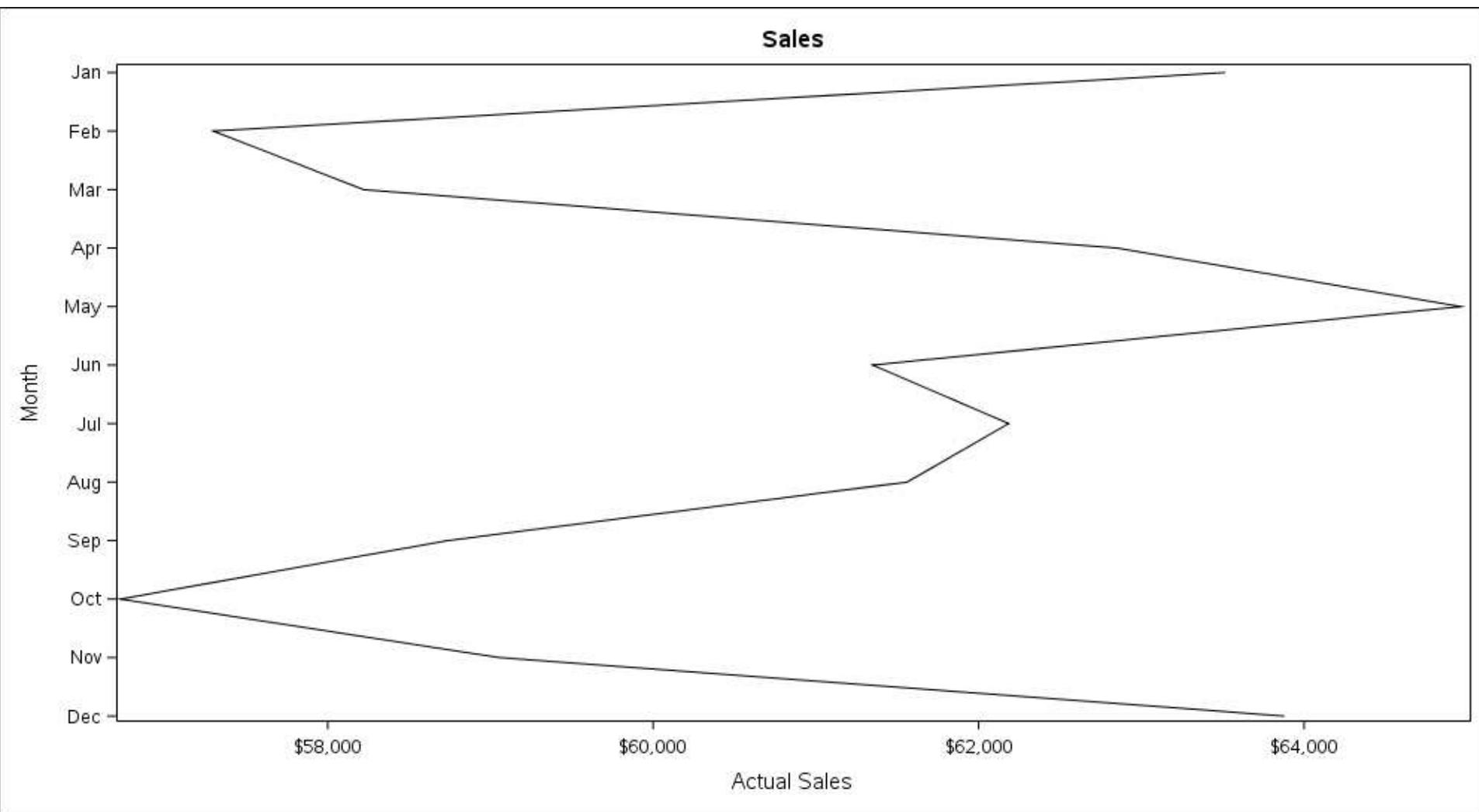
LINE CHARTS: EXERCISE 1

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



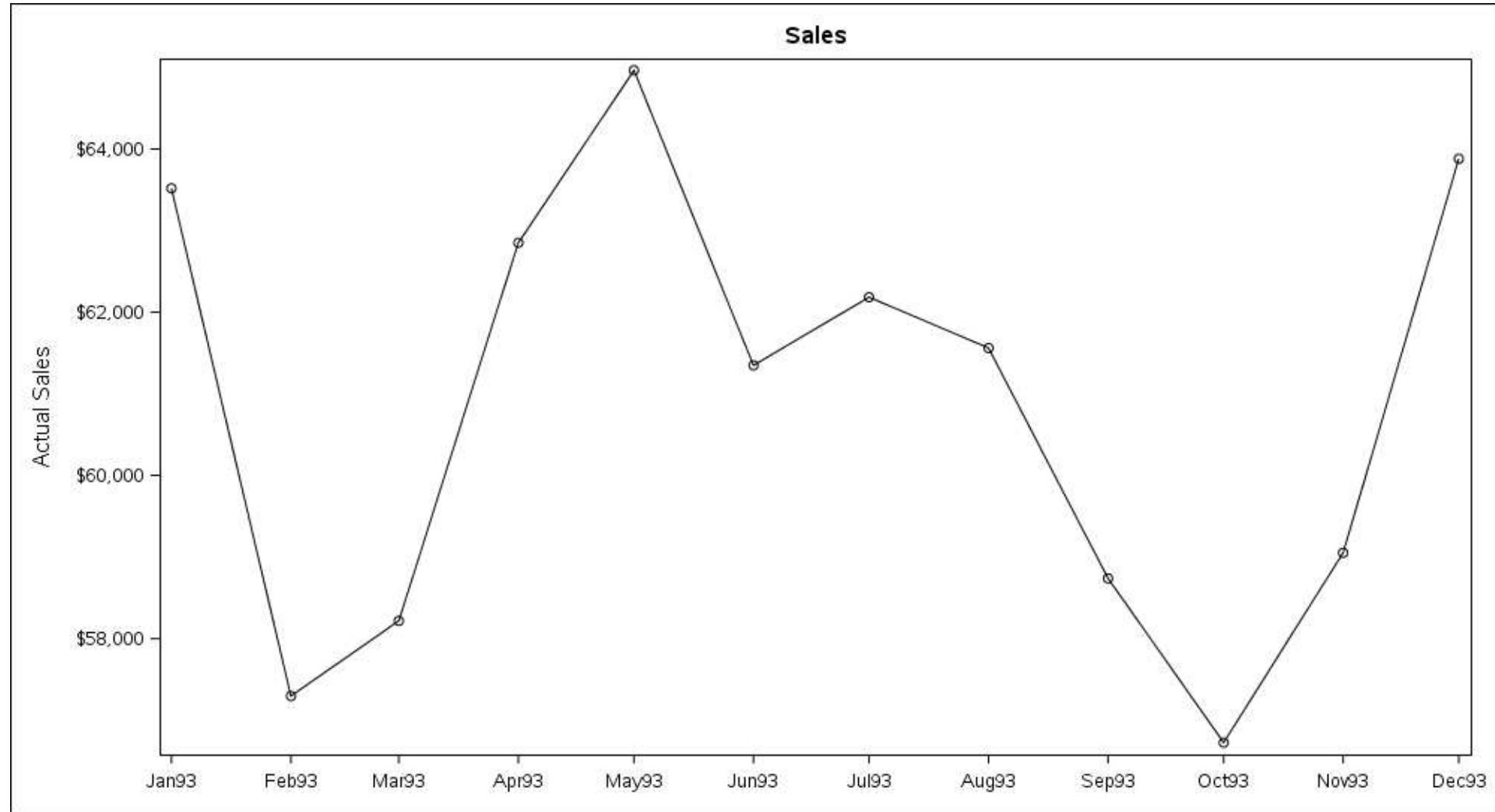
LINE CHARTS: EXERCISE 2

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



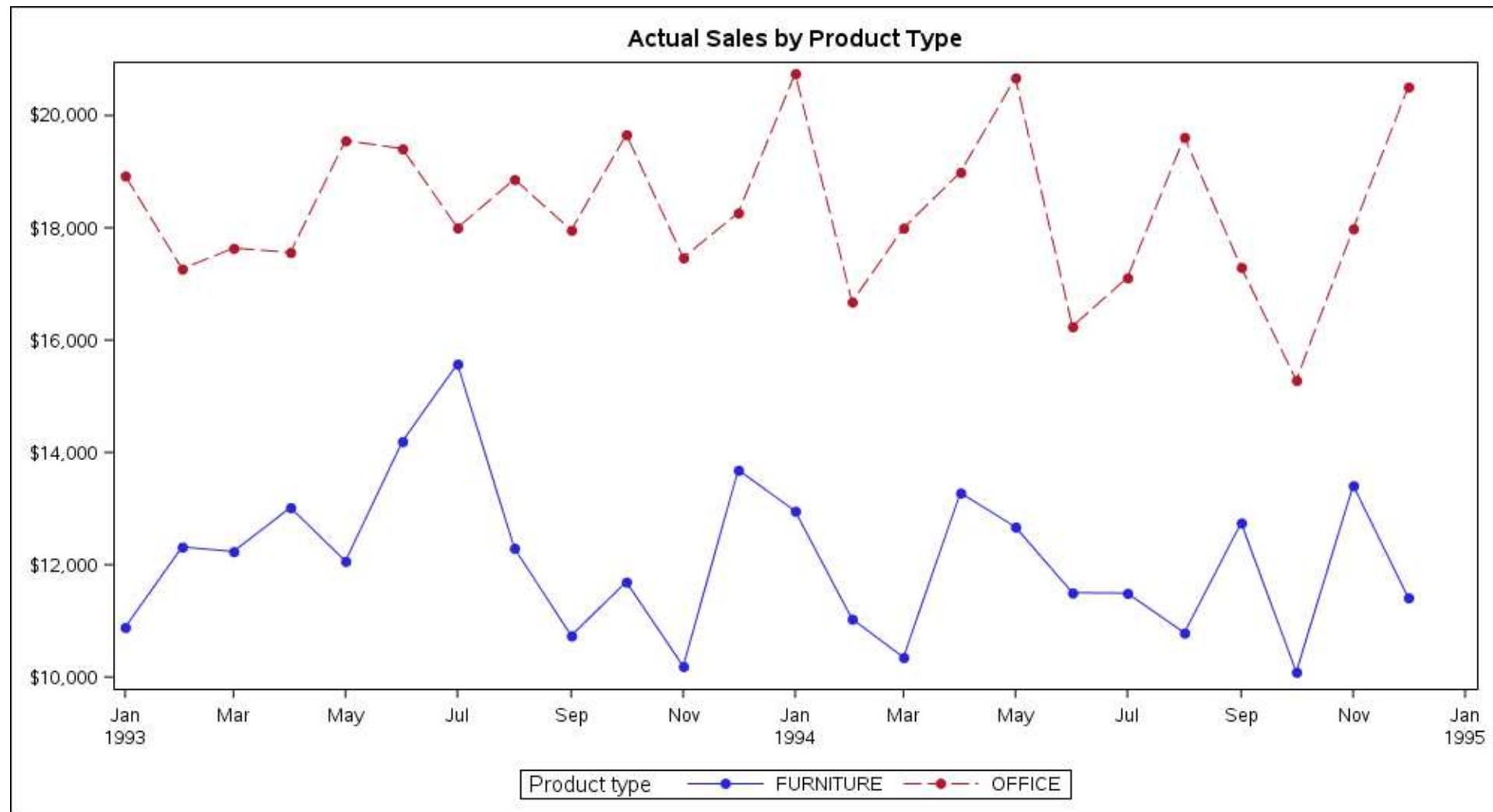
LINE CHARTS: EXERCISE 3

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



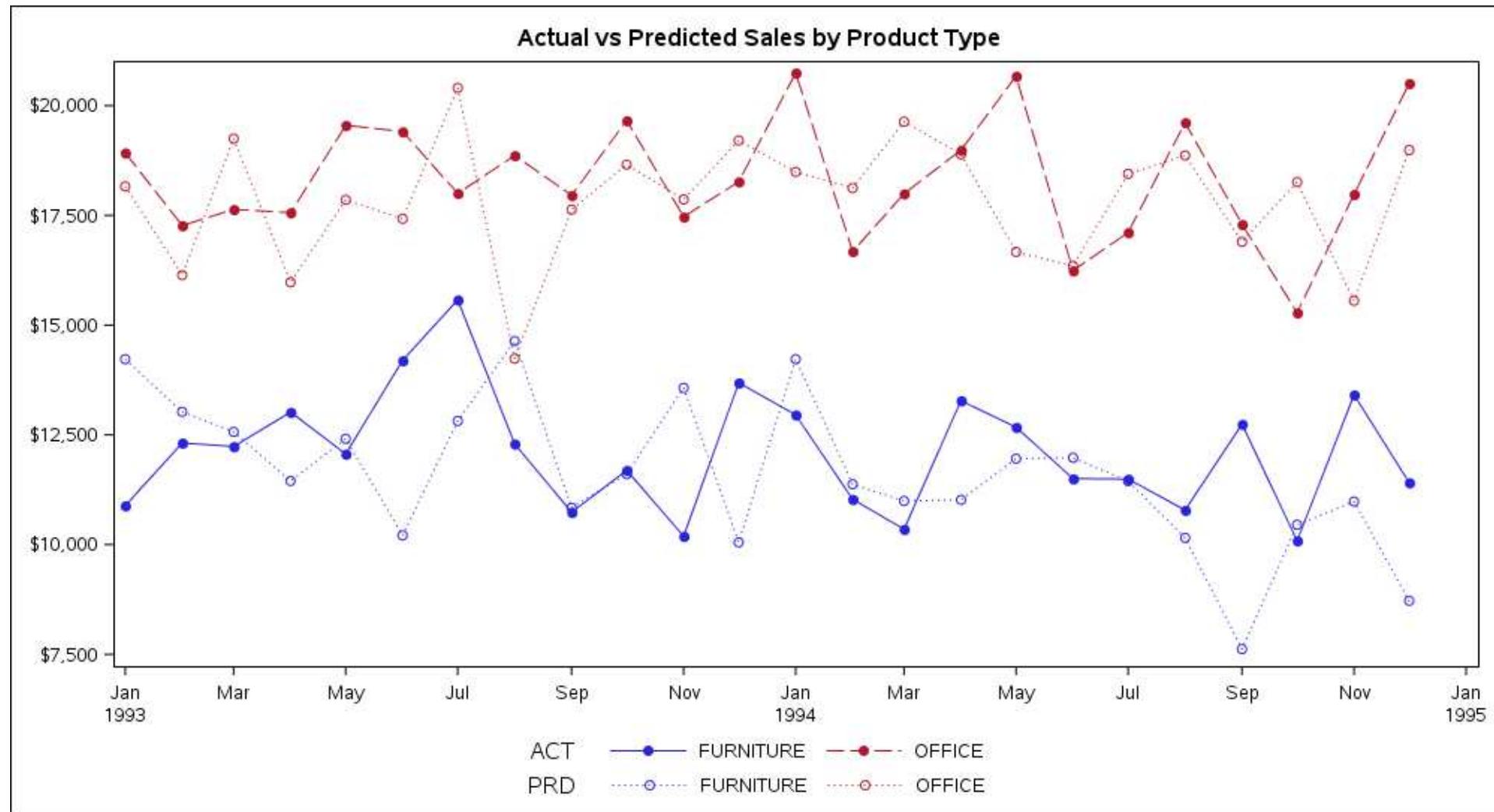
LINE CHARTS: EXERCISE 4

```
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.;
```



LINE CHARTS: EXERCISE 5

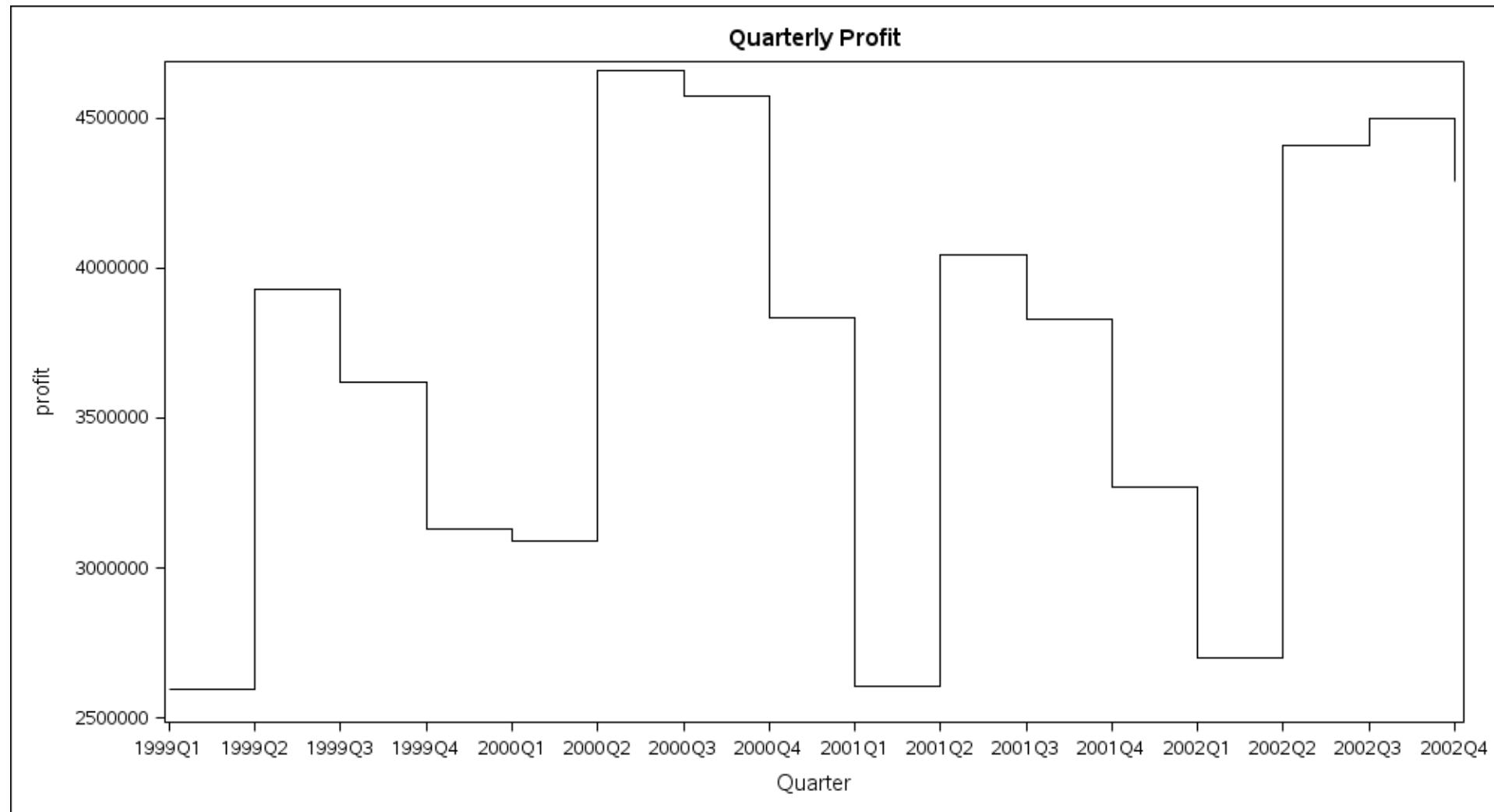
```
proc sgplot data=sashelp.prdsale;
title "Actual vs Predicted Sales by Product Type";
vline month / response=actual
    markers markerattrs=(symbol=circlefilled)
        group=prodtype name="actual";
vline month / response=predict
    markers markerattrs=(symbol=circle)
        group=prodtype lineattrs=(pattern=dot)
        name="predict";
xaxis display=(nolabel) type=time;
yaxis display=(nolabel);
format month yymmmdd10.;
keylegend "actual" / title="ACT" position=bottom noborder;
keylegend "predict" / title="PRD" position=bottom noborder;
```



STEP CHARTS

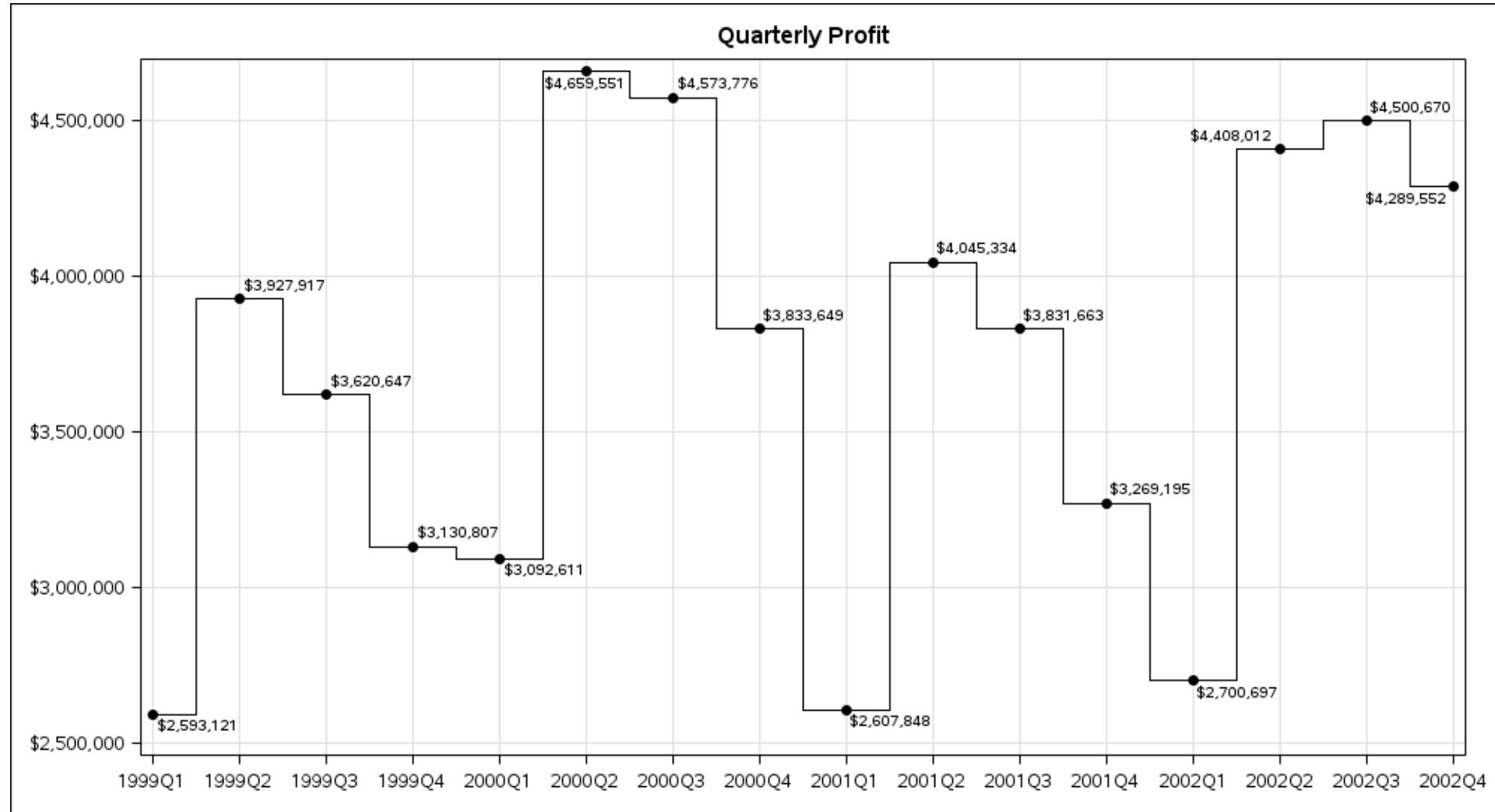
STEP CHARTS: EXERCISE 1

```
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;
```



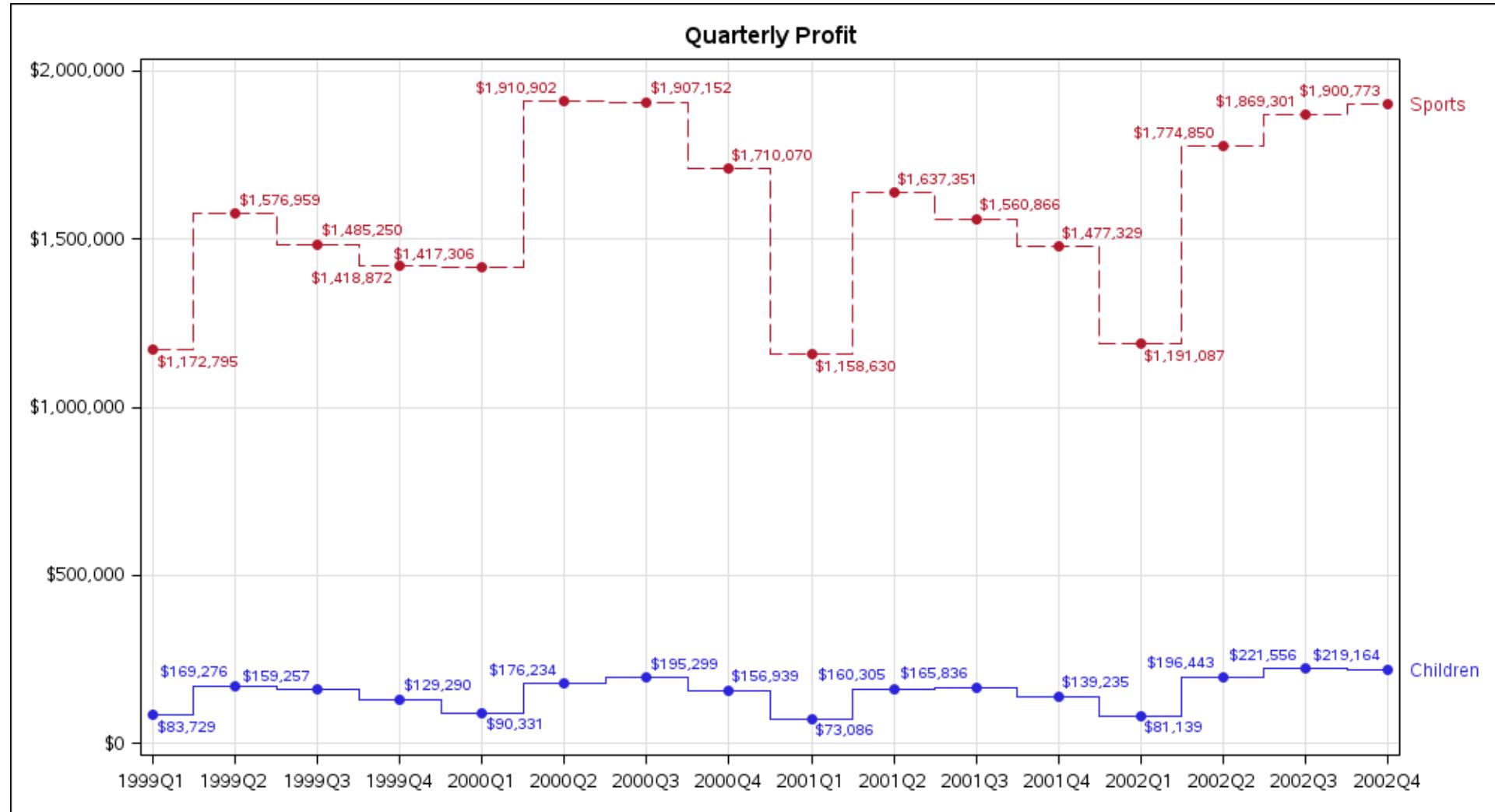
STEP CHARTS: EXERCISE 2

```
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;
```



STEP CHARTS: EXERCISE 3

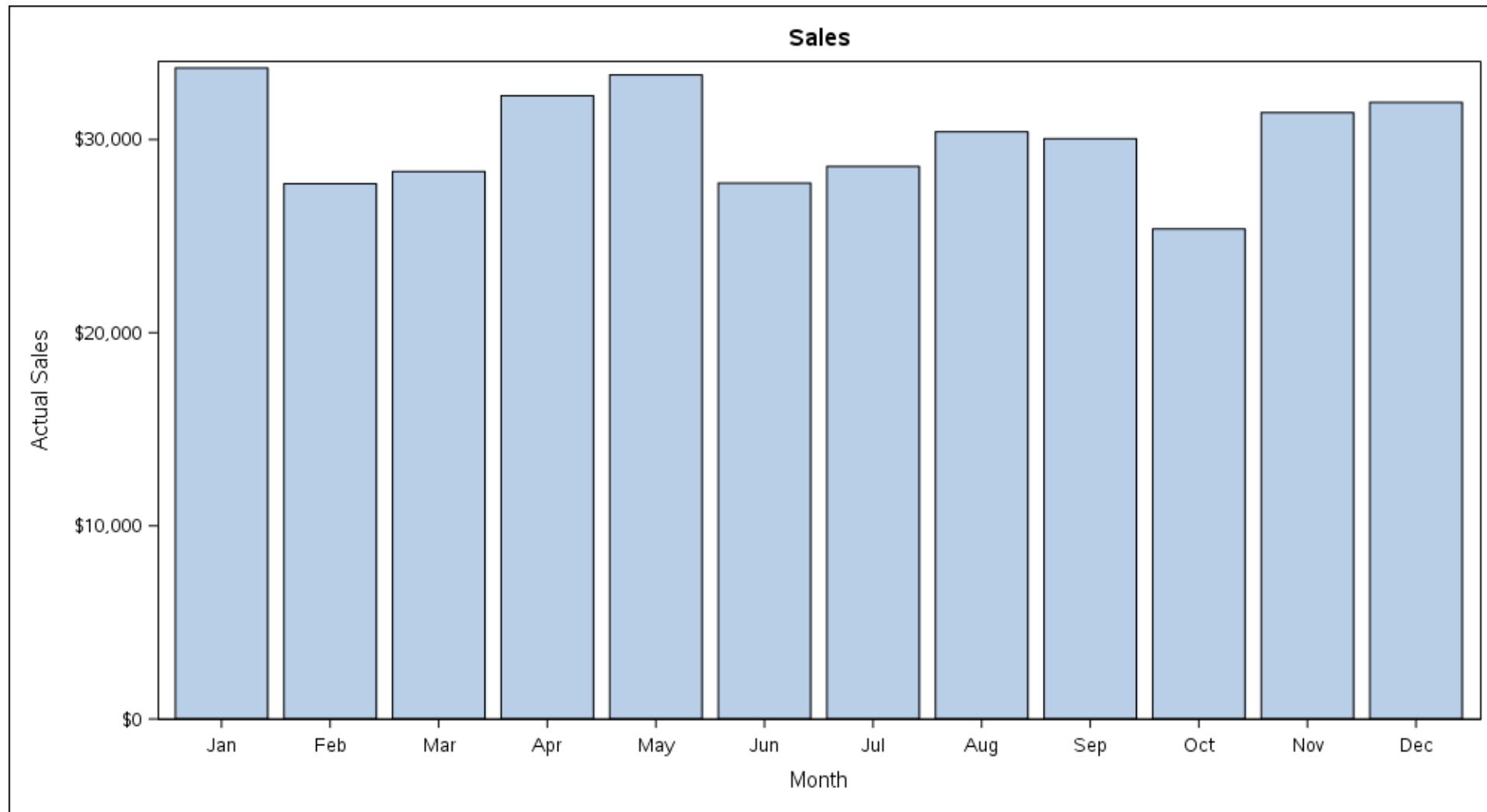
```
proc sql noprint;
create table orsalesum2 as
select quarter, product_line, sum(profit) as profit
from sashelp.orsales
where product_line in ('Children', 'Sports')
group by 1, 2 order by 1, 2;
proc sgplot data=orsalesum2;
title "Quarterly Profit";
step x=quarter y=profit /
  markers markerattrs=(symbol=circlefilled)
  justify=center
  datalabel
  group=product_line
  curvelabel curvelabelloc=outside;
format profit dollar10.;
xaxis display=(nolabel) grid;
yaxis display=(nolabel) grid;
```



BAR CHARTS

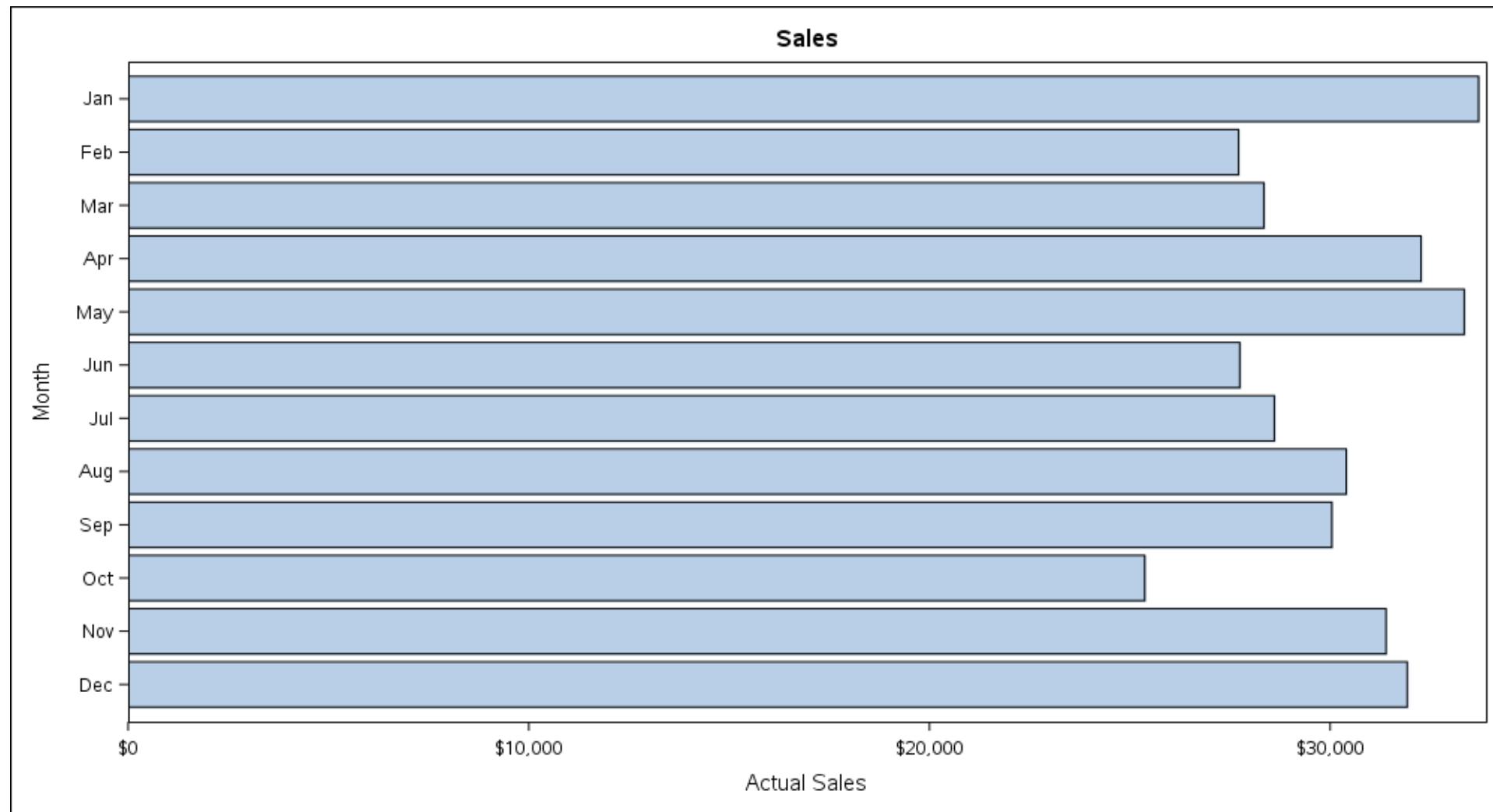
BAR CHARTS: EXERCISE 1

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



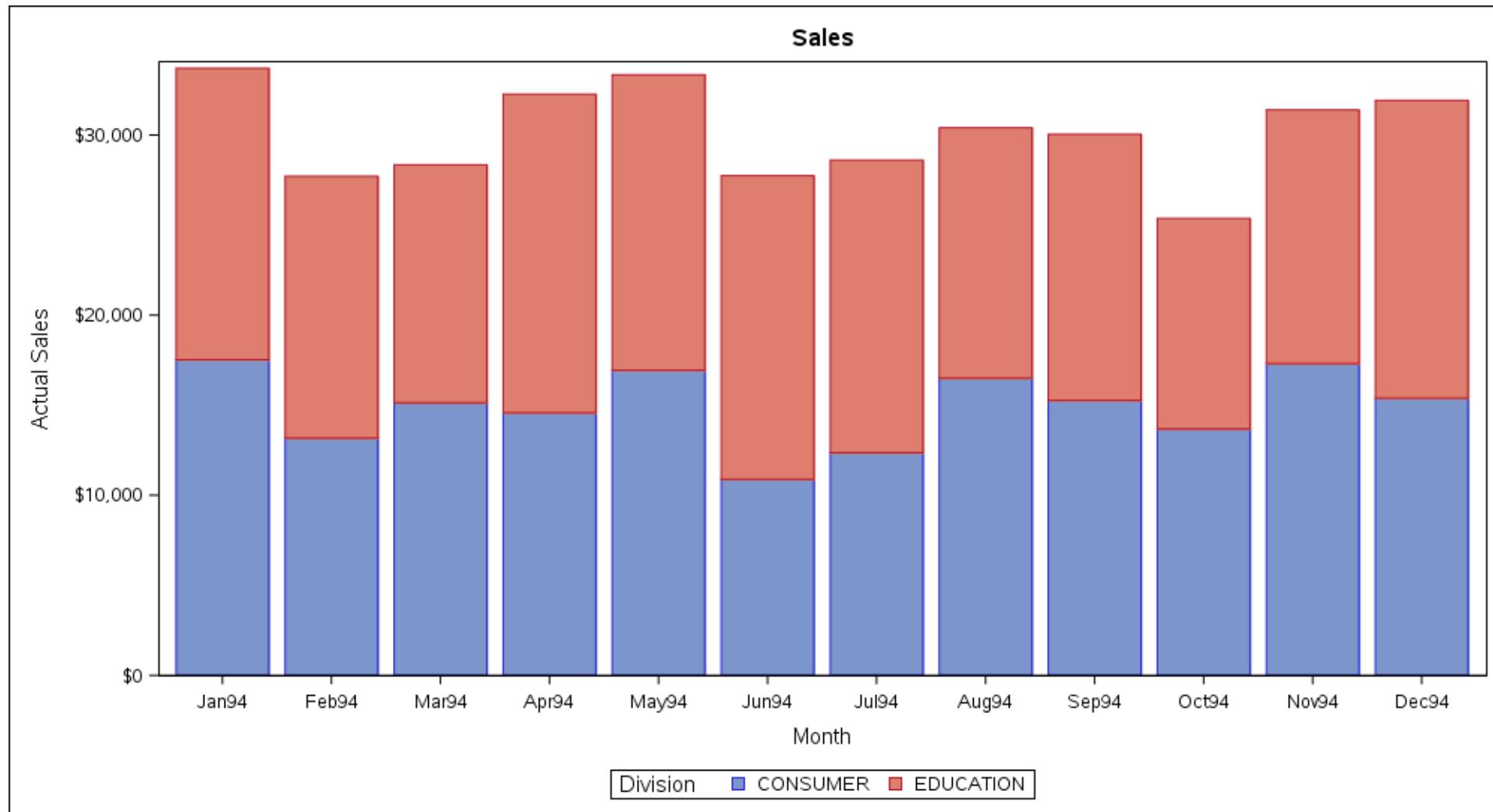
BAR CHARTS: EXERCISE 2

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



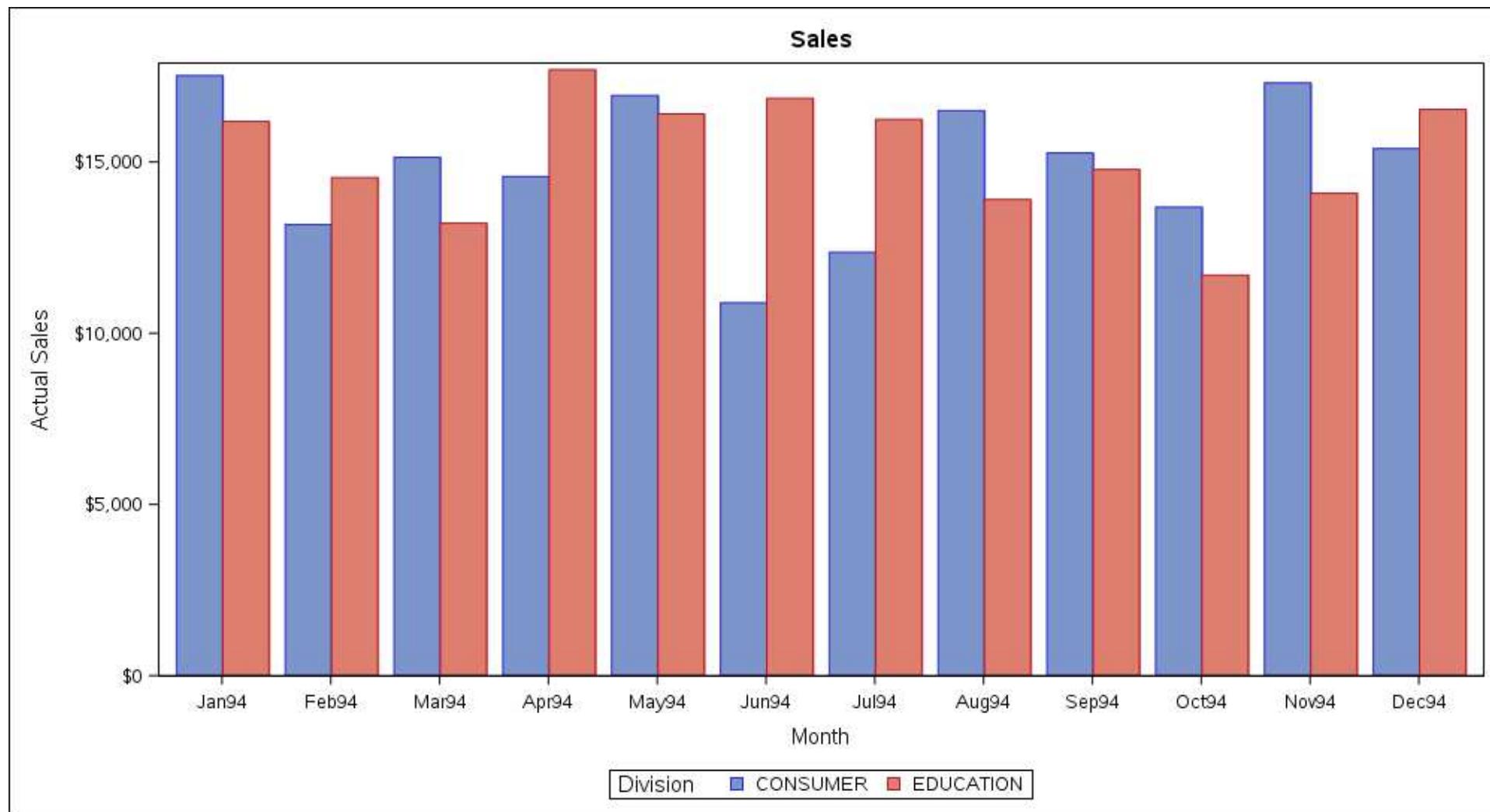
BAR CHARTS: EXERCISE 3

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



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.;
```



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 seglabeformat=dollar9. seglabelattrs=(size=8.5pt);
xaxis display=(nolabel);
yaxis display=(nolabel) grid;
keylegend / title="" noborder;
format actual dollar9. month monname3.;
```

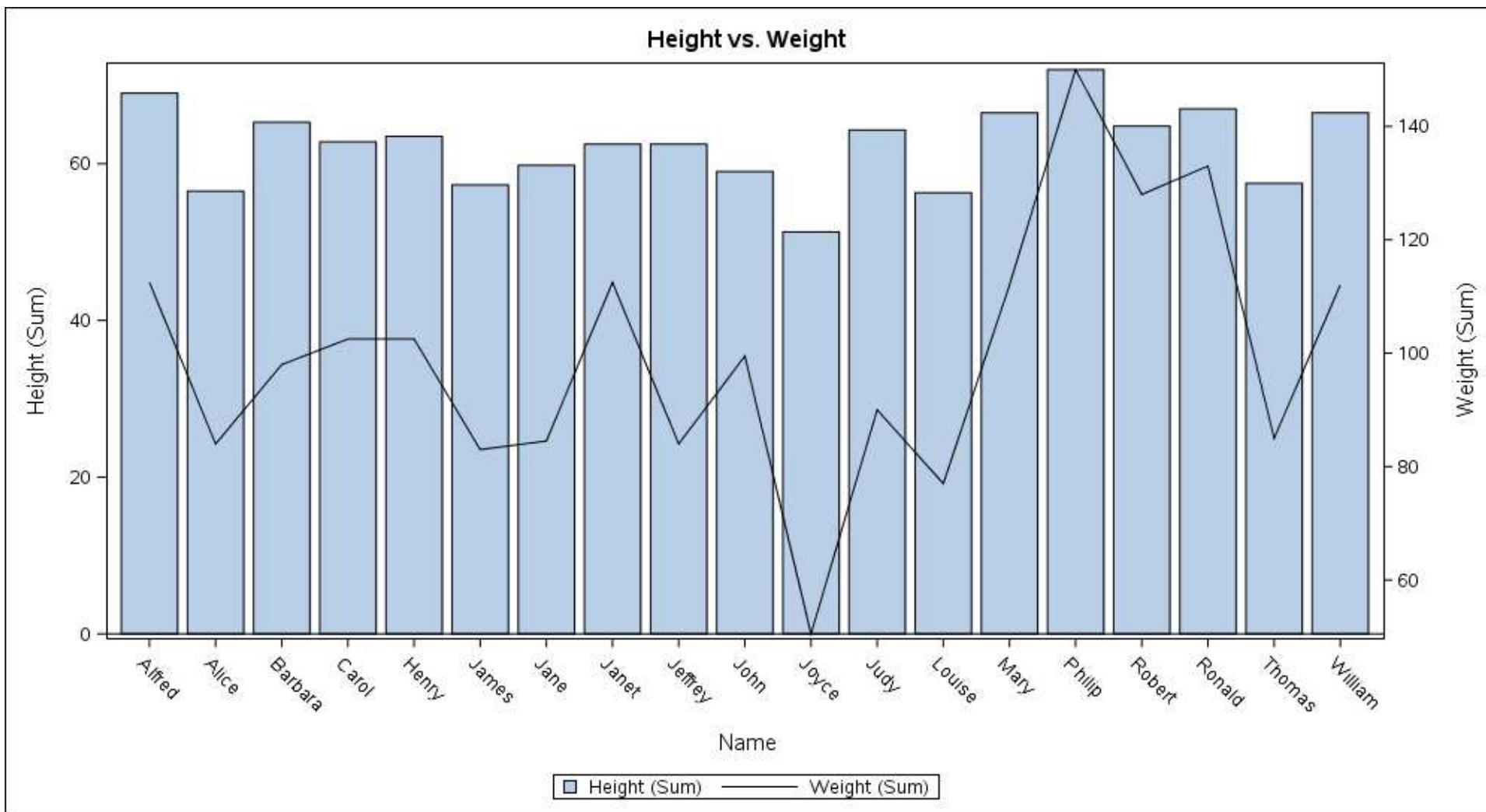
1994 MONTHLY SALES



COMBO CHARTS

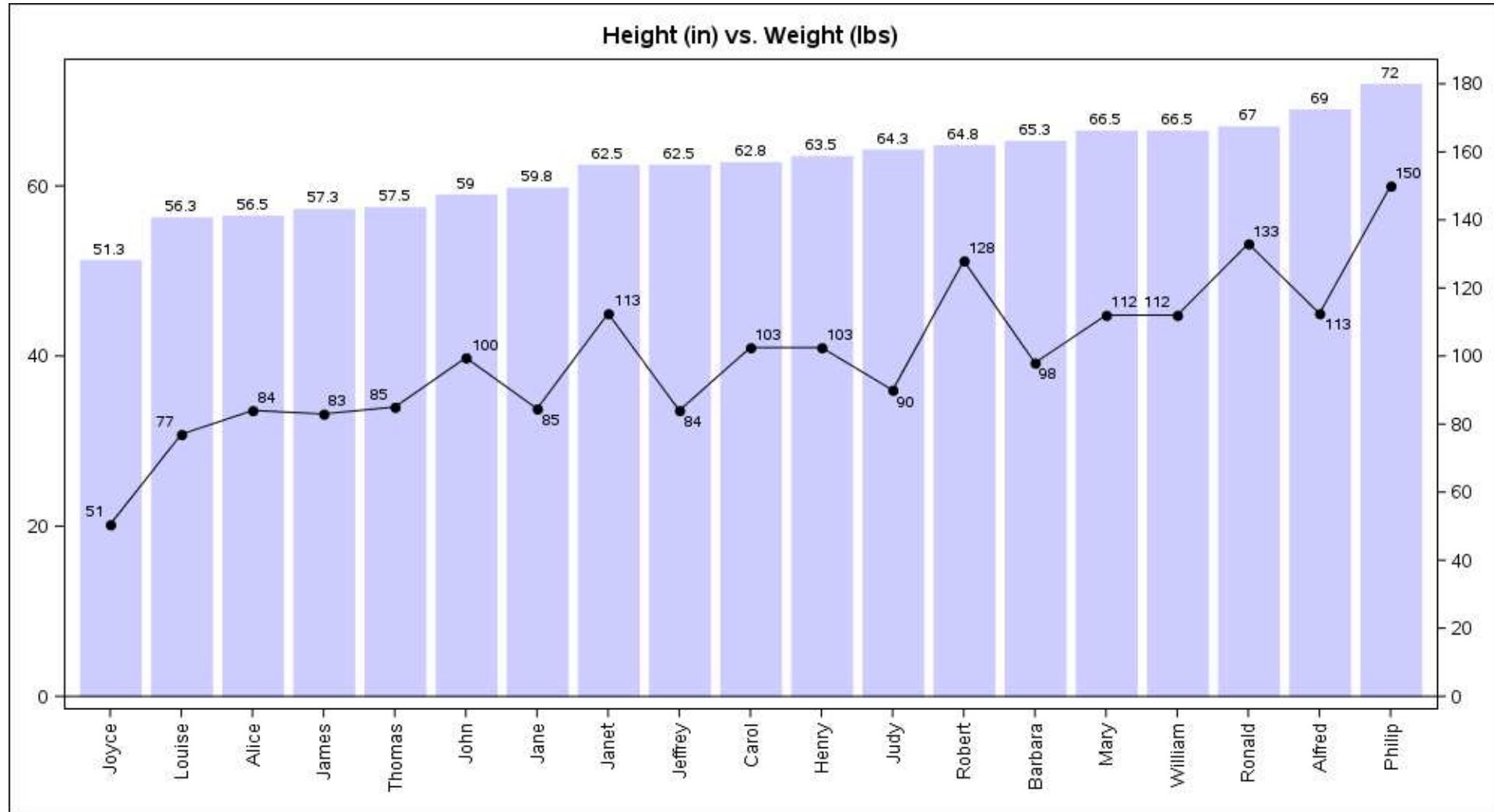
COMBO CHARTS: EXERCISE 1

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



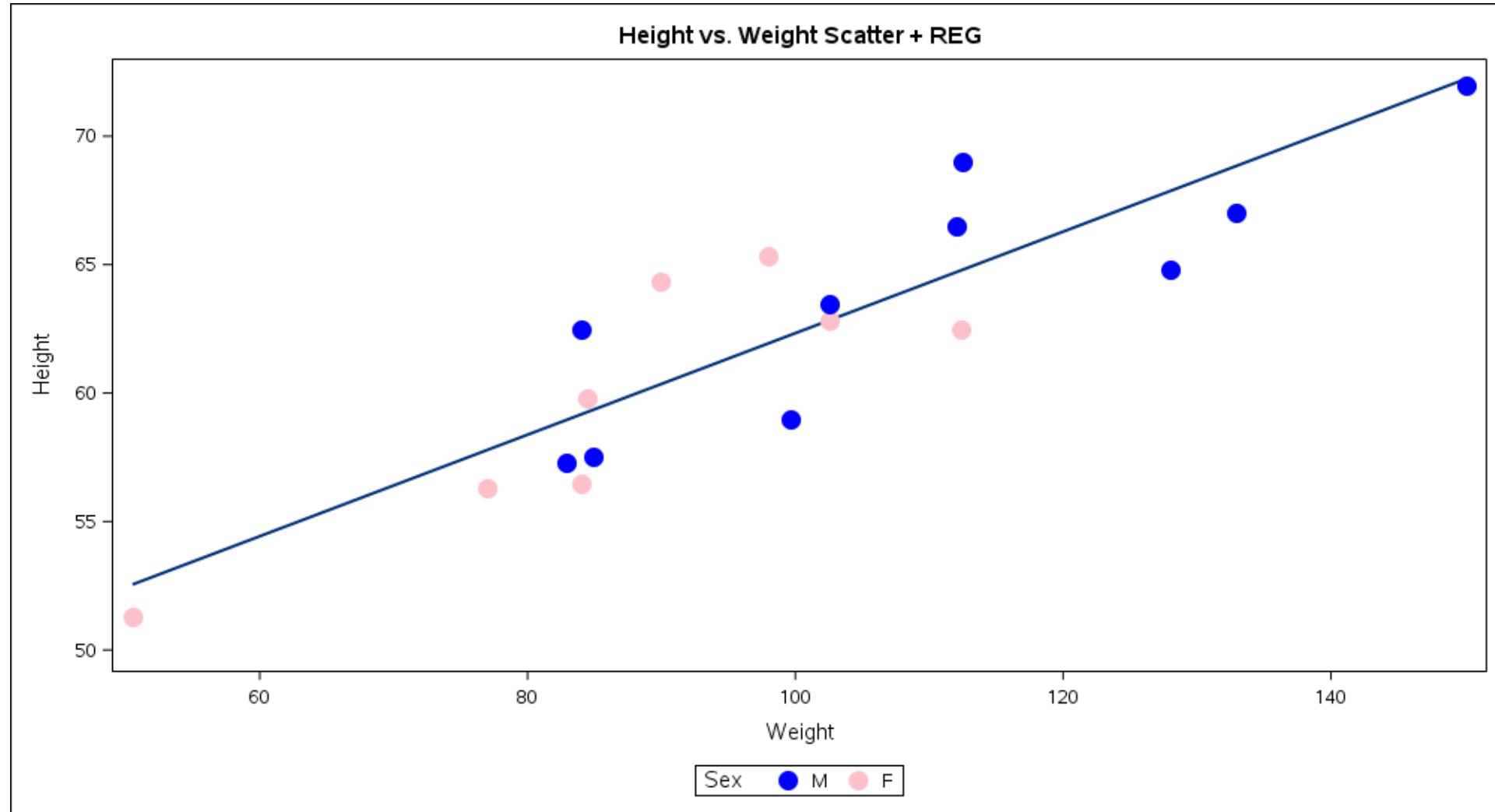
COMBO CHARTS: EXERCISE 2

```
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.;
```



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;
```



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;
```

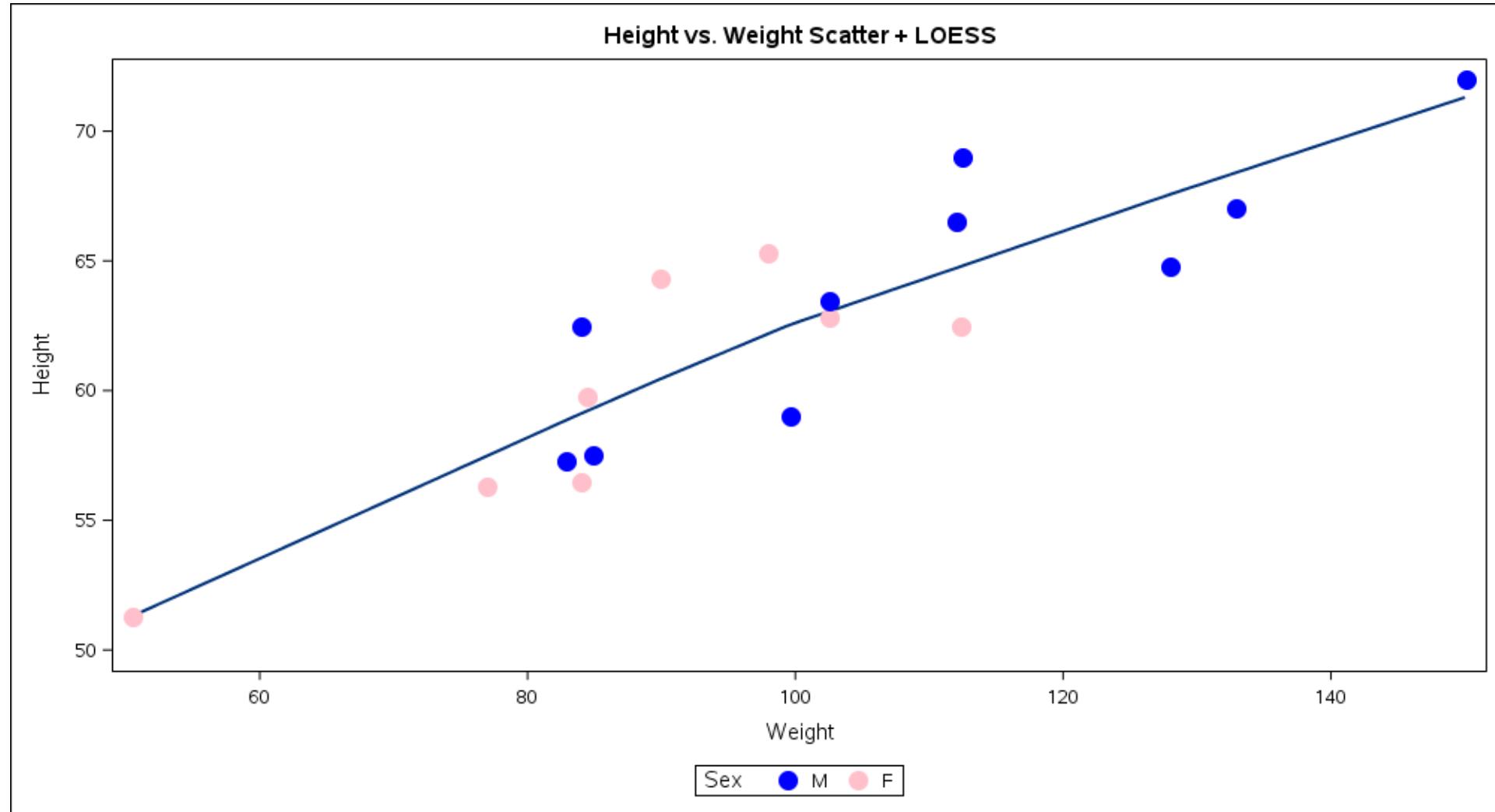
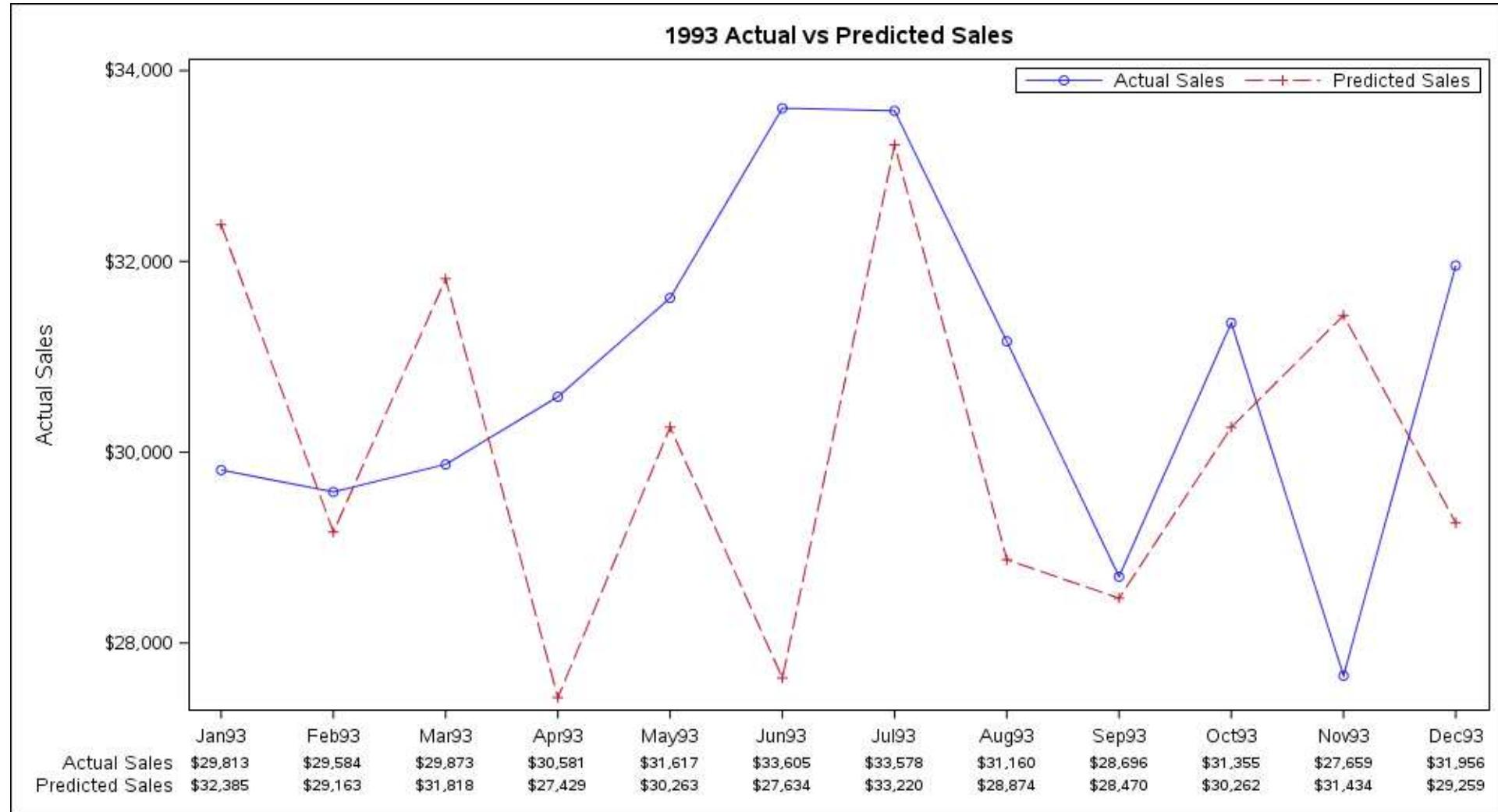


TABLE CHARTS

TABLE CHARTS: EXERCISE 1

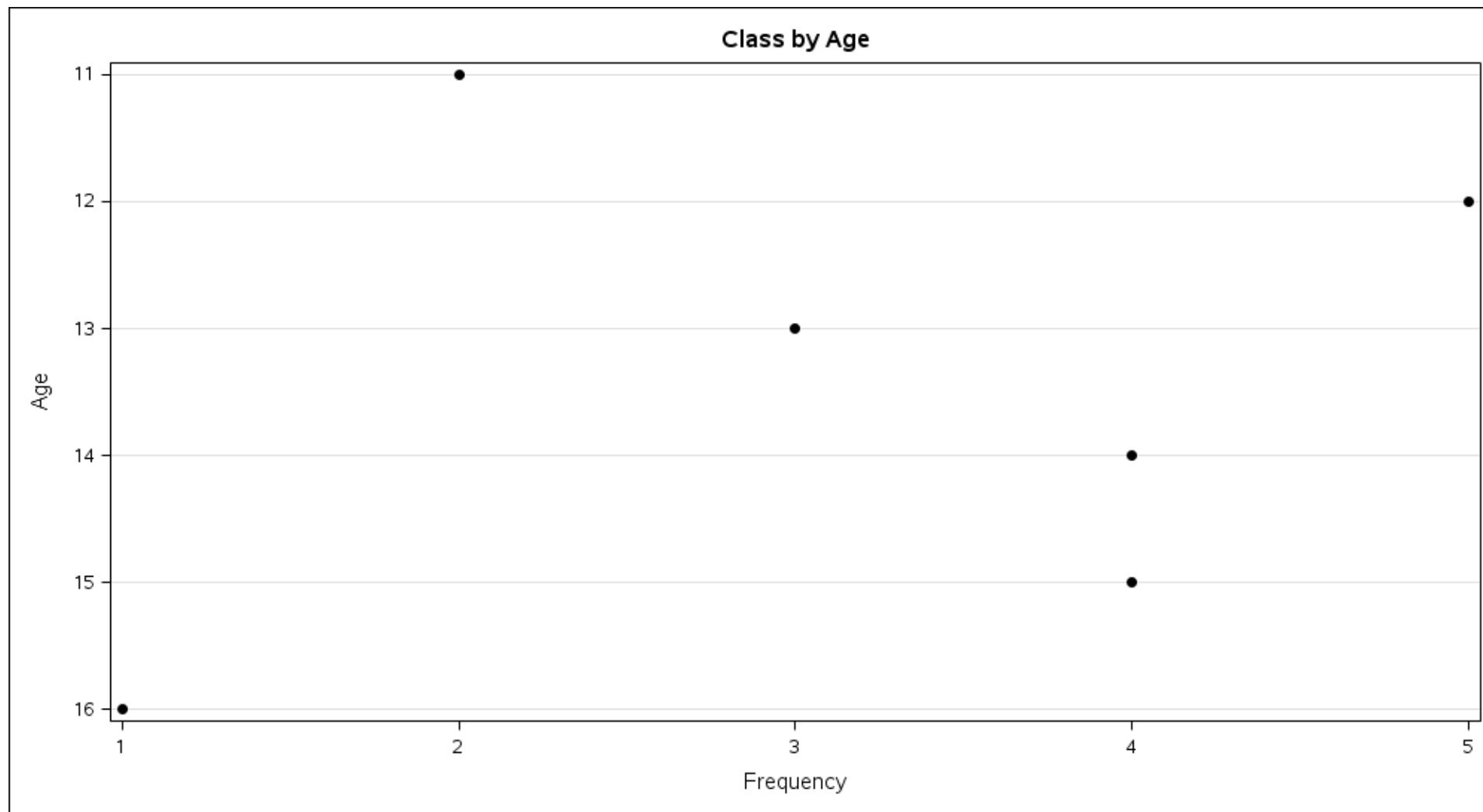
```
proc sgplot data=sashelp.prdsale(where=(year=1993));
title "1993 Actual vs Predicted Sales";
vline month / markers response=actual;
vline month / markers response=predict;
format month monyy5. actual predict dollar7.0;
xaxistable actual predict / location=outside;
keylegend / location=inside position=topright;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



DOT CHARTS

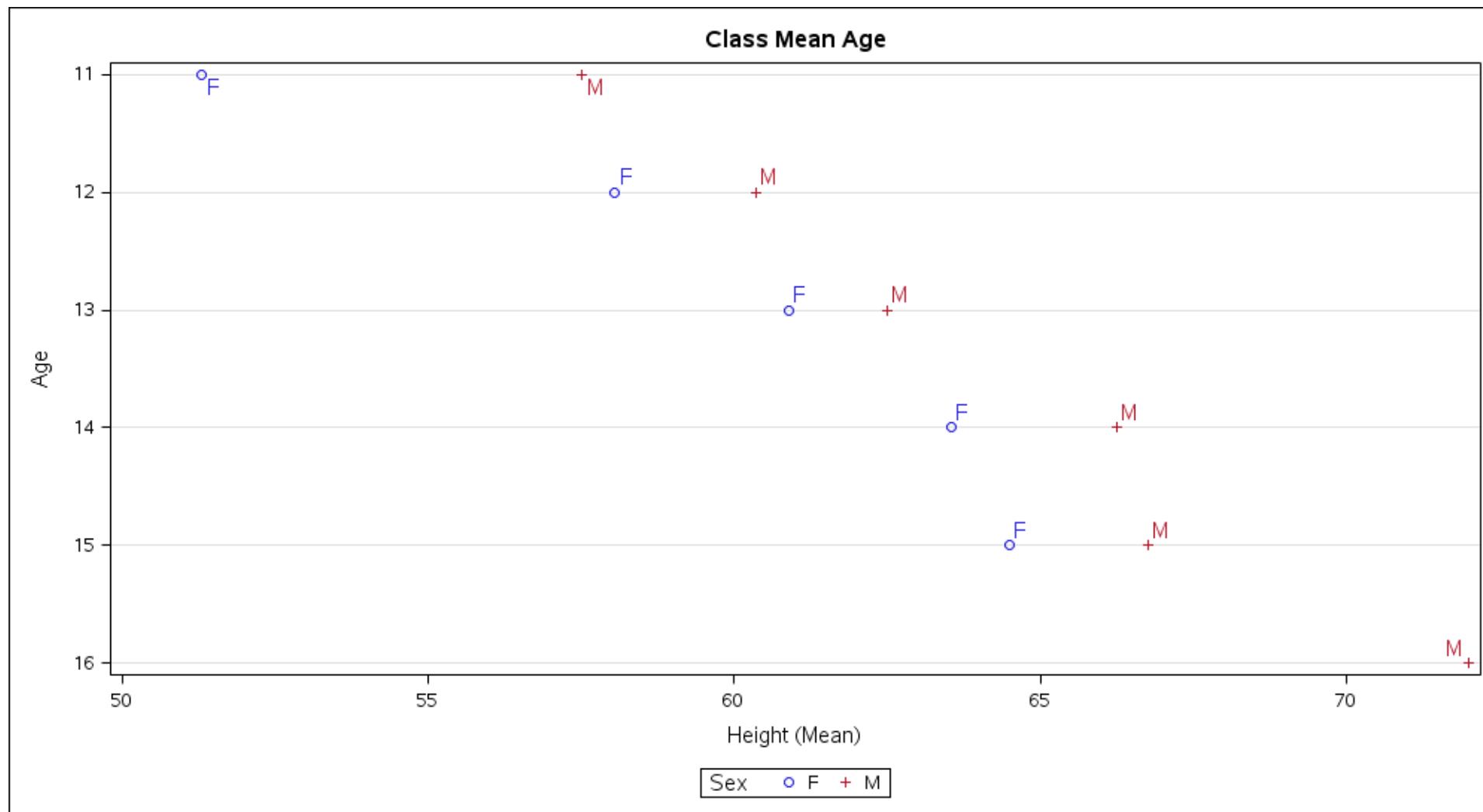
DOT CHARTS: EXERCISE 1

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



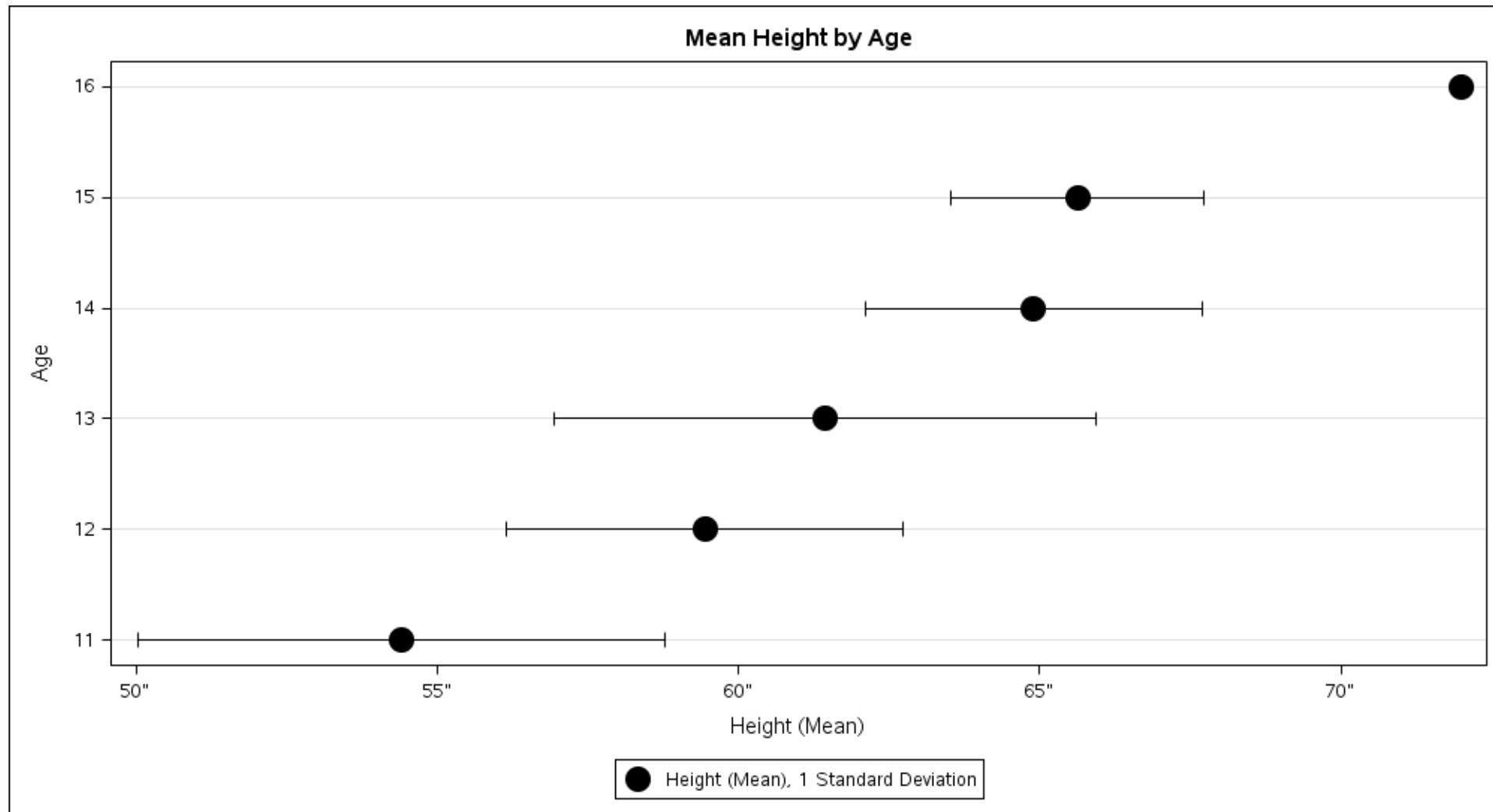
DOT CHARTS: EXERCISE 2

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



DOT CHARTS: EXERCISE 3

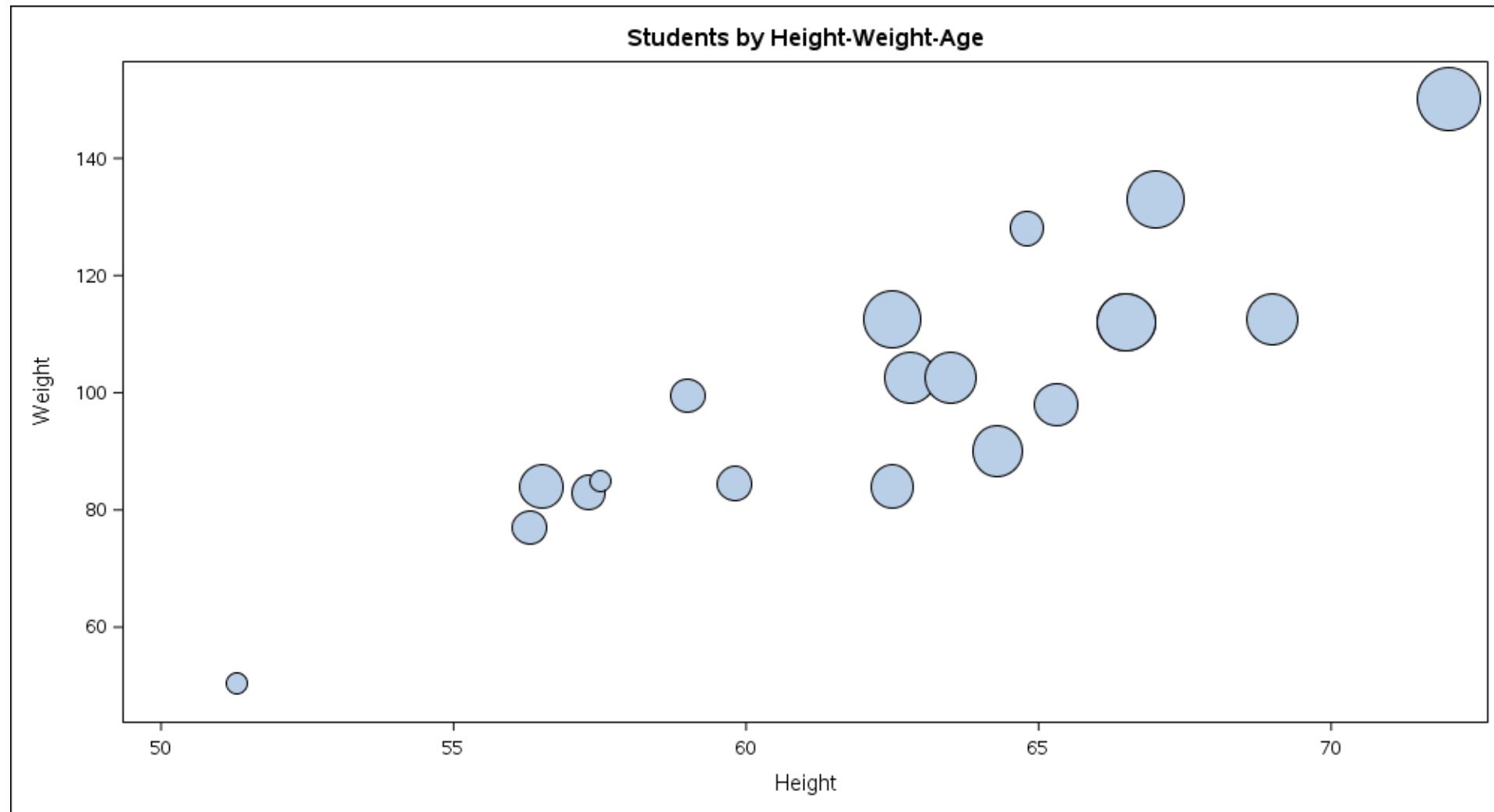
```
proc format;  
picture inchF low-high ='99"';  
  
proc sgplot data=sashelp.class;  
title "Mean Height by Age";  
dot age / response=height stat=mean  
    limitstat=stddev numstd=1  
    markerattrs=(size=12pt symbol=circlefilled);  
xaxis valuesformat=inchF.;  
yaxis reverse;
```



BUBBLE CHARTS

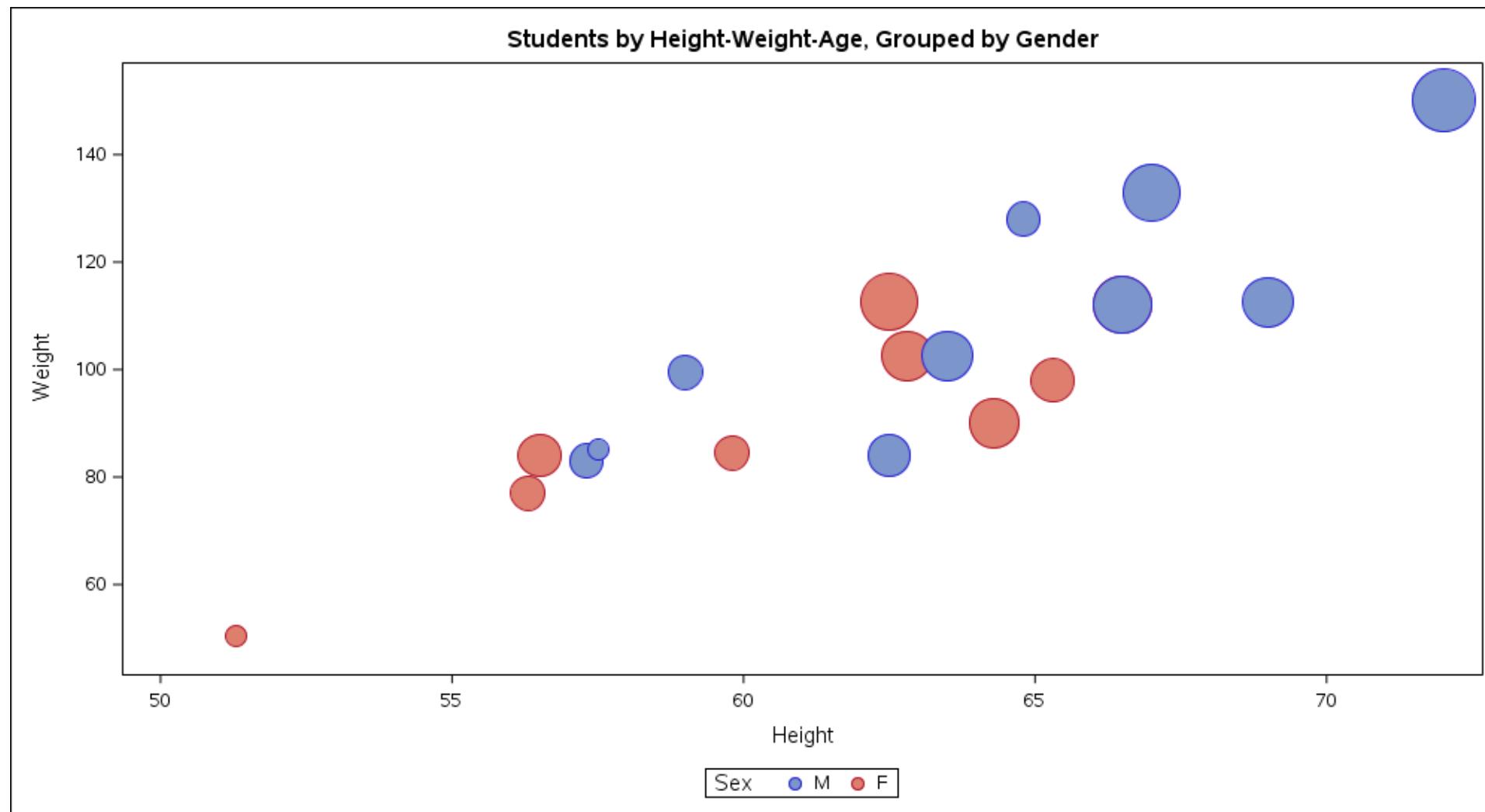
BUBBLE CHARTS: EXERCISE 1

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



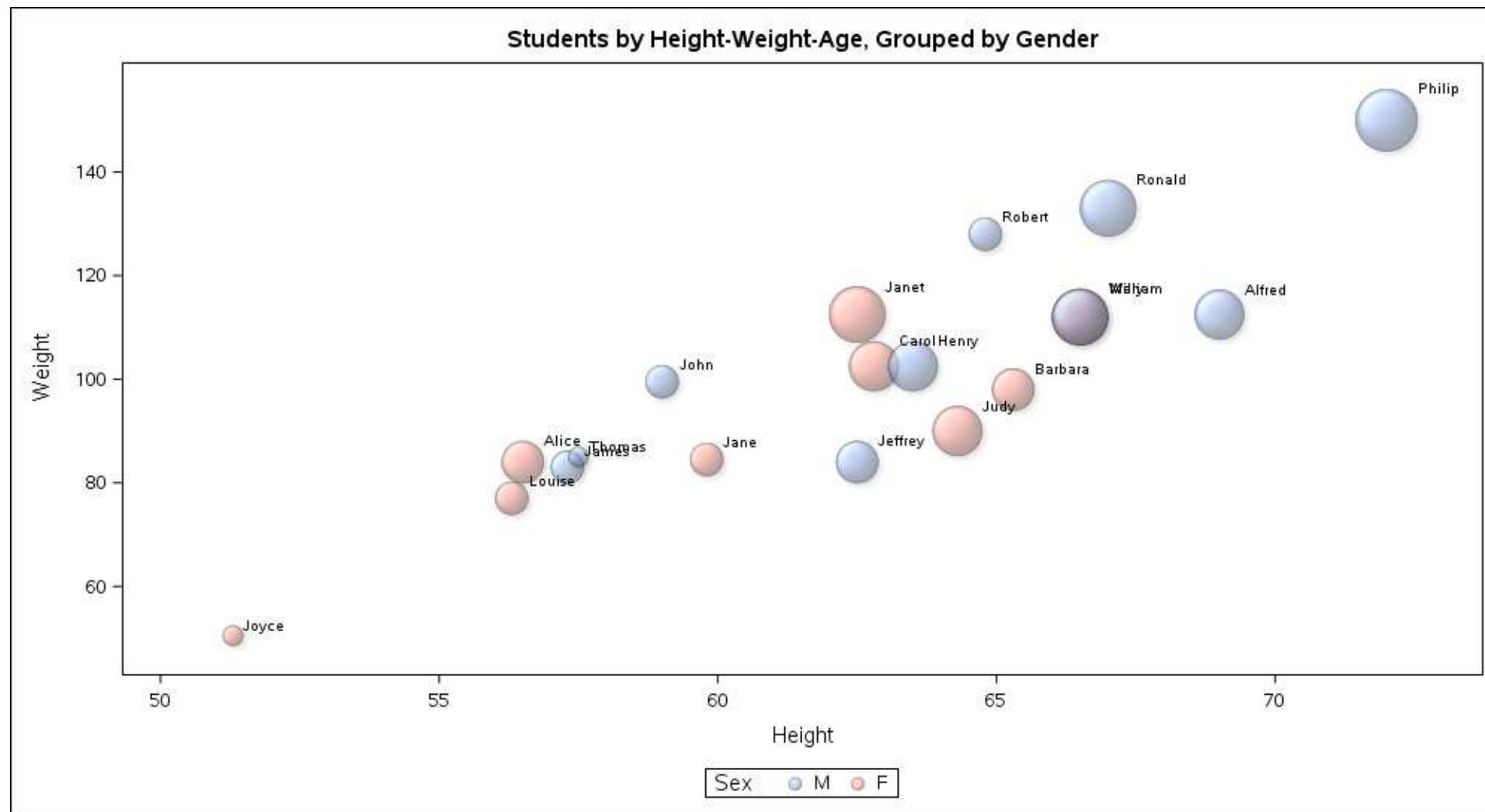
BUBBLE CHARTS: EXERCISE 2

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



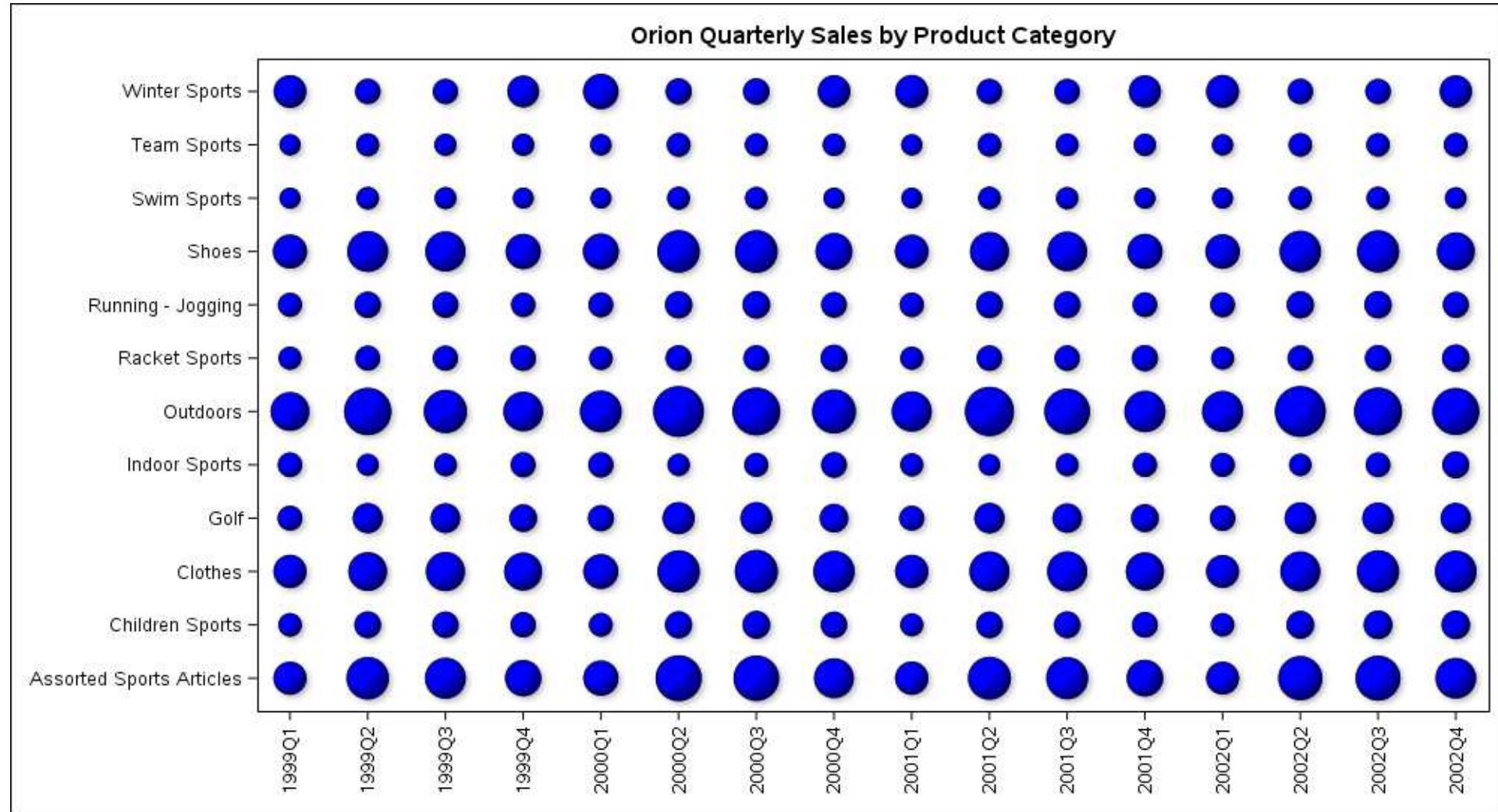
BUBBLE CHARTS: EXERCISE 3

```
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);
```



BUBBLE CHARTS: EXERCISE 4

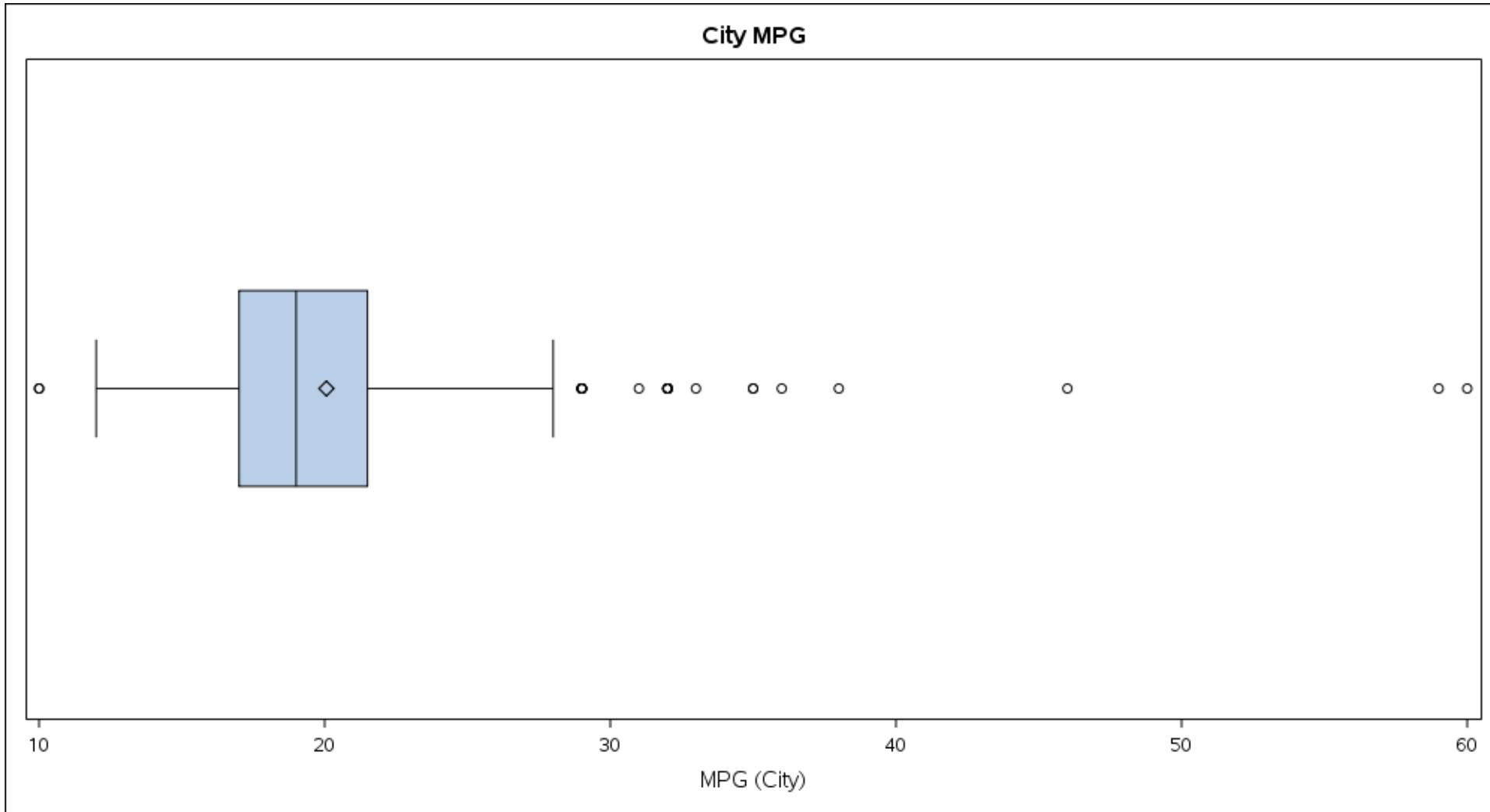
```
proc sql noprint;
create table orsalesum as
select quarter, product_category, sum(profit) as profit format=dollar10.
from sashelp.orsales group by 1, 2 order by 1, 2;
proc sgplot data=orsalesum;
title "Orion Quarterly Sales by Product Category";
bubble y=product_category x=quarter size=profit /
    bradiusmax=12pt
    dataskin=sheen fillattrs=(color=blue);
xaxis display=(nolabel) valuesrotate=vertical;
yaxis display=(nolabel);
```



BOX CHARTS

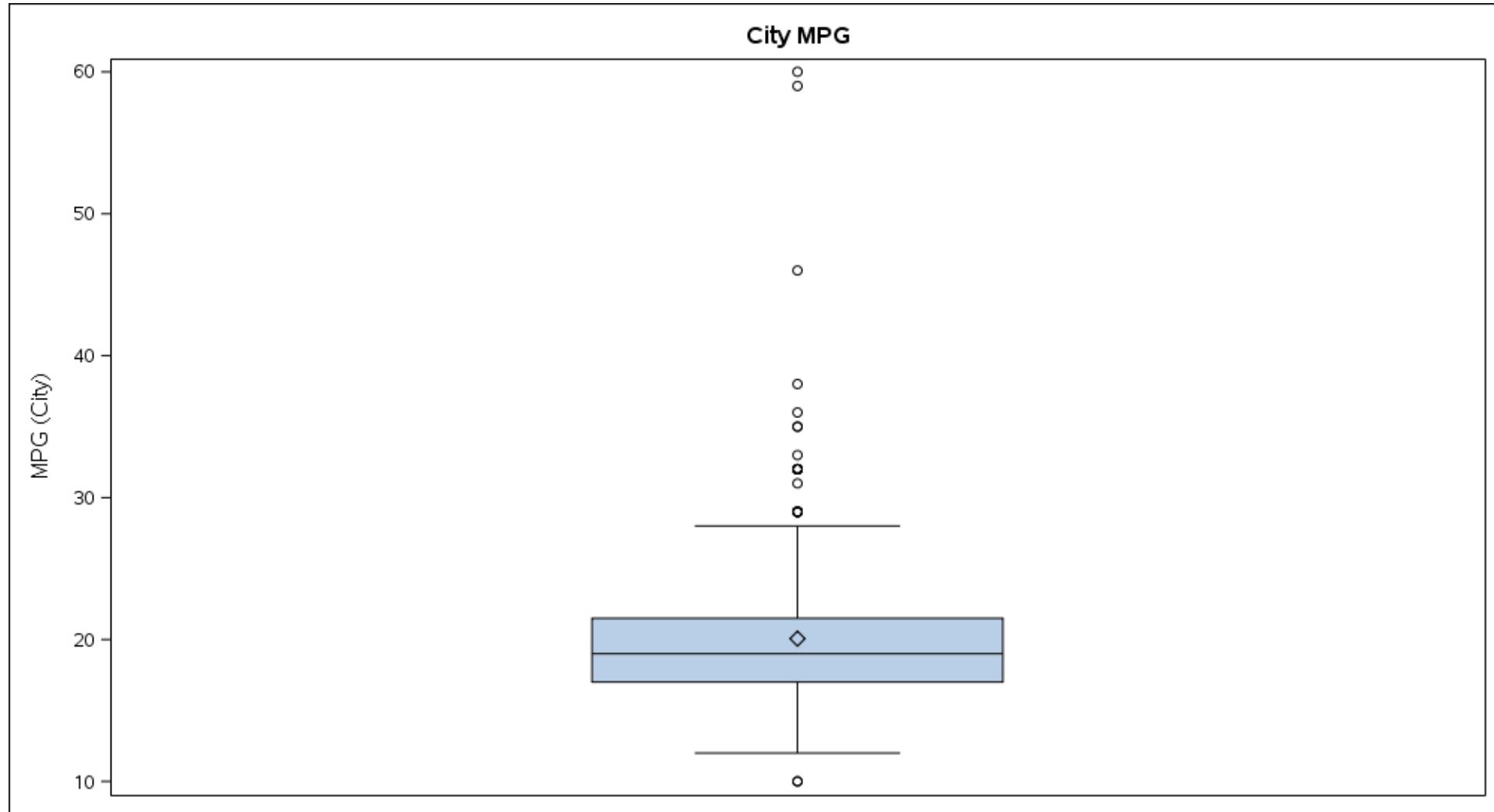
BOX CHARTS: EXERCISE 1

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



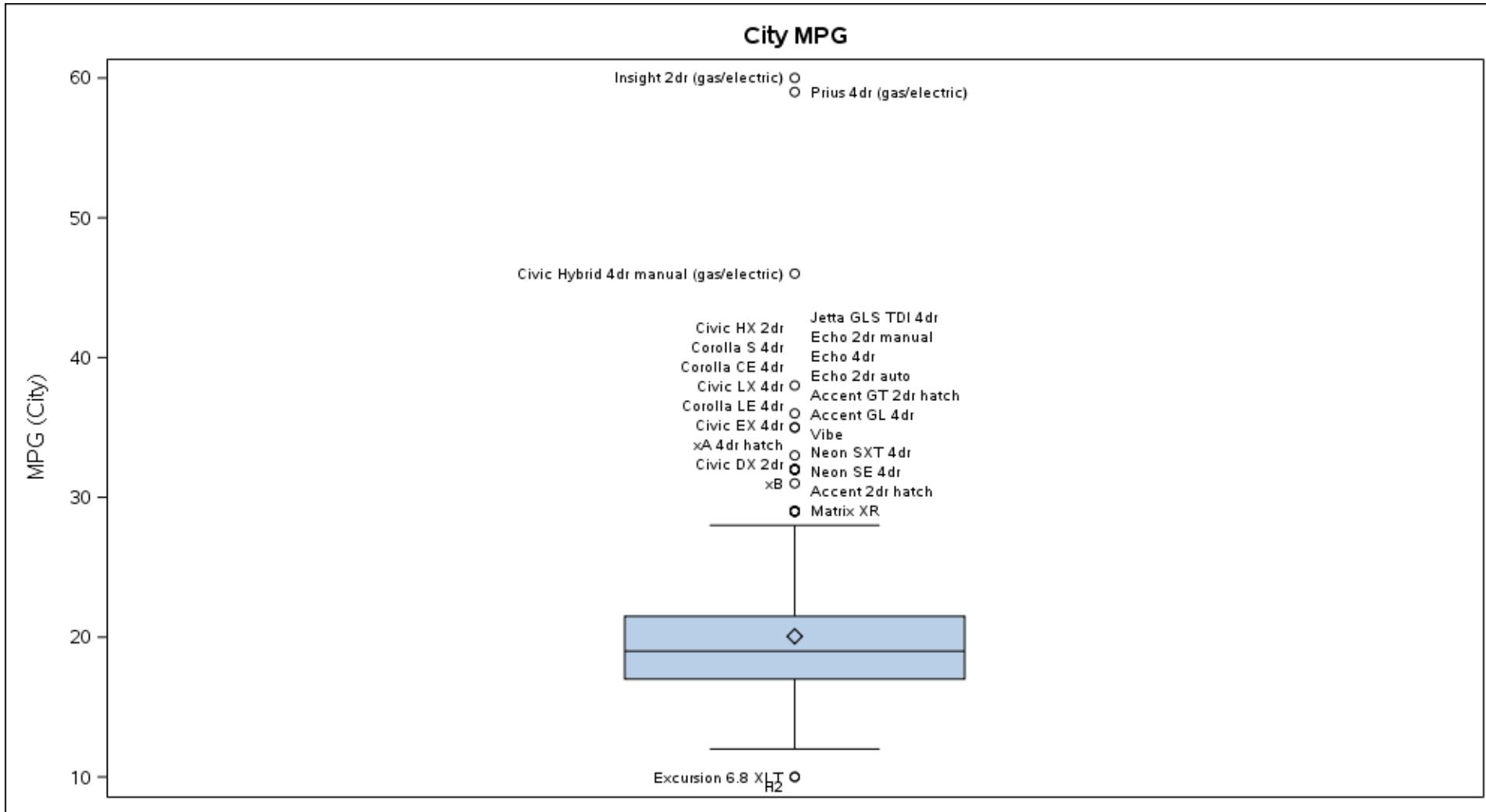
BOX CHARTS: EXERCISE 2

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



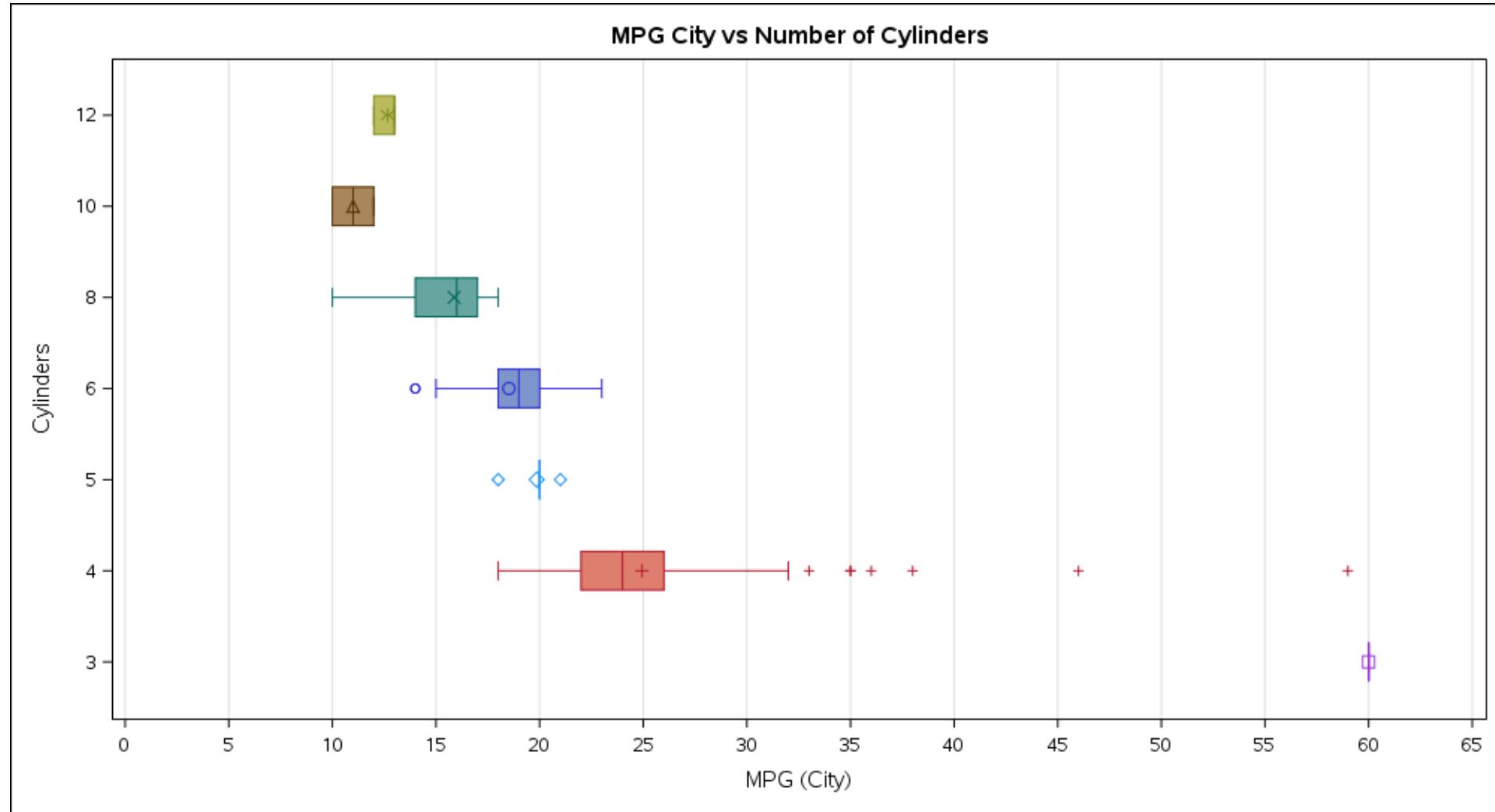
BOX CHARTS: EXERCISE 3

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



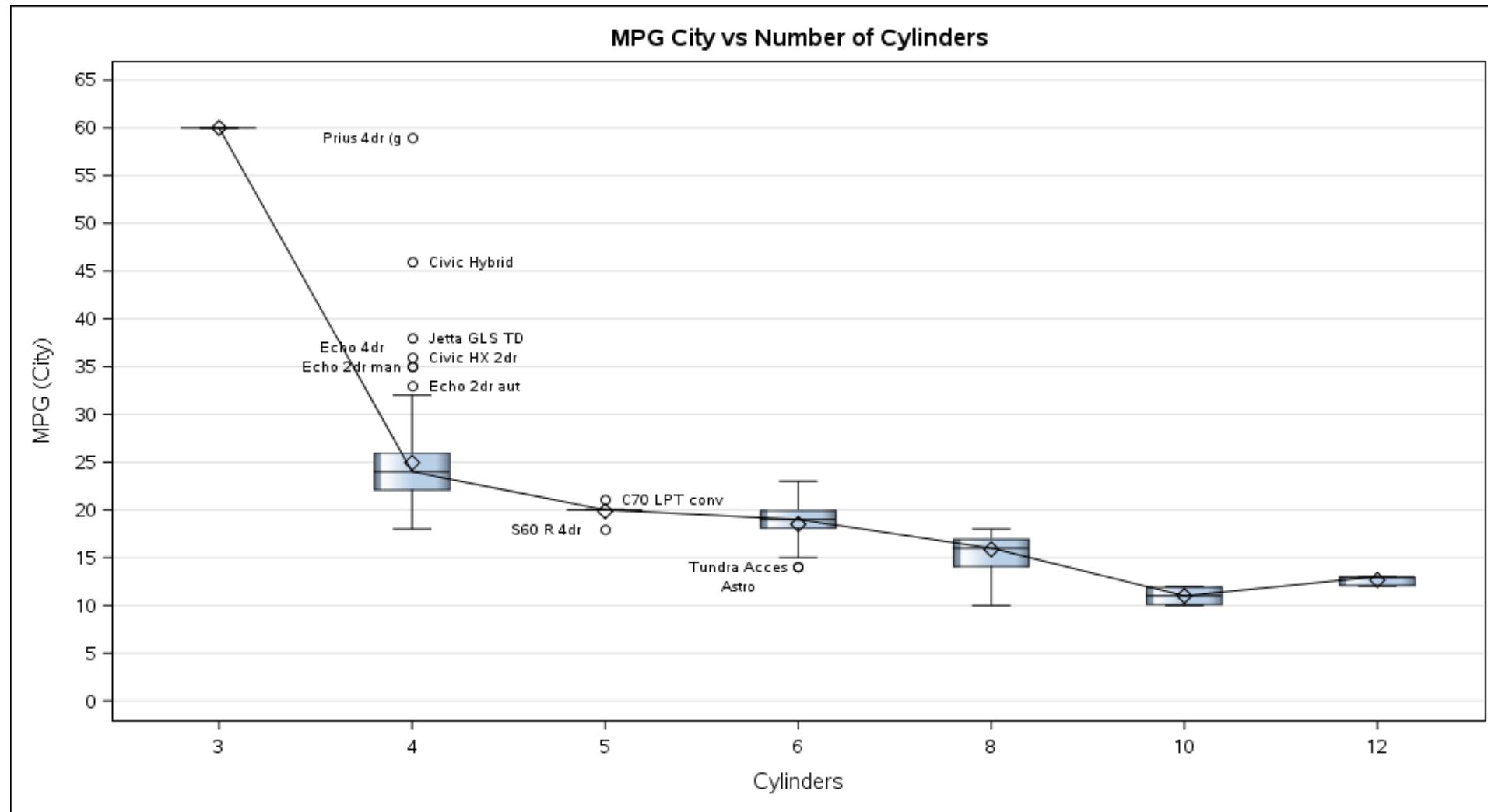
BOX CHARTS: EXERCISE 4

```
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);
```



BOX CHARTS: EXERCISE 5

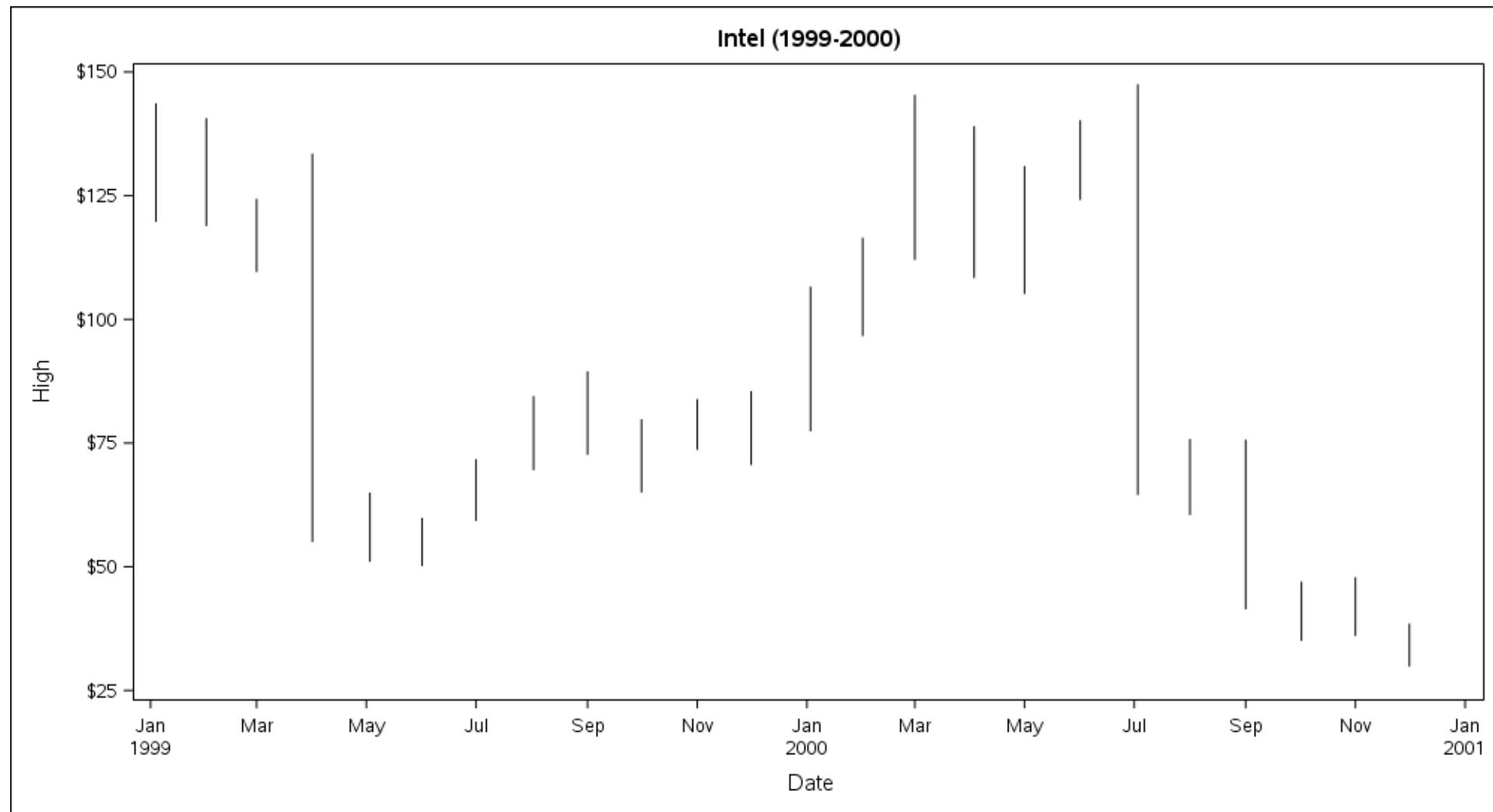
```
proc sgplot data=sashelp.cars;
title "MPG City vs Number of Cylinders";
vbox mpg_city /
    category=cylinders connect=median
    datalabel=model dataskin=gloss;
yaxis grid values=(0 to 65 by 5);
format model $13.;
```



HIGHLOW CHARTS

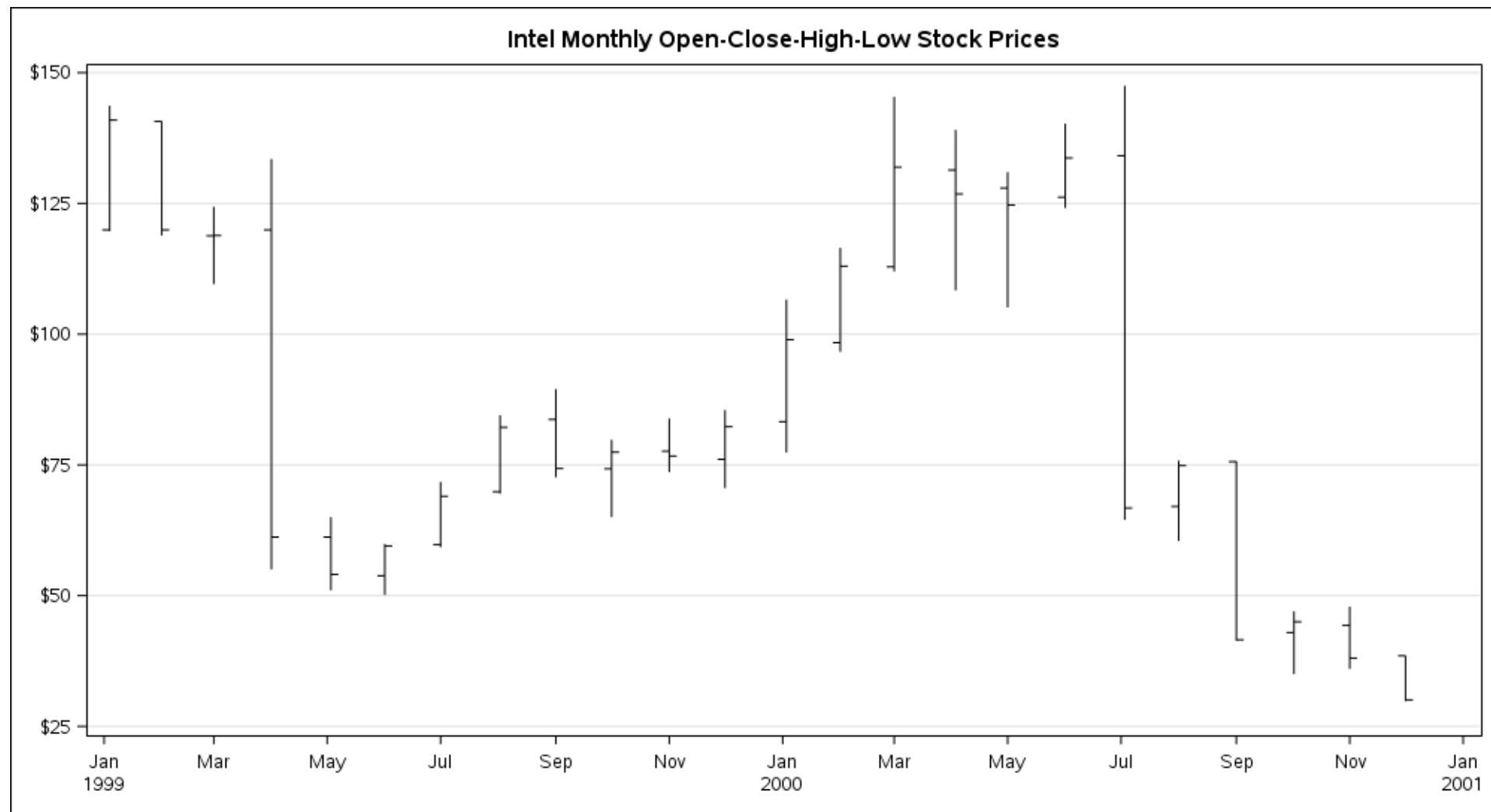
HIGHLOW CHARTS: EXERCISE 1

```
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;
```



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;
```



HIGHLOW CHARTS: EXERCISE 3

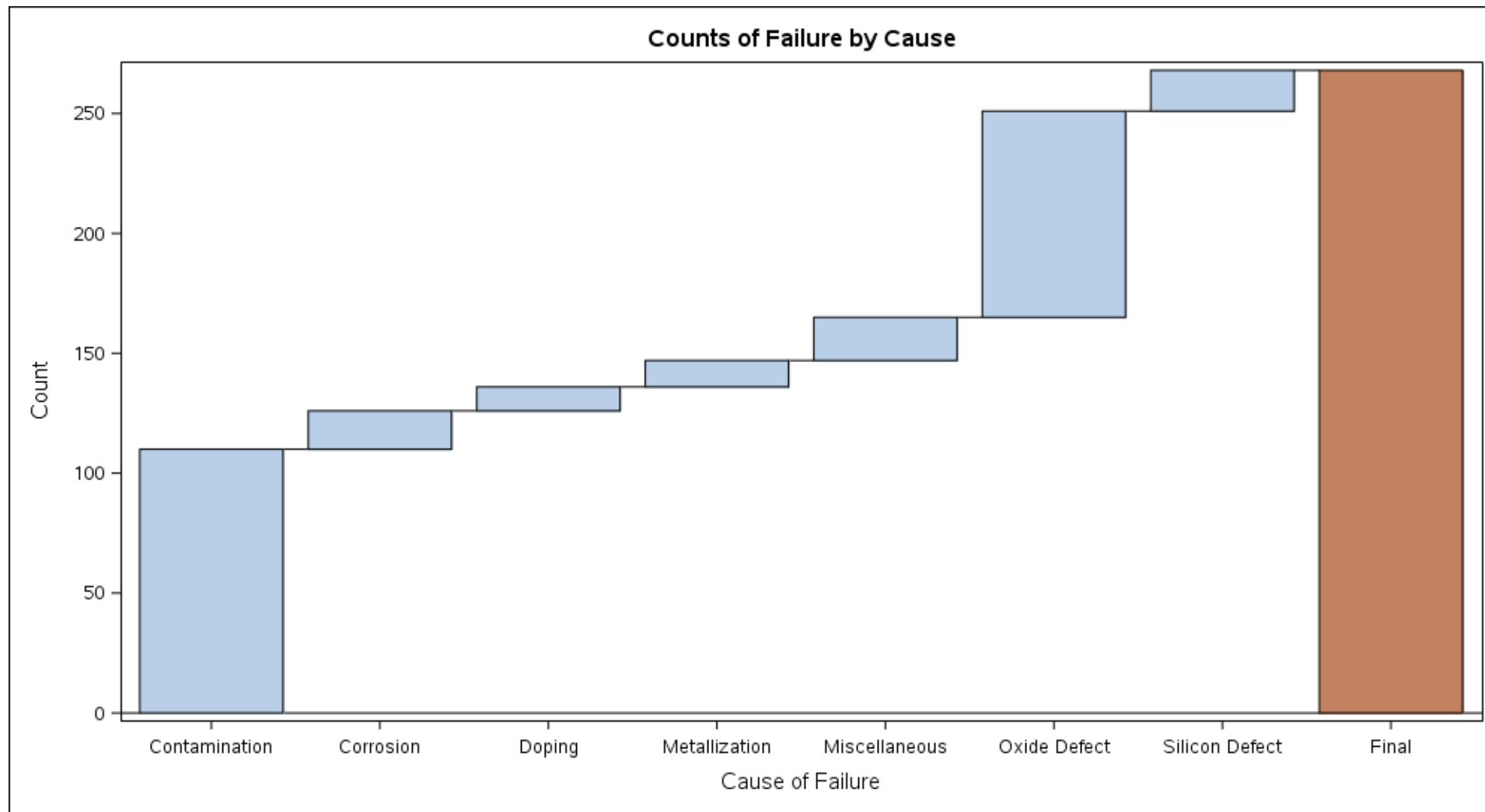
```
proc sgplot data=sashelp.stocks;
title "Intel Monthly High-Low Stock Prices";
where stock='Intel' and '01jan1999'd<=date<'01jan2001'd;
highlow y=date high=high low=low /
  type=bar nooutline barwidth=.75
  fill fillattrs=(color="verylightblue")
  lowlabel=low highlabel=high
  open=open close=close;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



WATERFALL CHARTS

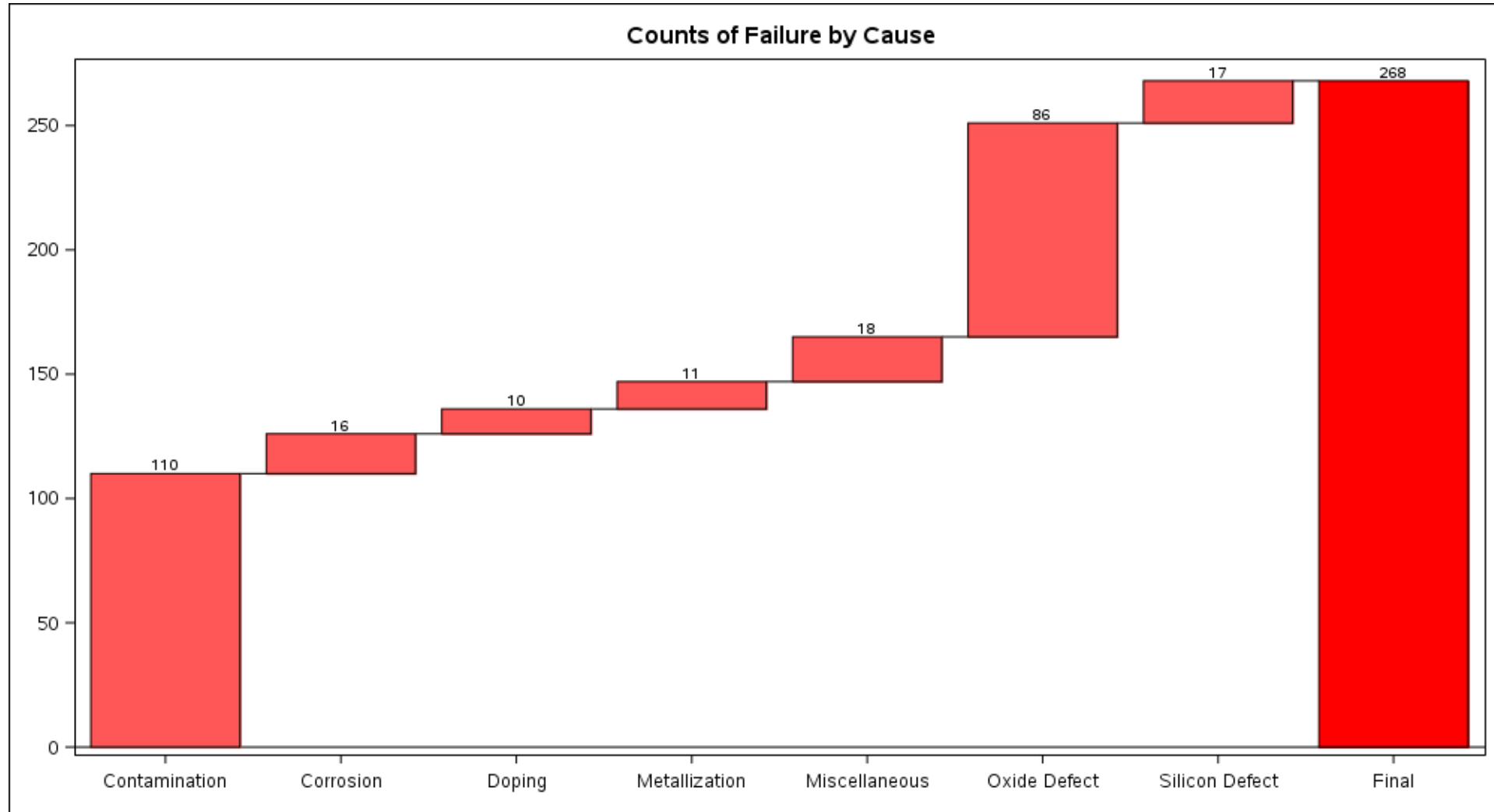
WATERFALL CHARTS: EXERCISE 1

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



WATERFALL CHARTS: EXERCISE 2

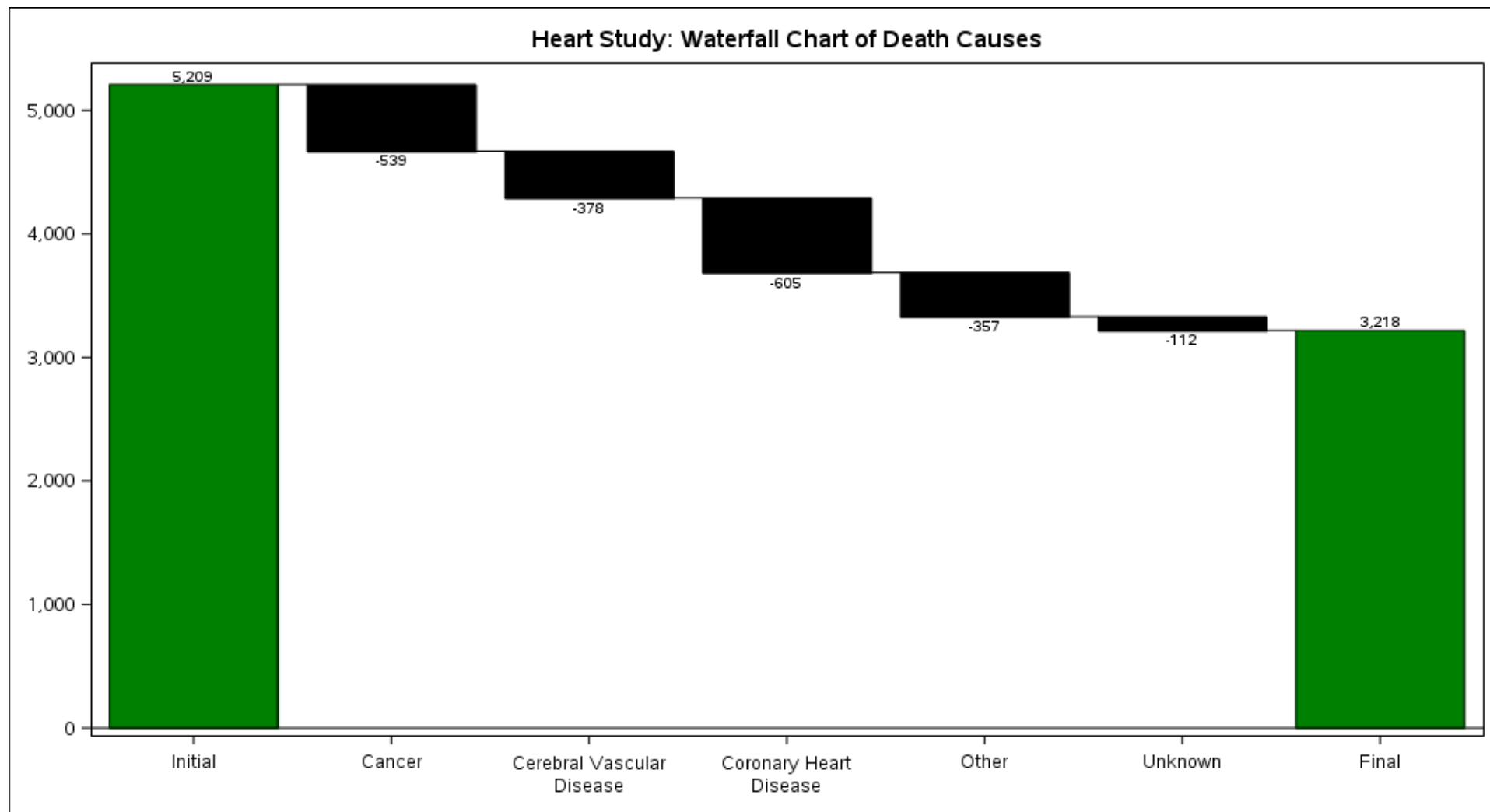
```
proc sgplot data=sashelp.failure;
title "Counts of Failure by Cause";
waterfall category=cause response=count /
    datalabel fillattrs=(color=lightred)
    finalbarattrs=(color=red);
xaxis display=(nolabel);
yaxis display=(nolabel);
```



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;

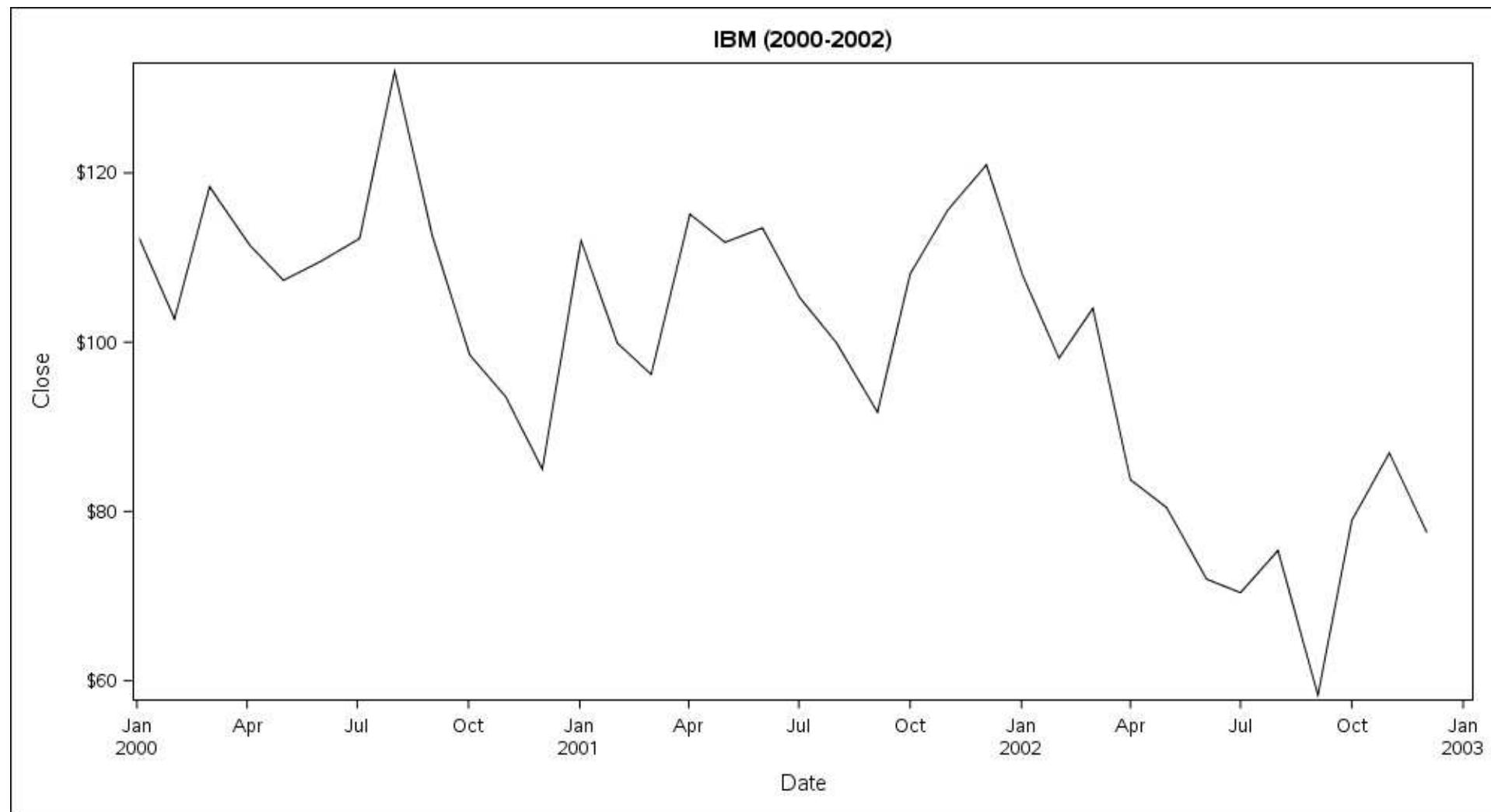
proc sgplot data=heartdeaths;
title "Heart Study: Waterfall Chart of Death Causes";
waterfall category=deathcause response=deaths /
  datalabel fillattrs=(color=black)
  initialbarvalue=&Participants
  initialbarattrs=(color=green)
  finalbarattrs=(color=green);
xaxis display=(nolabel);
yaxis display=(nolabel);
format deaths comma7.;
```



SERIES CHARTS

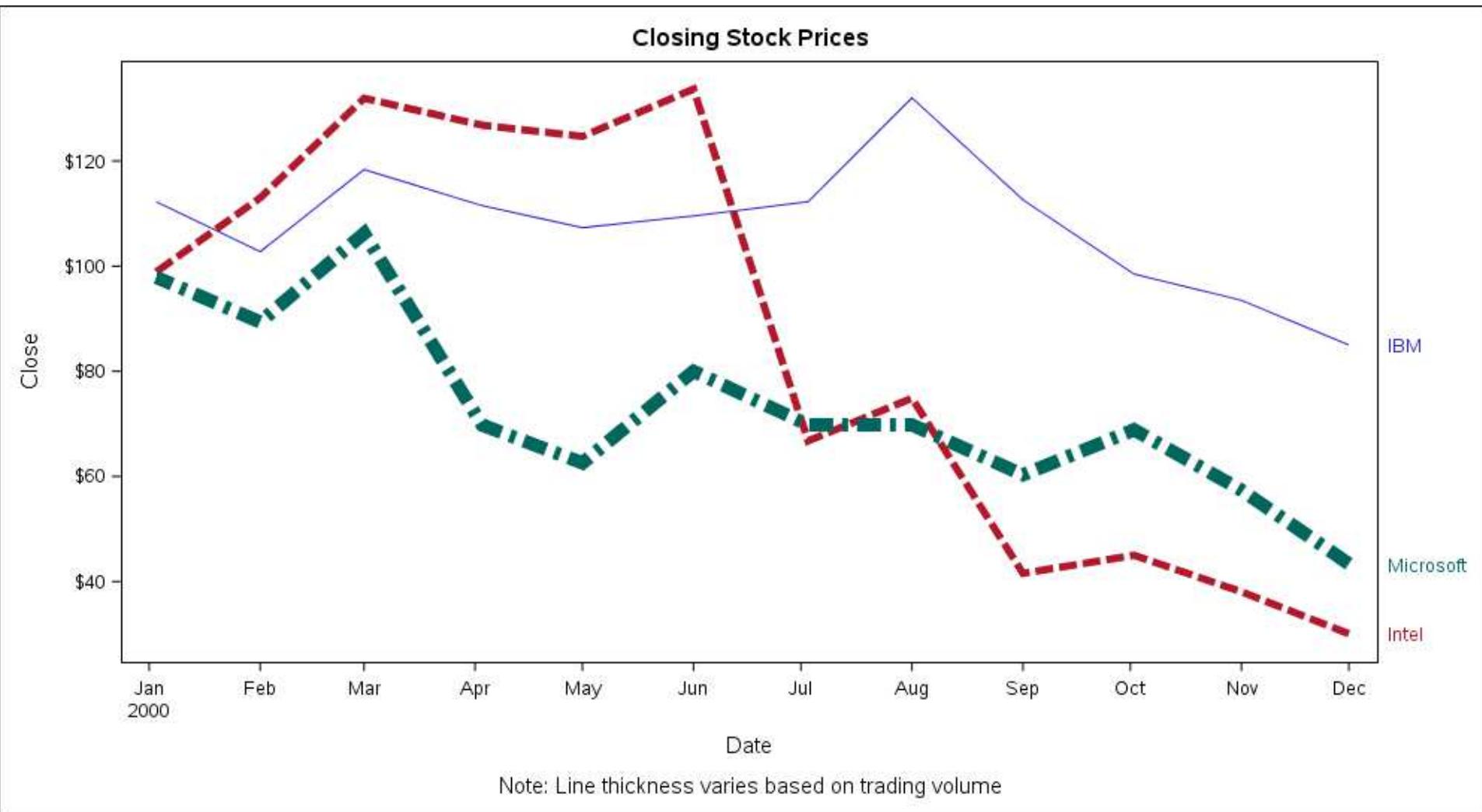
SERIES CHARTS: EXERCISE 1

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



SERIES CHARTS: EXERCISE 2

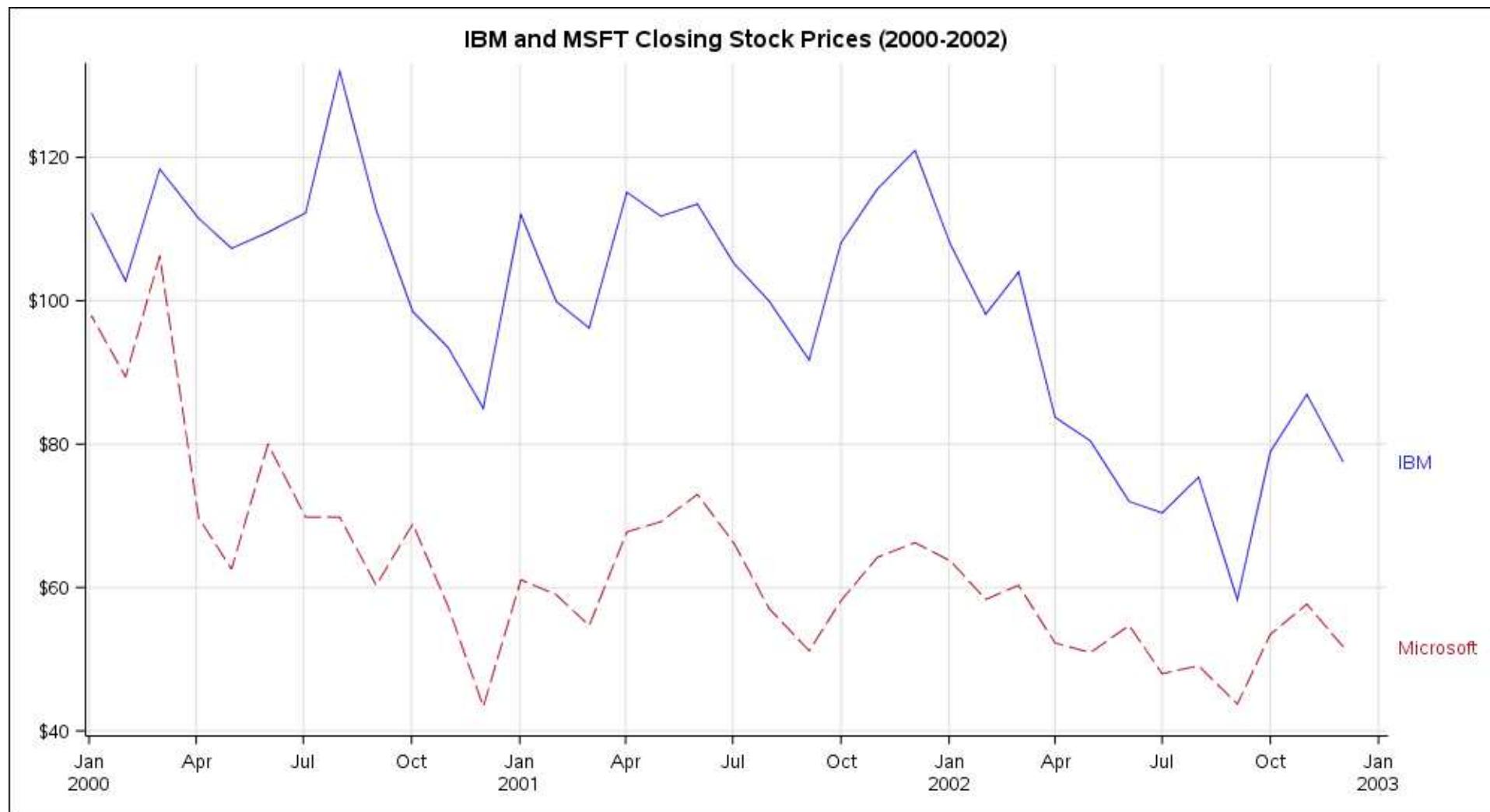
```
proc sgplot data=sashelp.stocks;
title "Closing Stock Prices";
where '01jan2000'd<=date<'01jan2001'd;
series x=date y=close /
  group=stock thickresp=volume
  curvelabel curvelabelloc=outside;
footnote "Note: Line thickness varies based on trading volume";
footnote;
```



100

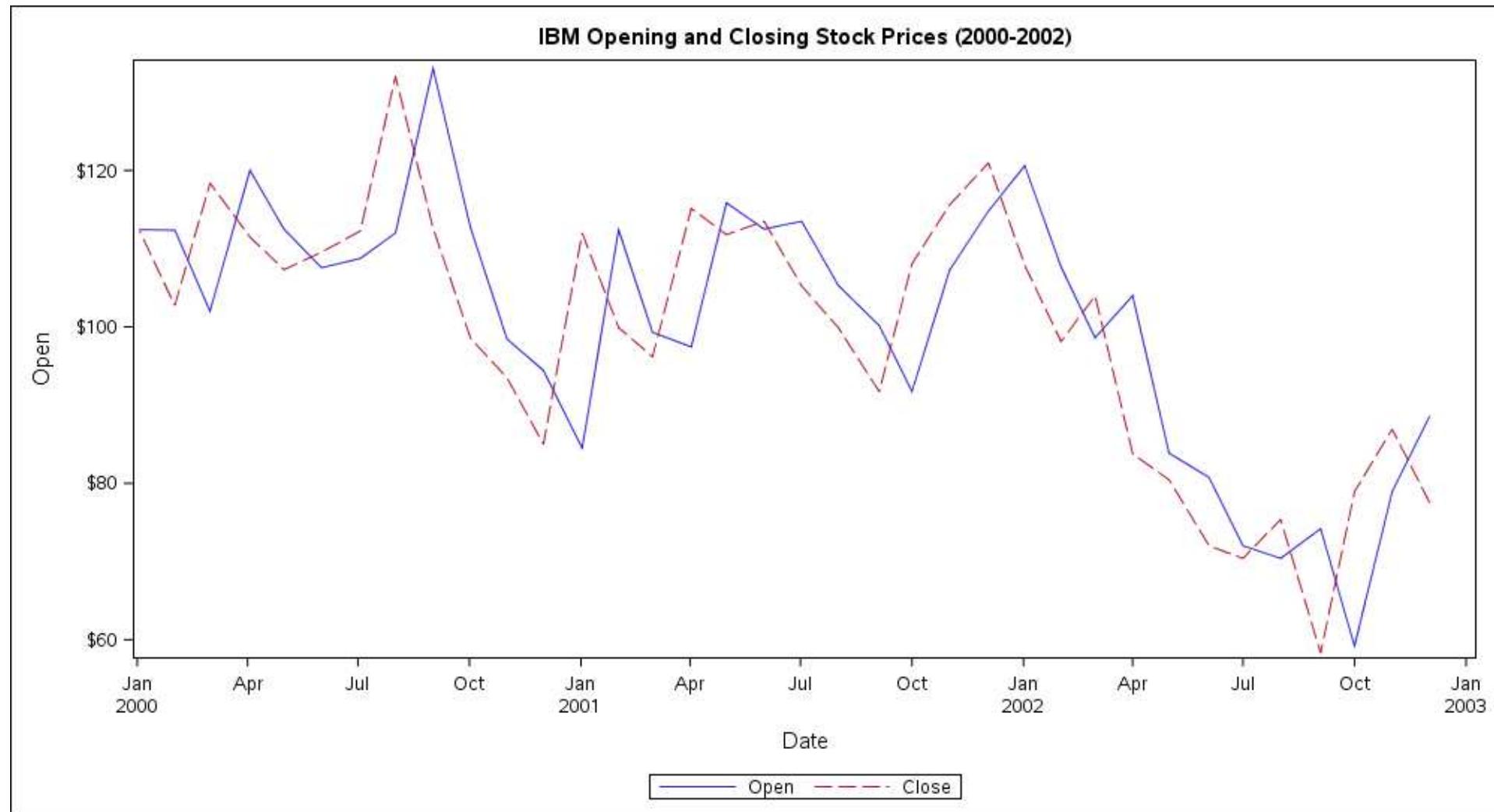
SERIES CHARTS: EXERCISE 3

```
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;
```



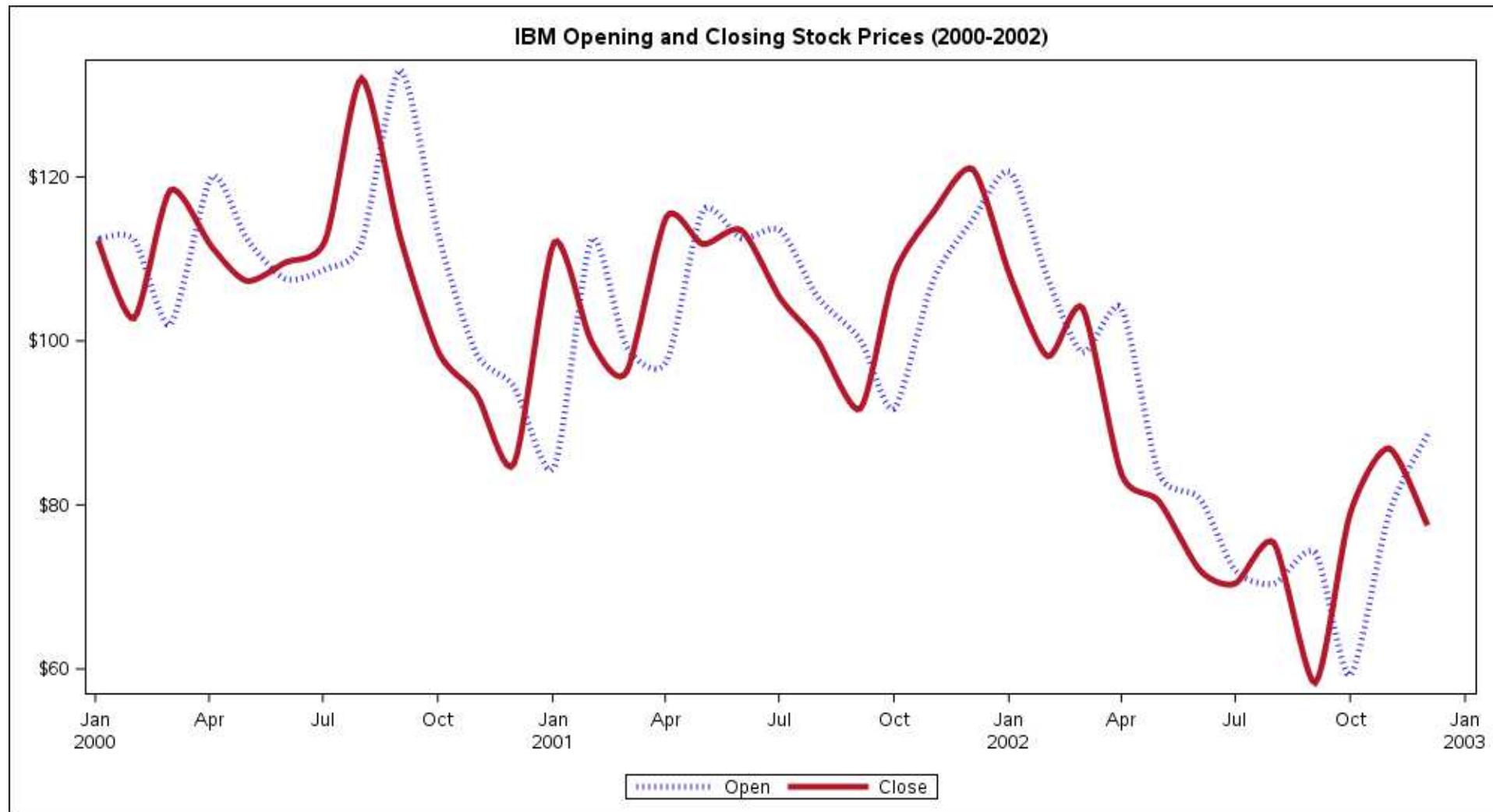
SERIES CHARTS: EXERCISE 4

```
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;
```



SERIES CHARTS: EXERCISE 5

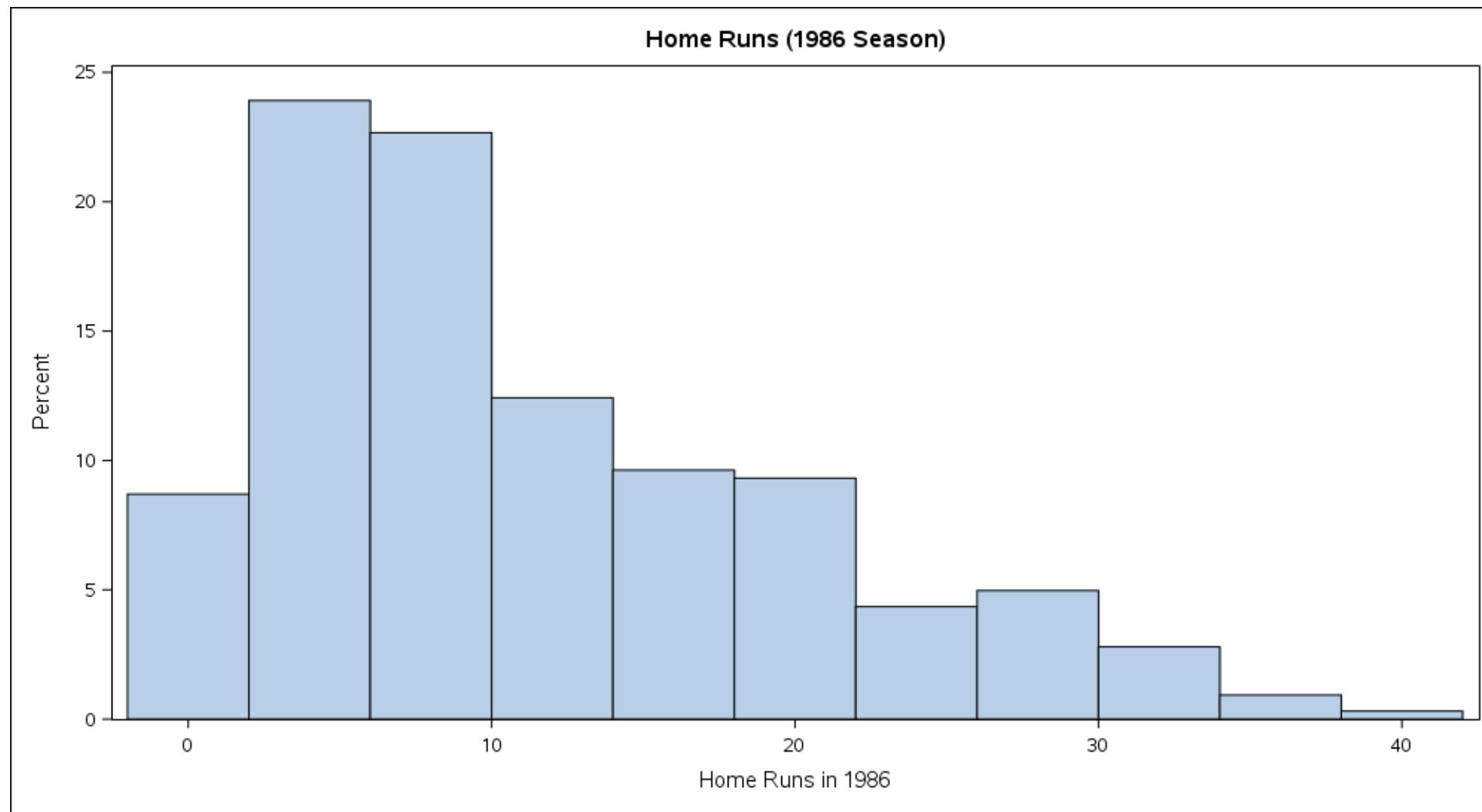
```
proc sgplot data=sashelp.stocks;
where stock="IBM" and '01jan2000'd<=date<'01jan2003'd;
title height=10pt "IBM Opening and Closing Stock Prices (2000-2002)";
series x=date y=open / lineattrs=(pattern=dot thickness=3pt) smoothconnect;
series x=date y=close / lineattrs=(pattern=solid thickness=3pt)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



HISTOGRAM CHARTS

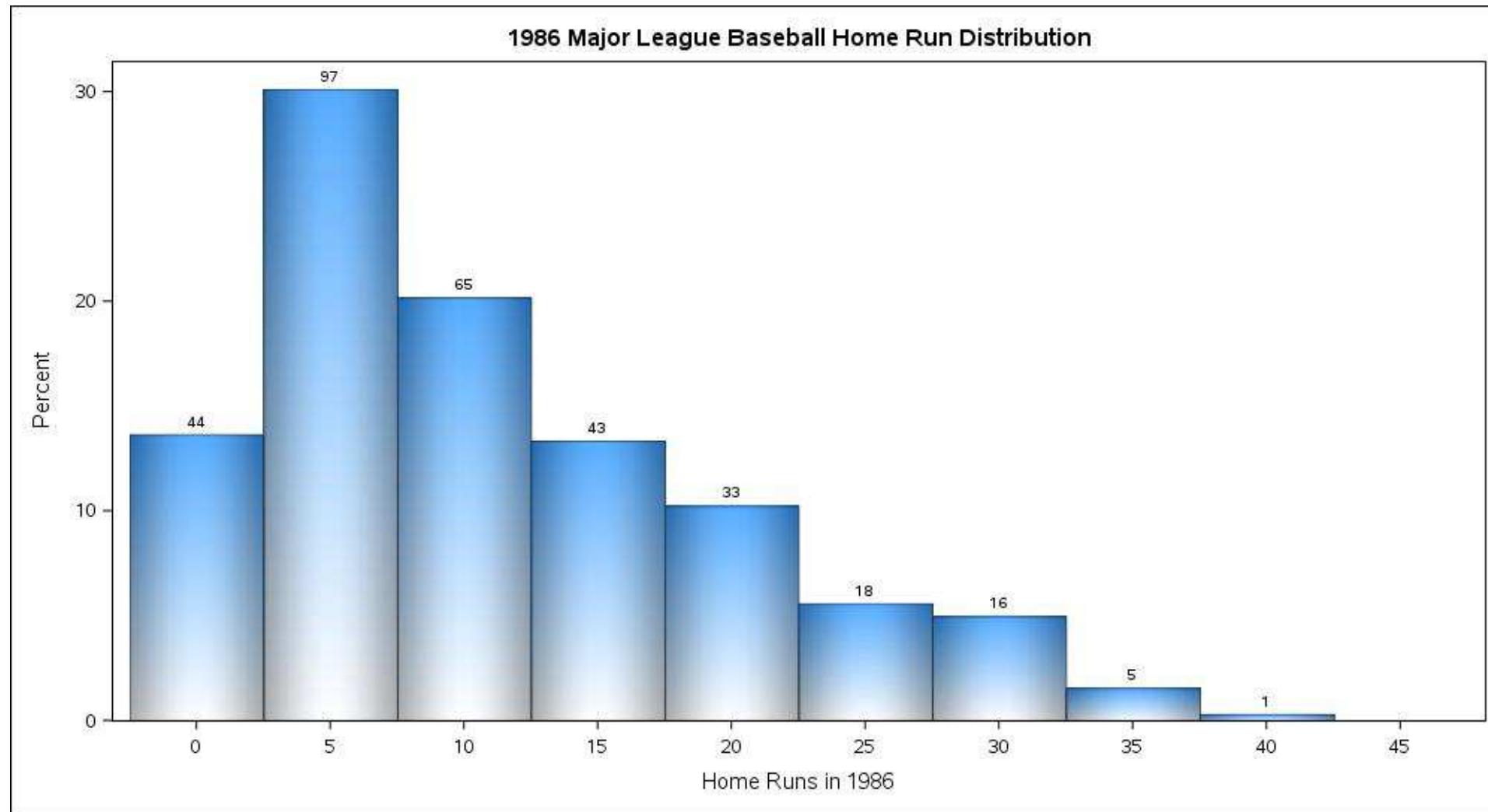
HISTOGRAM CHARTS: EXERCISE 1

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



HISTOGRAM CHARTS: EXERCISE 2

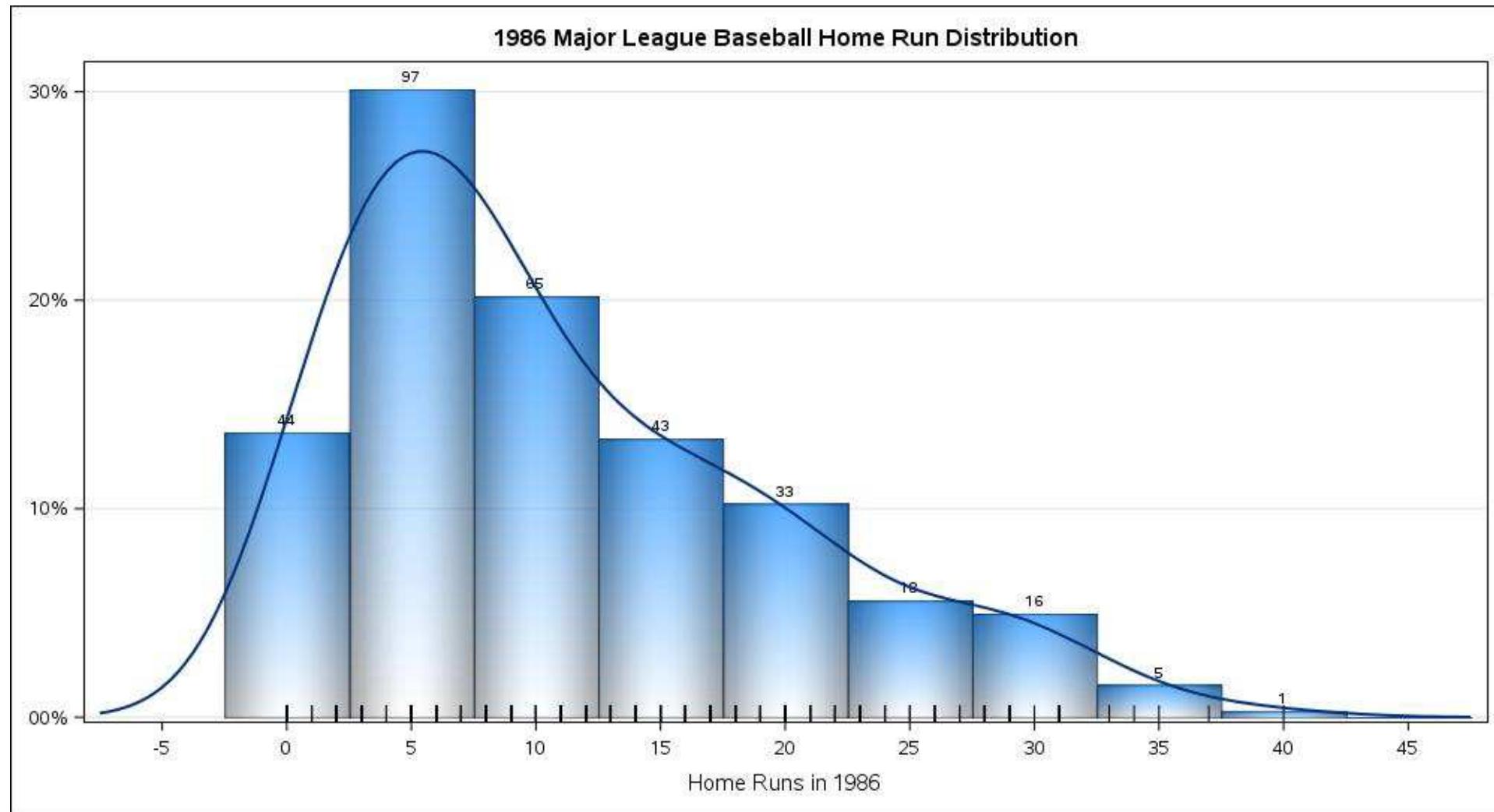
```
proc sgplot data=sashelp.baseball;
title "1986 Major League Baseball Home Run Distribution";
histogram nhome /
  datalabel=count nbins=10 showbins
  dataskin=pressed filltype=gradient
  fillattrs=(color=dodgerblue);
```



HISTOGRAM CHARTS: EXERCISE 3

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

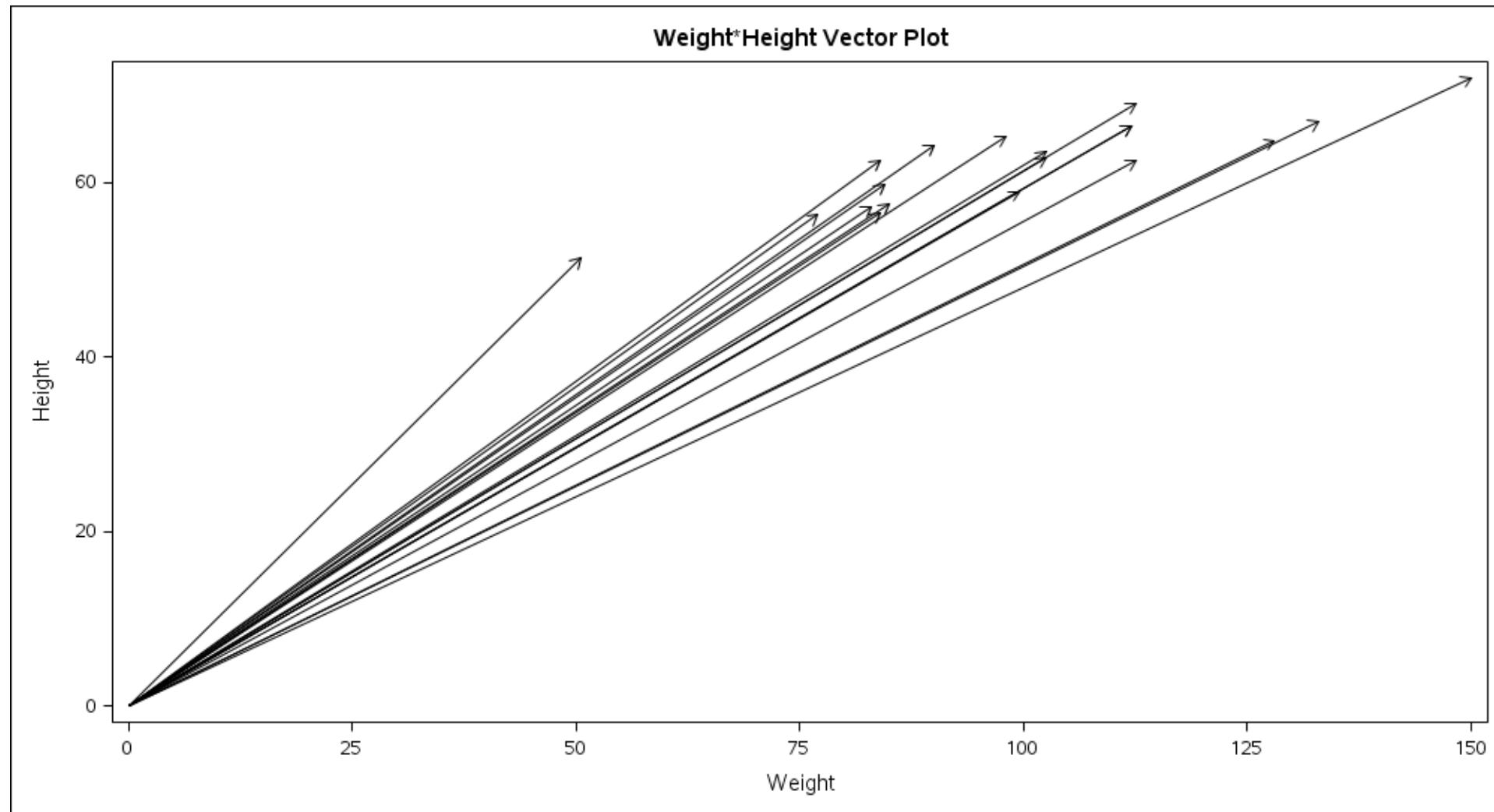
proc sgplot data=sashelp.baseball noautolegend;
title "1986 Major League Baseball Home Run Distribution";
histogram nhome /
    datalabel=count nbins=10 showbins
    dataskin=pressed filltype=gradient
    fillattrs=(color=dodgerblue);
density nhome / type=kernel;
fringe nhome;
yaxis display=(nolabel)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



VECTOR CHARTS

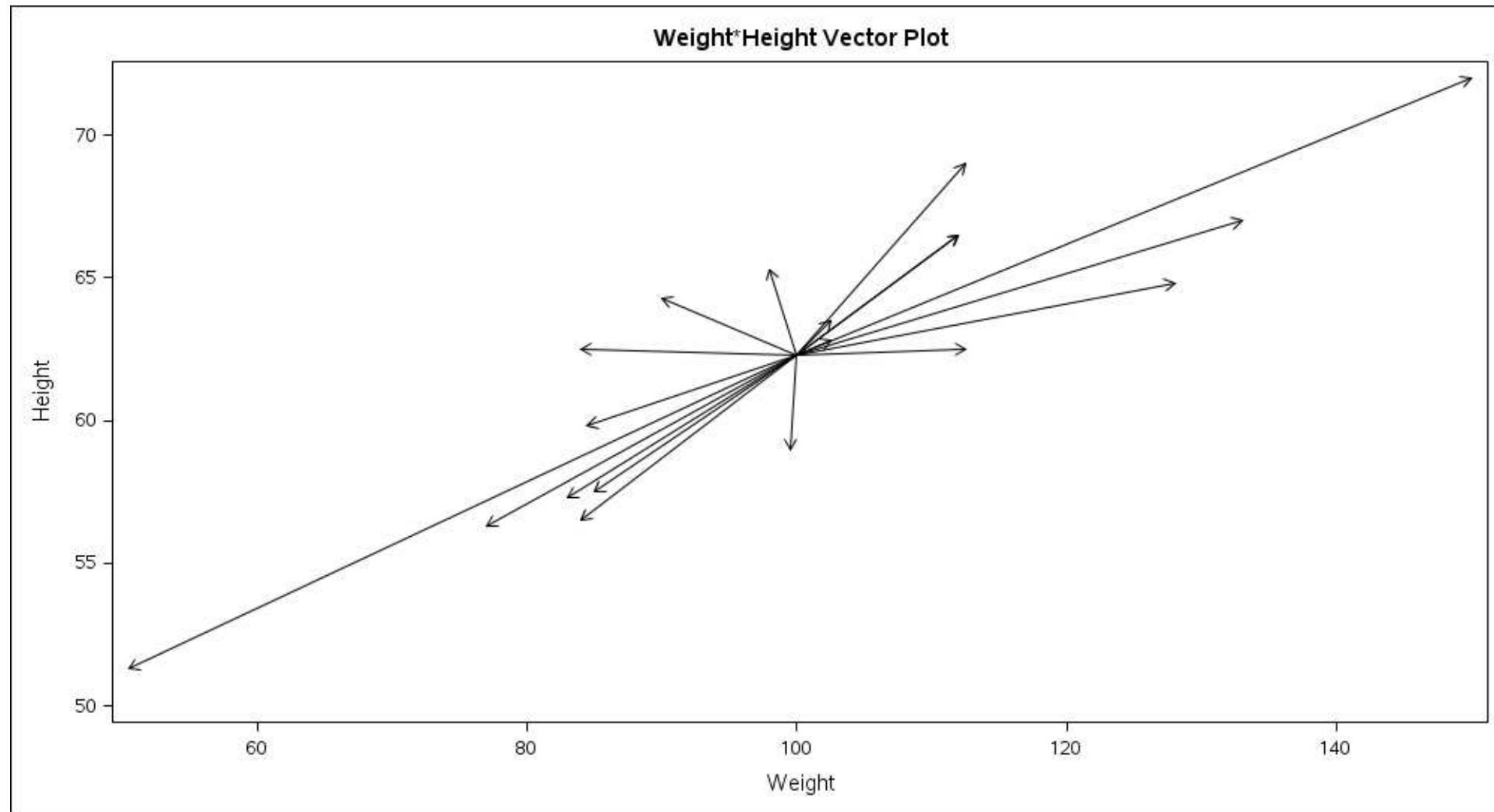
VECTOR CHARTS: EXERCISE 1

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



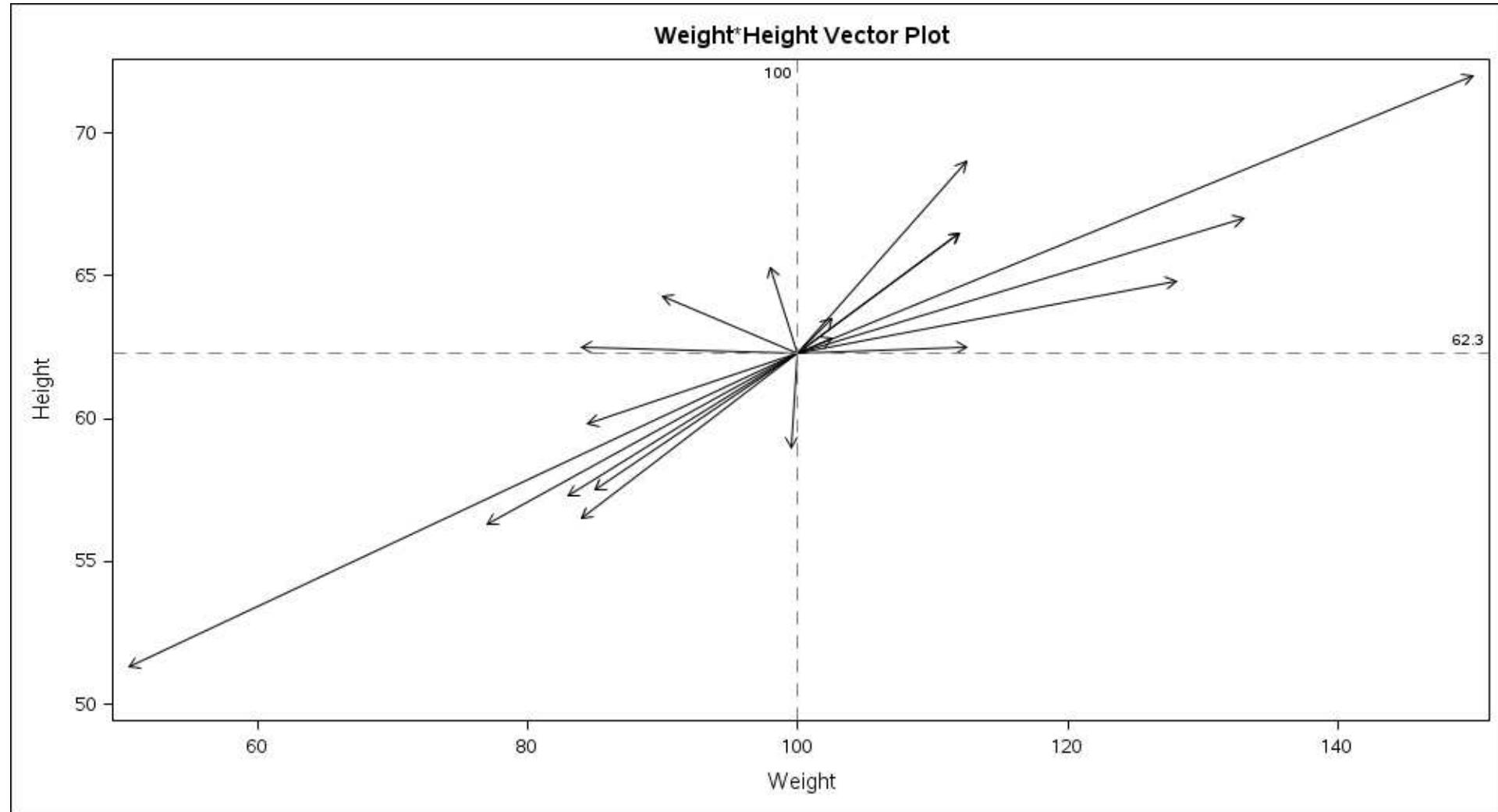
VECTOR CHARTS: EXERCISE 2

```
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;
```



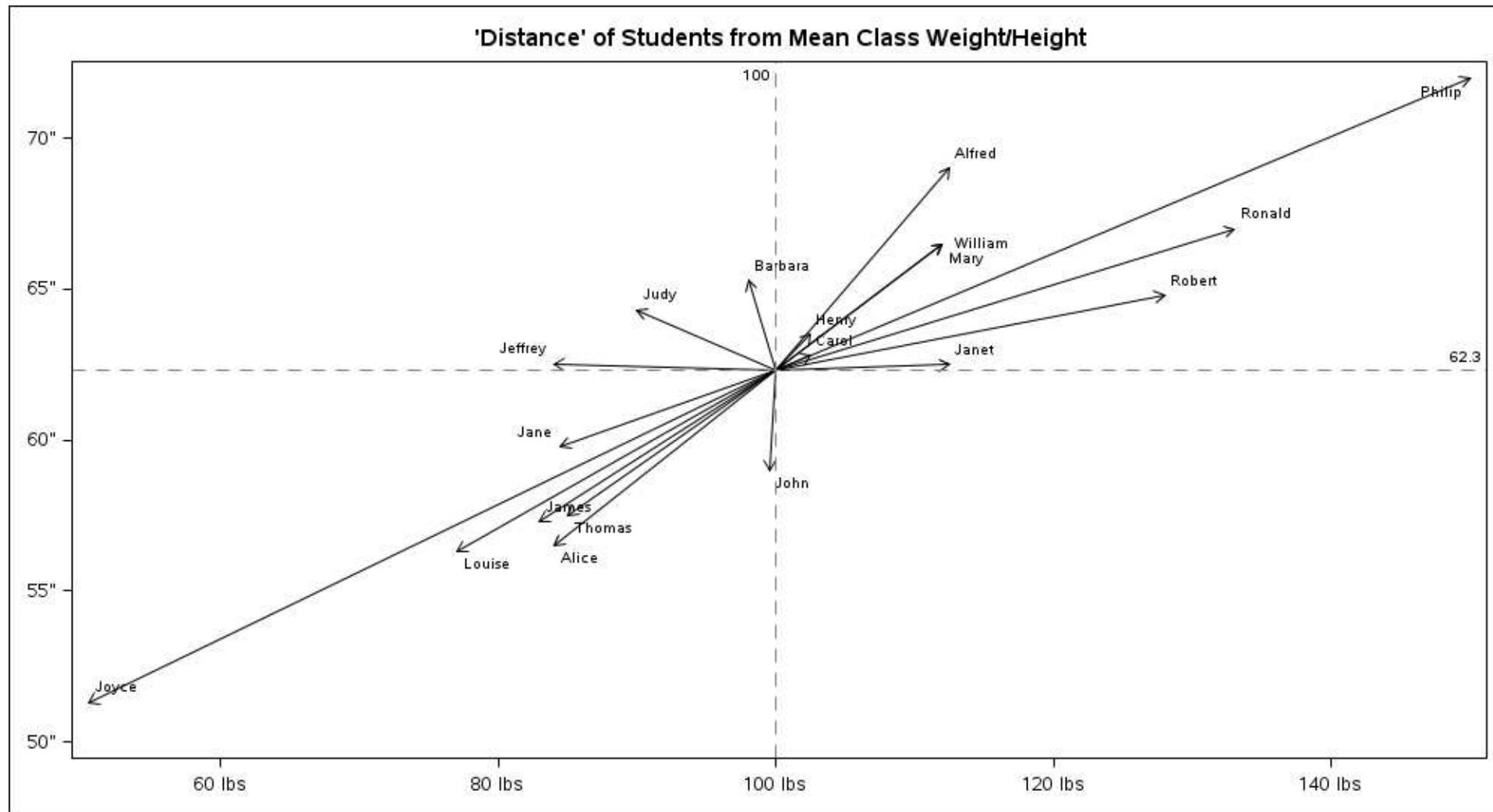
VECTOR CHARTS: EXERCISE 3

```
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);
```



VECTOR CHARTS: EXERCISE 4

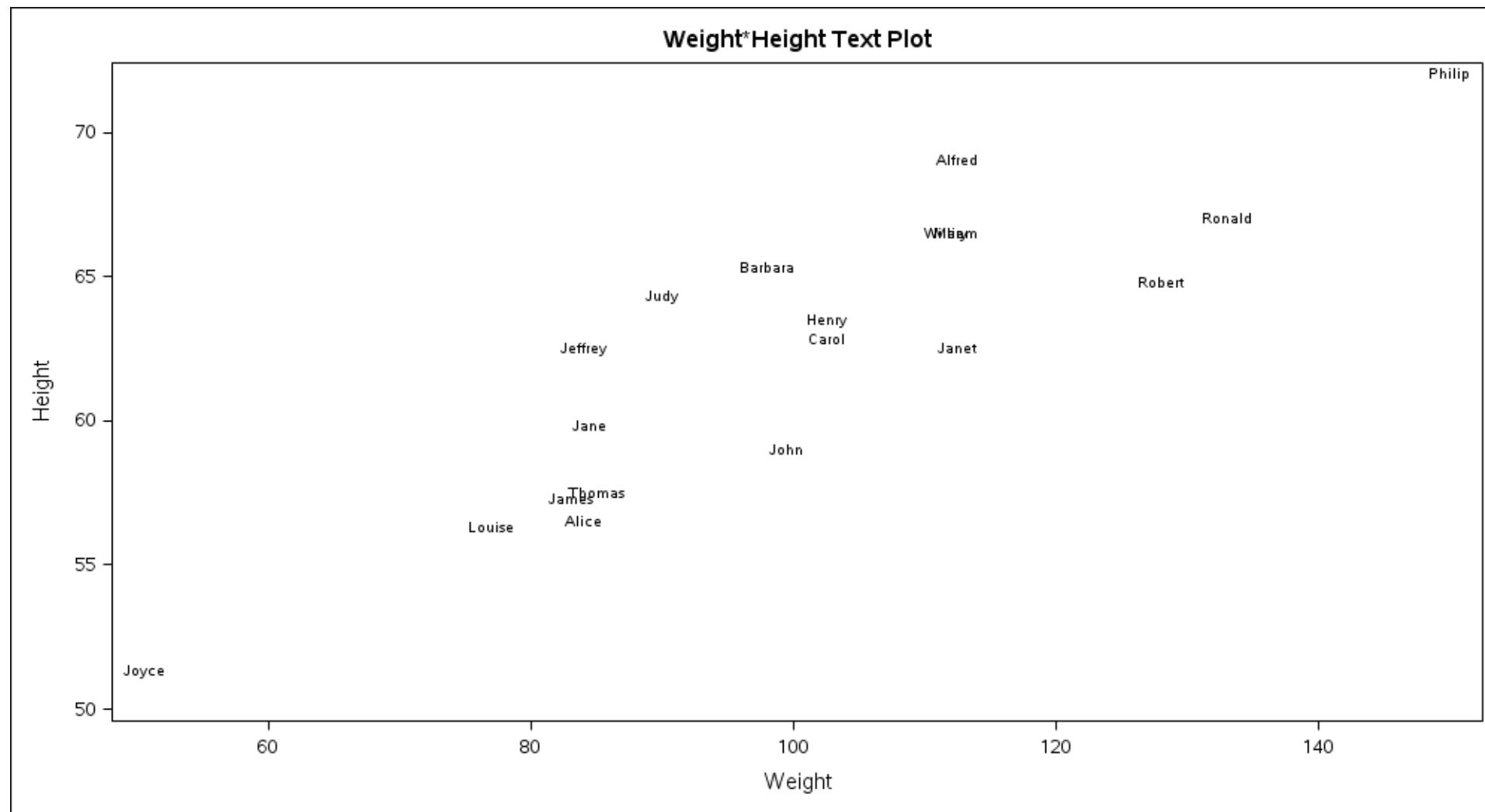
```
proc format;
picture inchF low-high ='99"';
picture lbsF low-high ='009 lbs';
proc sgplot data=sashelp.class;
title "'Distance' of Students from Mean Class Weight/Height";
vector x=weight y=height /
    xorigin=&avgweight yorigin=&avgheight datalabel=name;
refline &avgweight /
    axis=x labelloc=inside 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.;
```



TEXT CHARTS

TEXT CHARTS: EXERCISE 1

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



TEXT CHARTS: EXERCISE 2

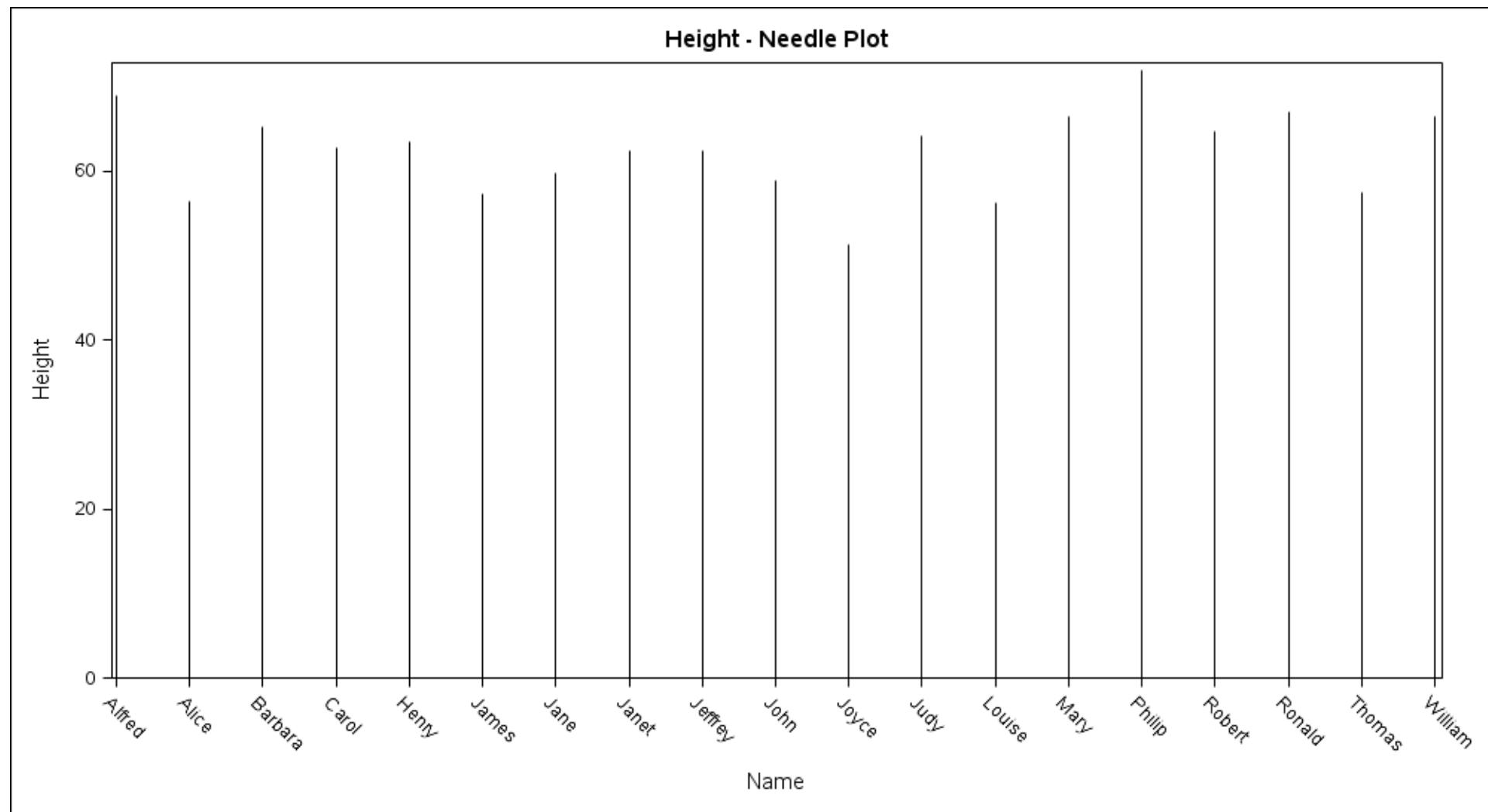
```
proc sql noprint;
create table classminmax as
select c.*,
       case when height=minheight or height=maxheight
             then name end as shownname
  from sashelp.class c,
       (select min(height) as minheight,
              max(height) as maxheight
     from sashelp.class) as minmax;
proc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



NEEDLE CHARTS

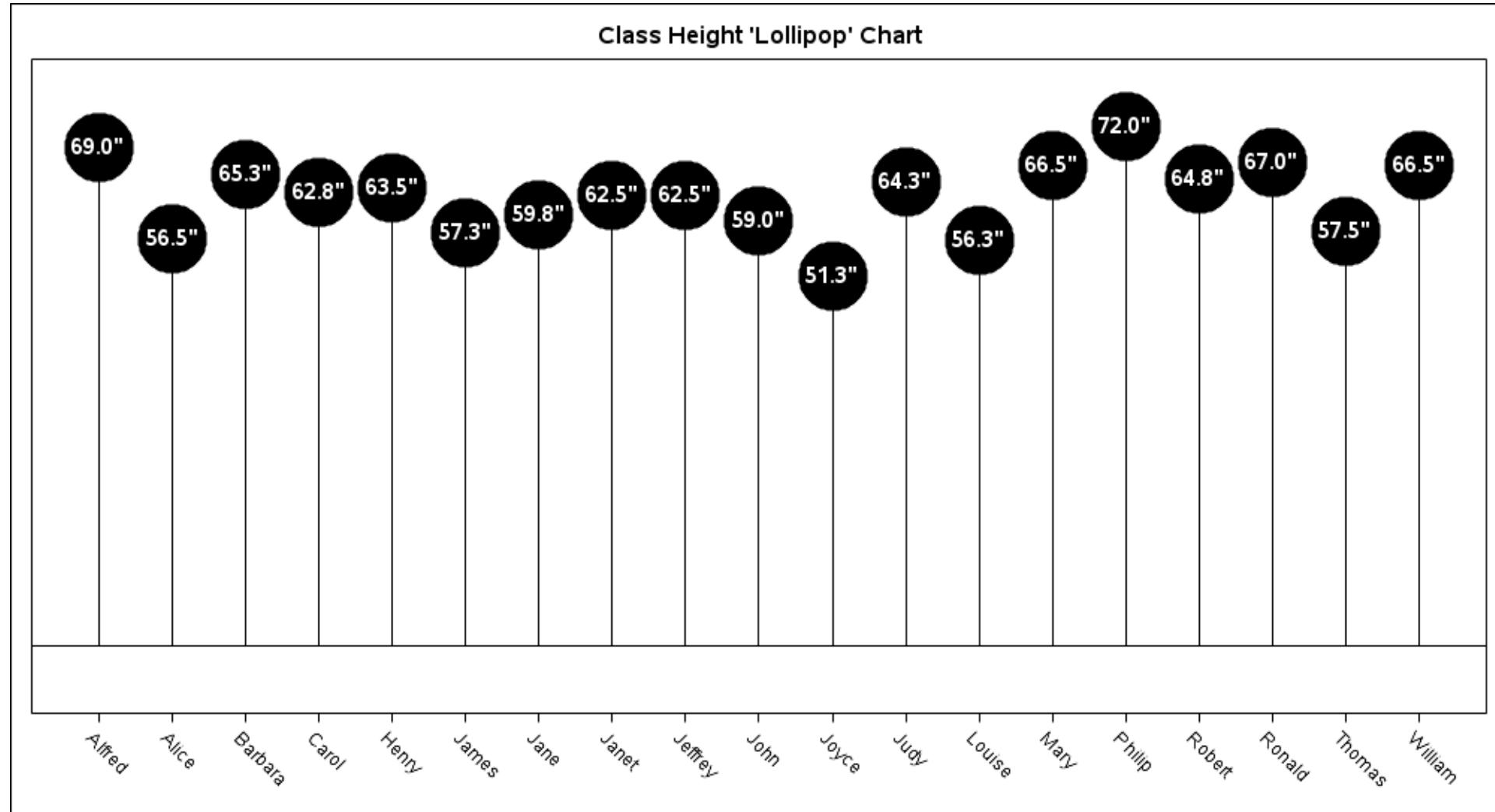
NEEDLE CHARTS: EXERCISE 1

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



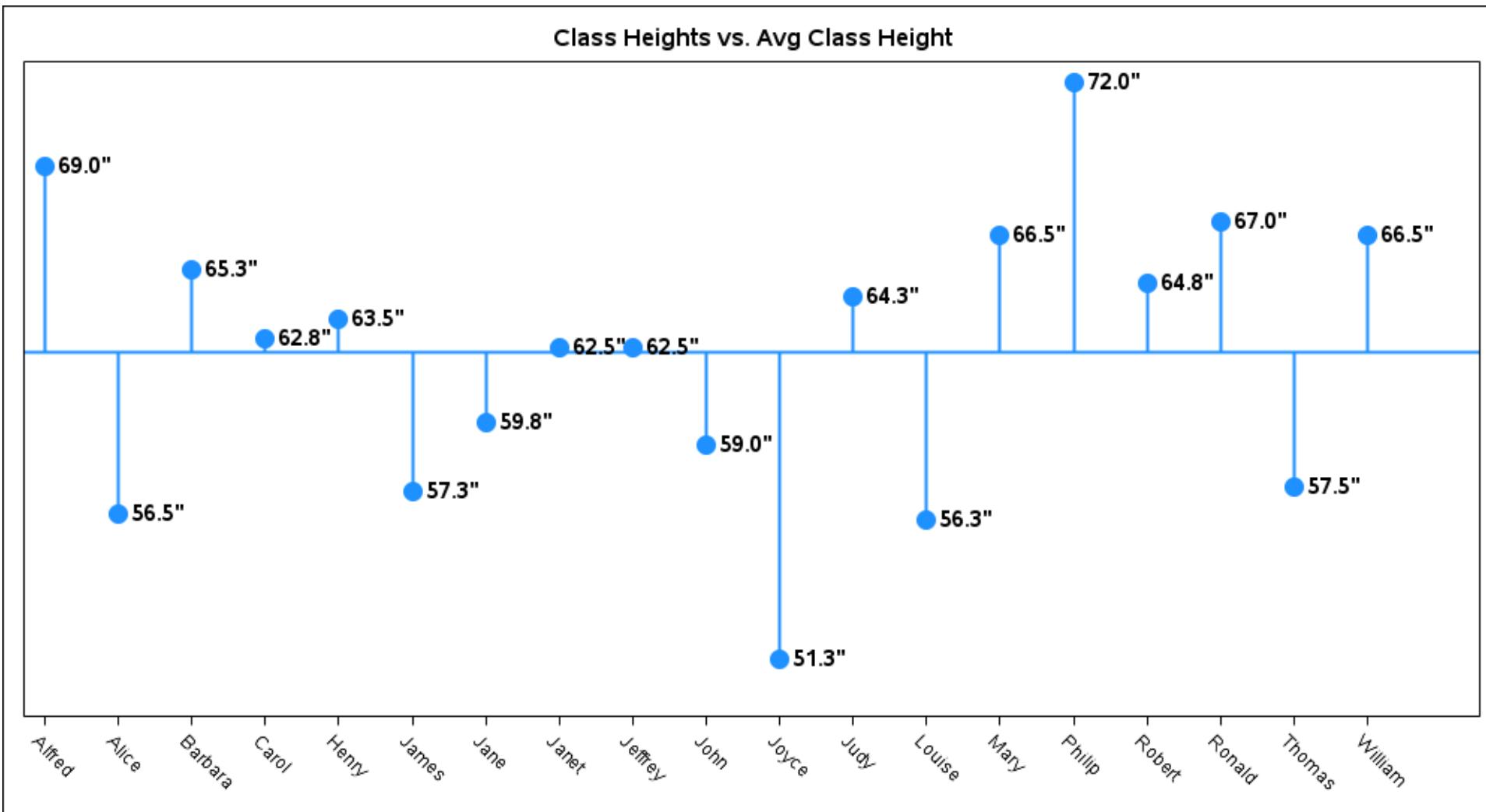
NEEDLE CHARTS: EXERCISE 2

```
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; 
```



NEEDLE CHARTS: EXERCISE 3

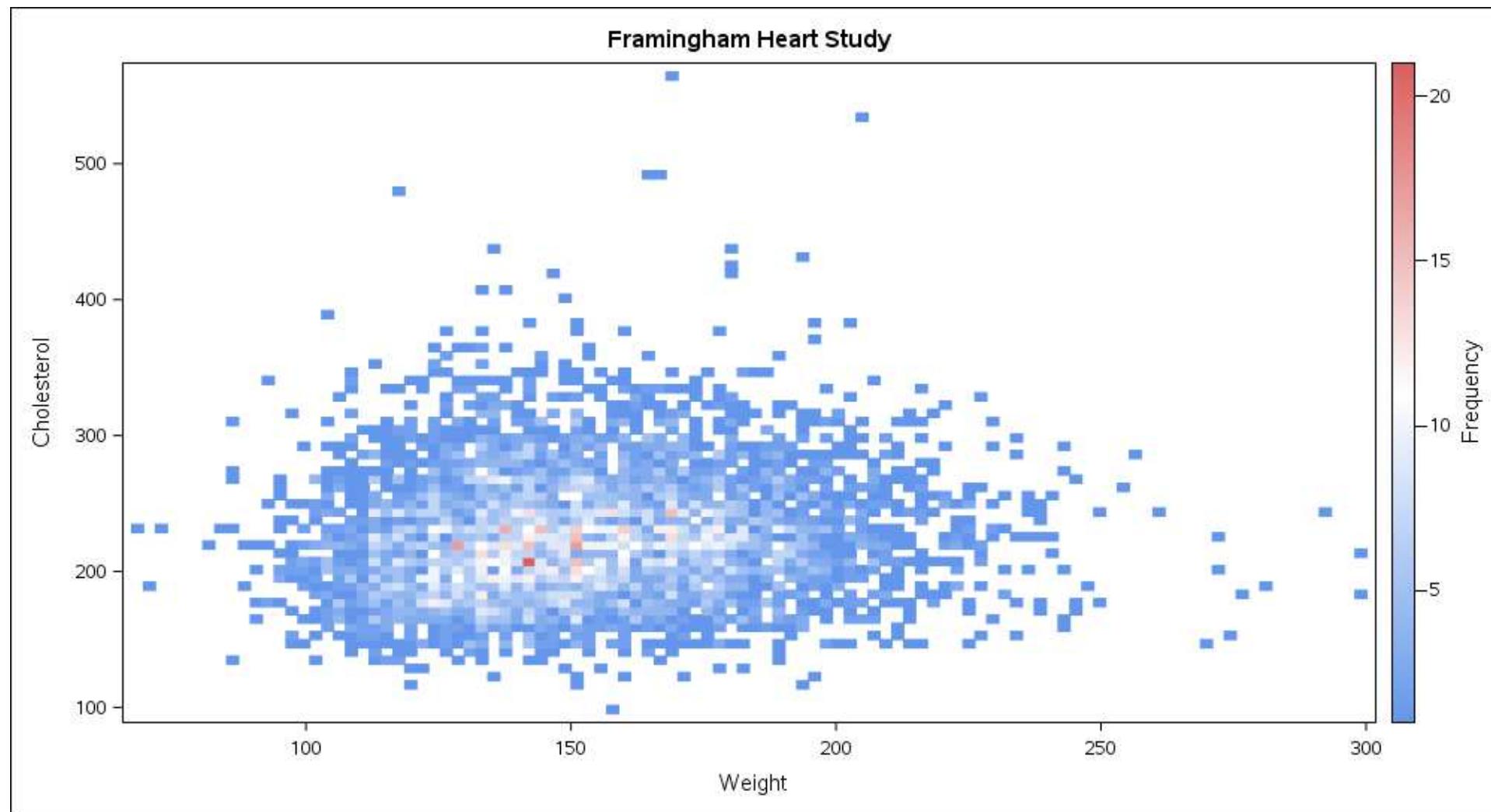
```
proc format;
picture inchF low-high ='99.9"';
proc sql noprint;
select avg(height) into :avgheight from sashelp.class;
proc sgplot data=sashelp.class;
title "Class Heights vs. Avg Class Height";
needle x=name y=height / datalabel datalabelpos=right
    datalabelattrs=(color=black size=10pt weight=bold)
    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.;
```



HEATMAP CHARTS

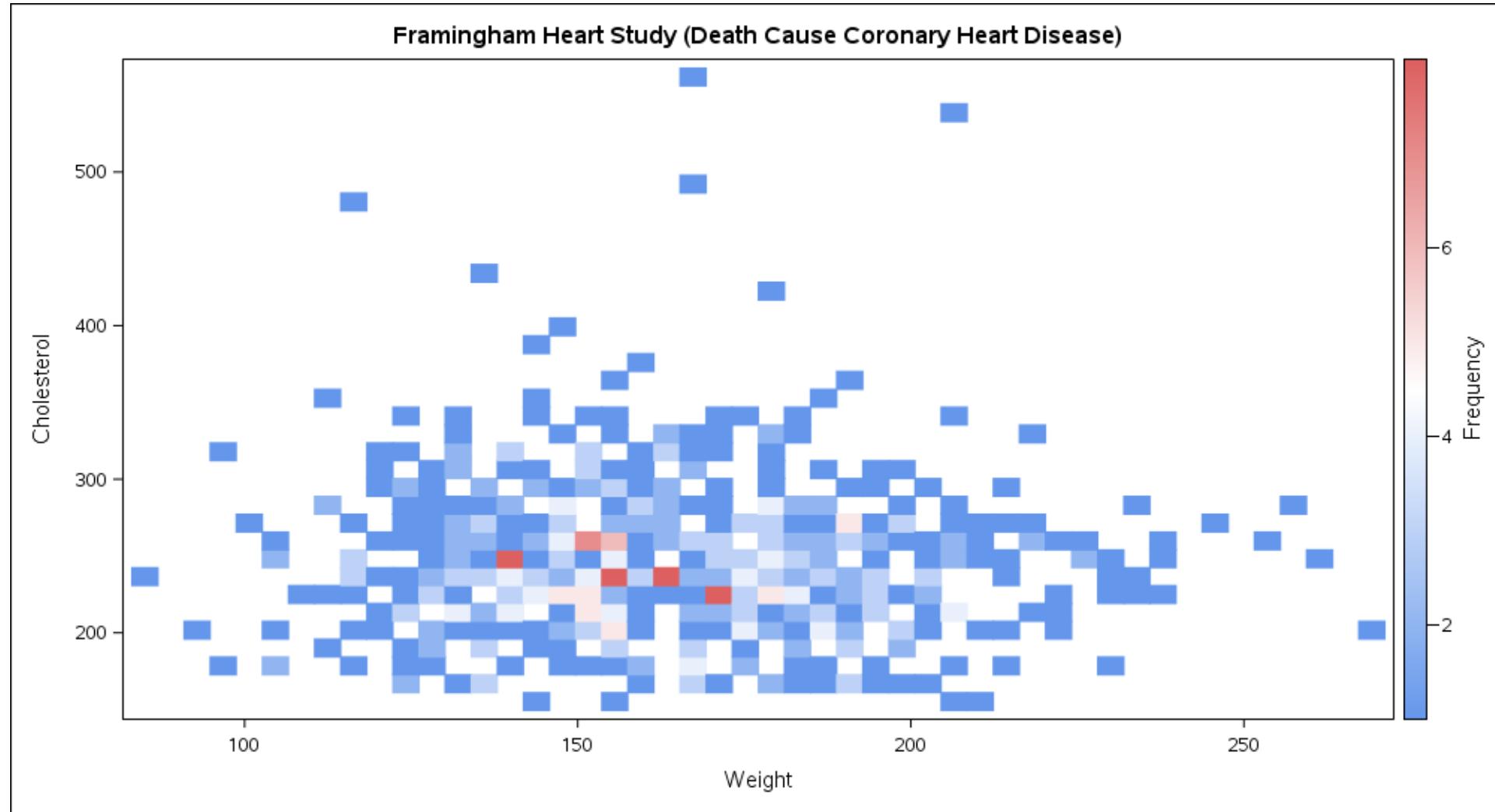
HEATMAP CHARTS: EXERCISE 1

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



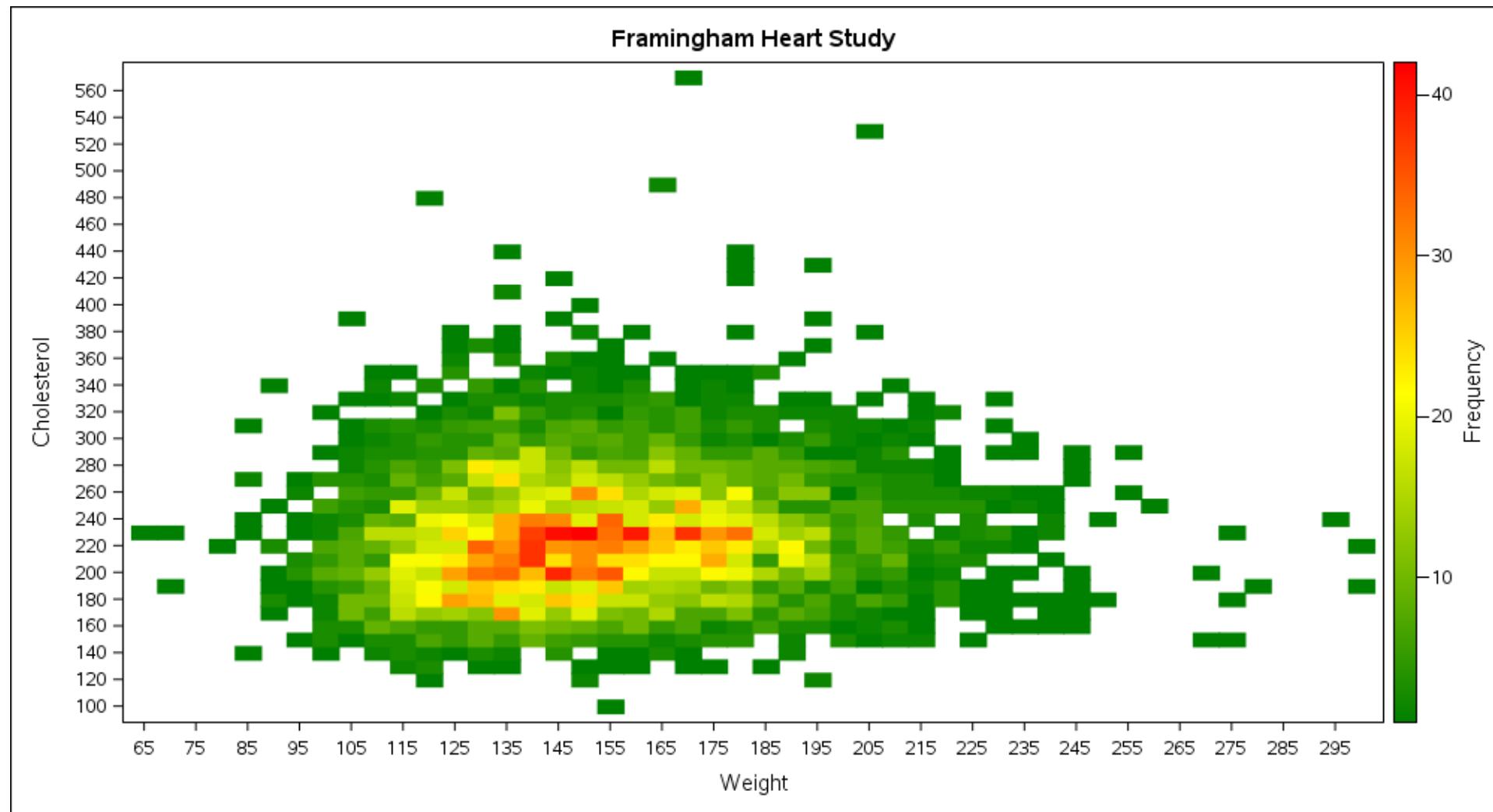
HEATMAP CHARTS: EXERCISE 2

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



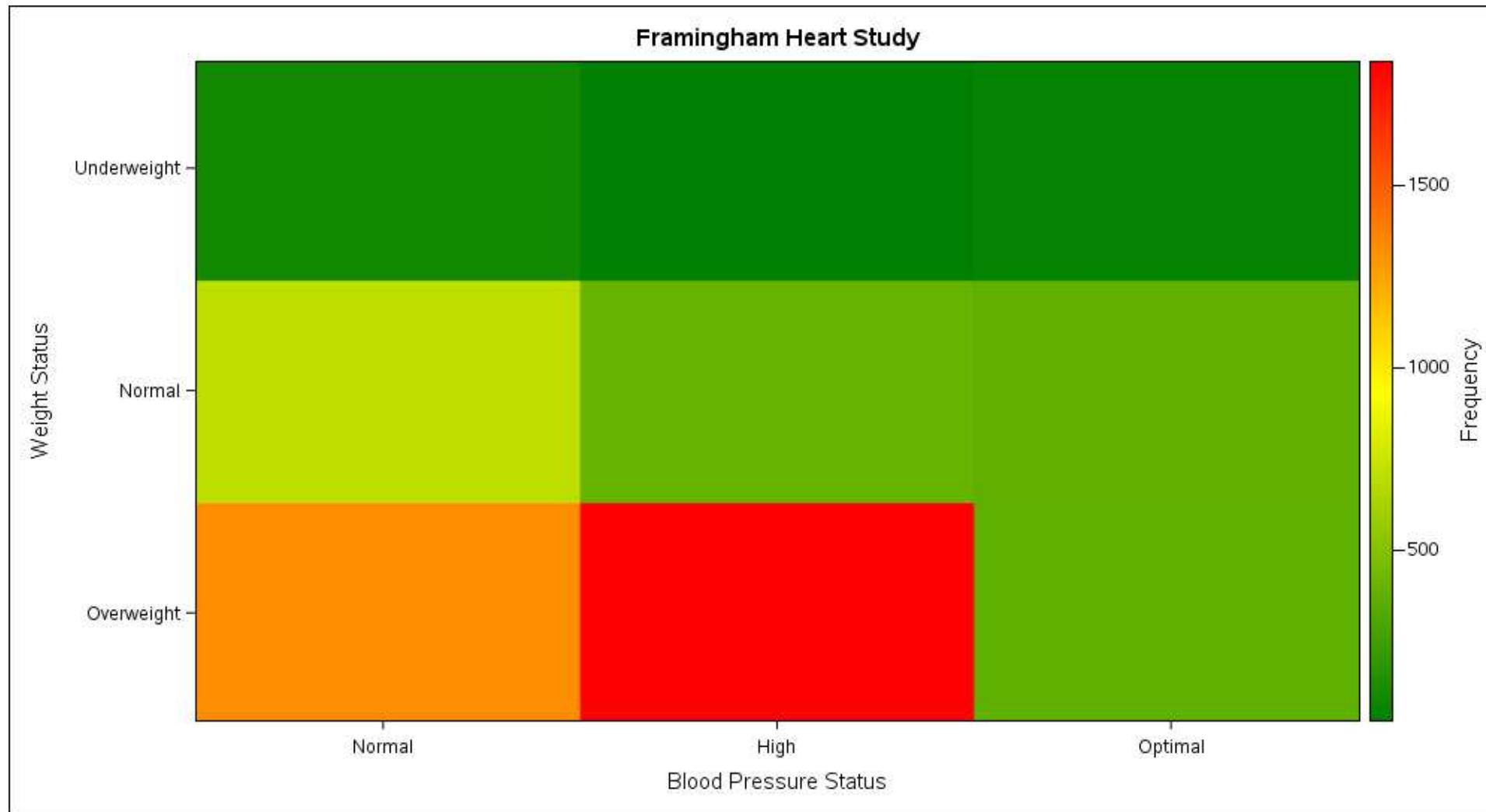
HEATMAP CHARTS: EXERCISE 3

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



HEATMAP CHARTS: EXERCISE 4

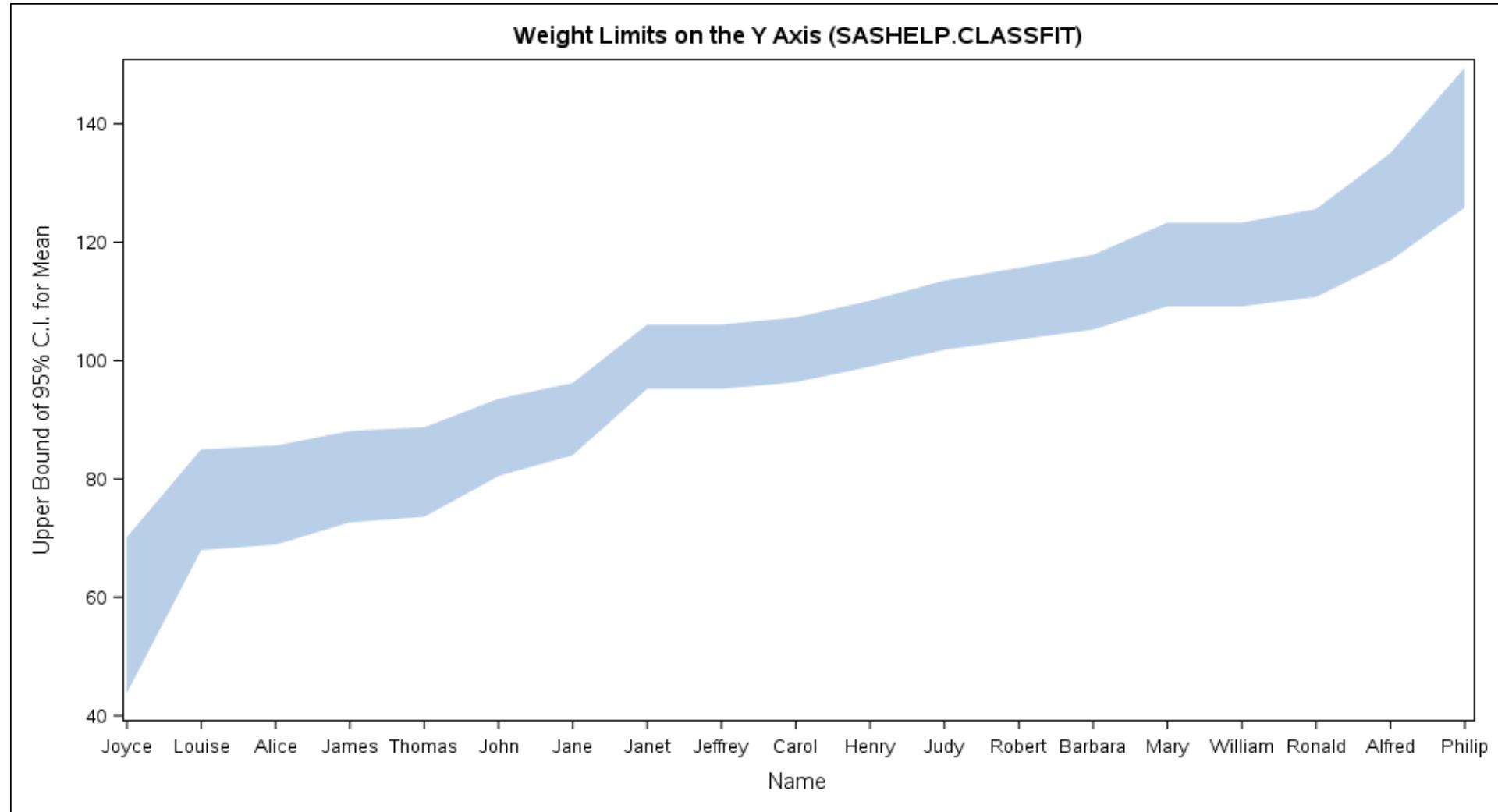
```
proc sgplot data=sashelp.heart;
title "Framingham Heart Study";
heatmap x=bp_status y=weight_status /
colormodel=(green yellow red);
```



BAND CHARTS

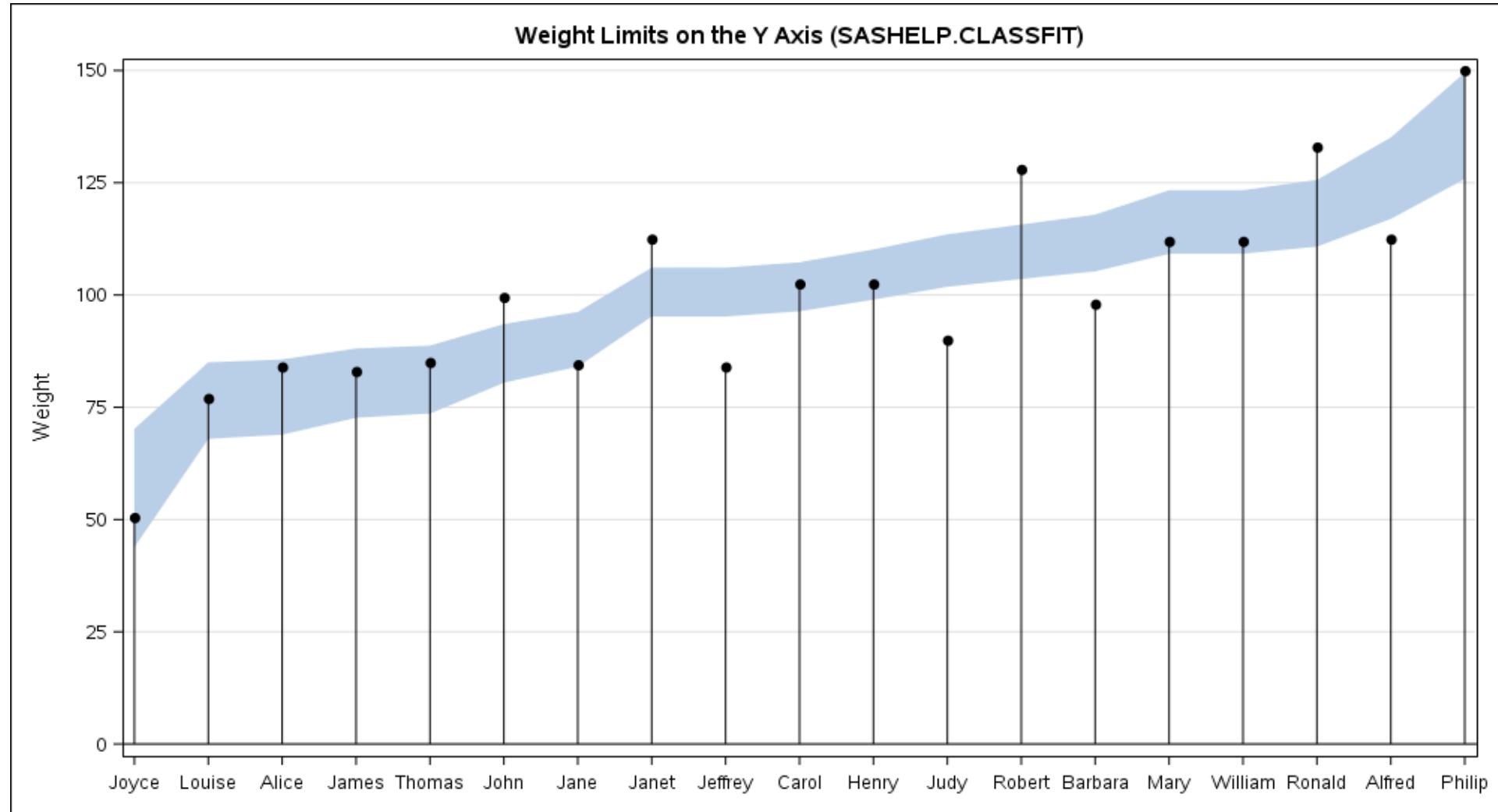
BAND CHARTS: EXERCISE 1

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



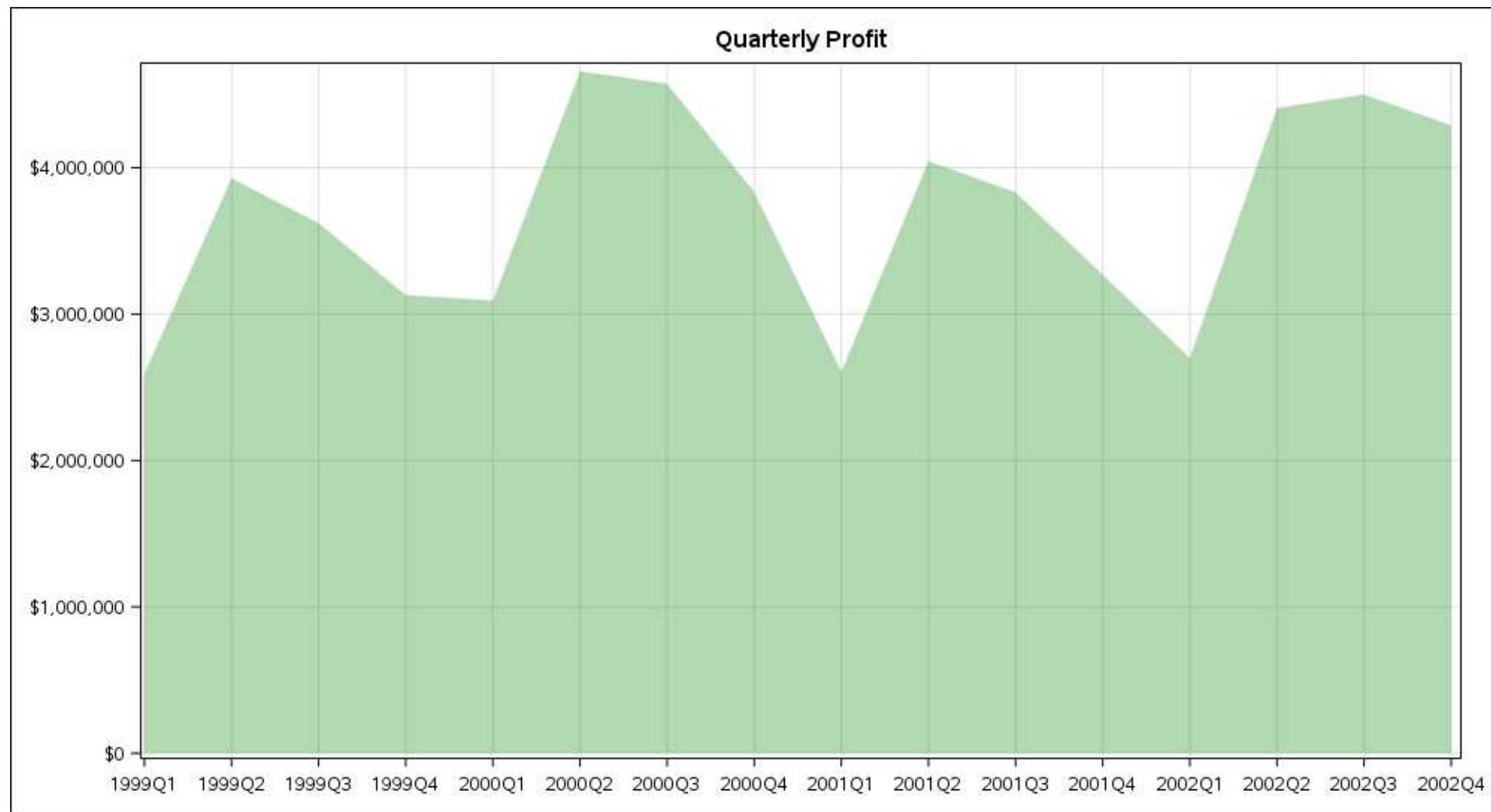
BAND CHARTS: EXERCISE 2

```
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;
```



BAND CHARTS: EXERCISE 3

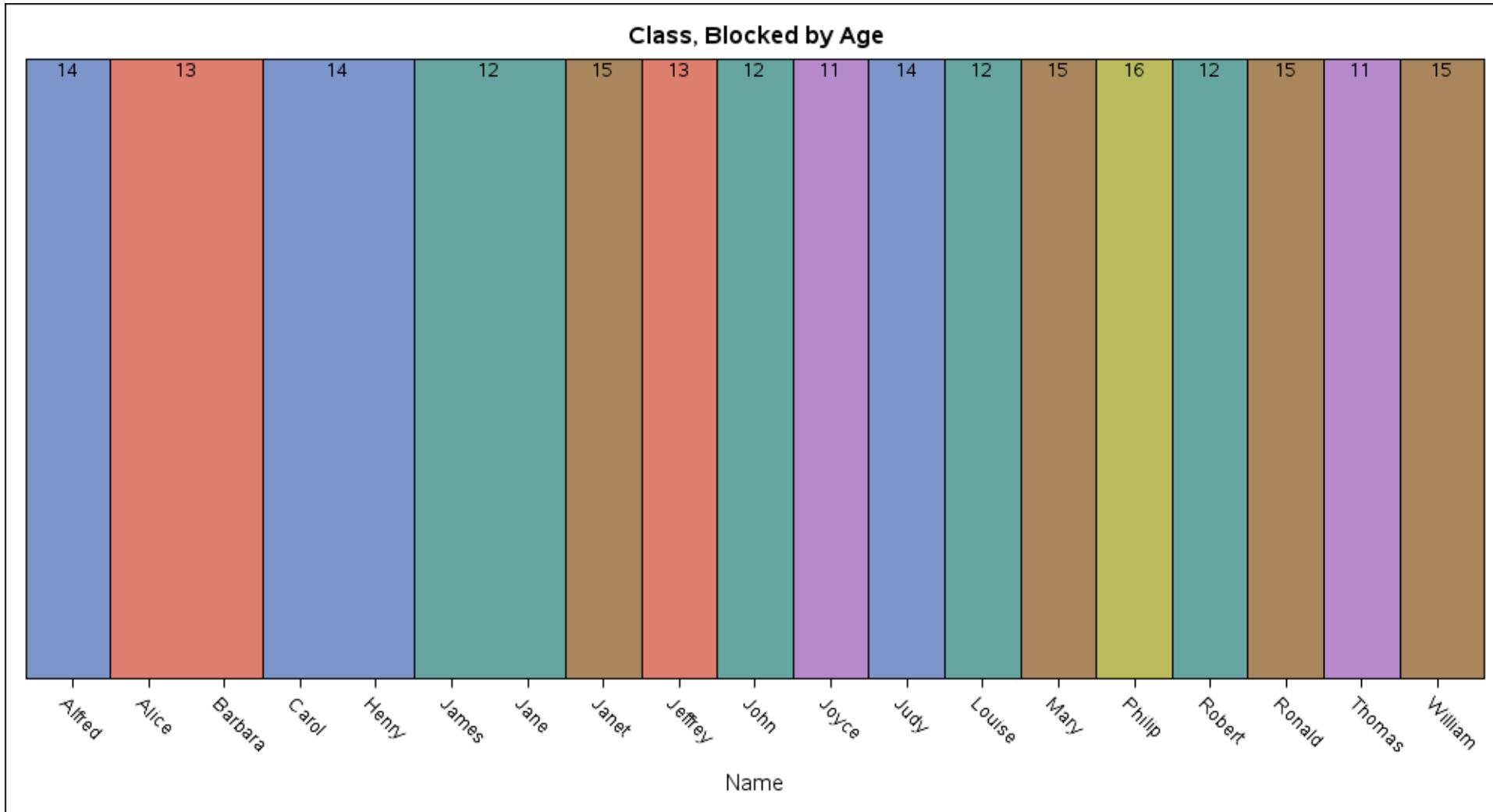
```
proc sql noprint;
create table orsalesum as
select quarter, sum(profit) as profit
from sashelp.orsales group by 1 order by 1;
proc sgplot data=orsalesum;
title "Quarterly Profit";
band x=quarter upper=profit lower=0 /
  fill fillattrs=(color=green transparency=.7);
format profit dollar10.;
xaxis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



BLOCK CHARTS

BLOCK CHARTS: EXERCISE 1

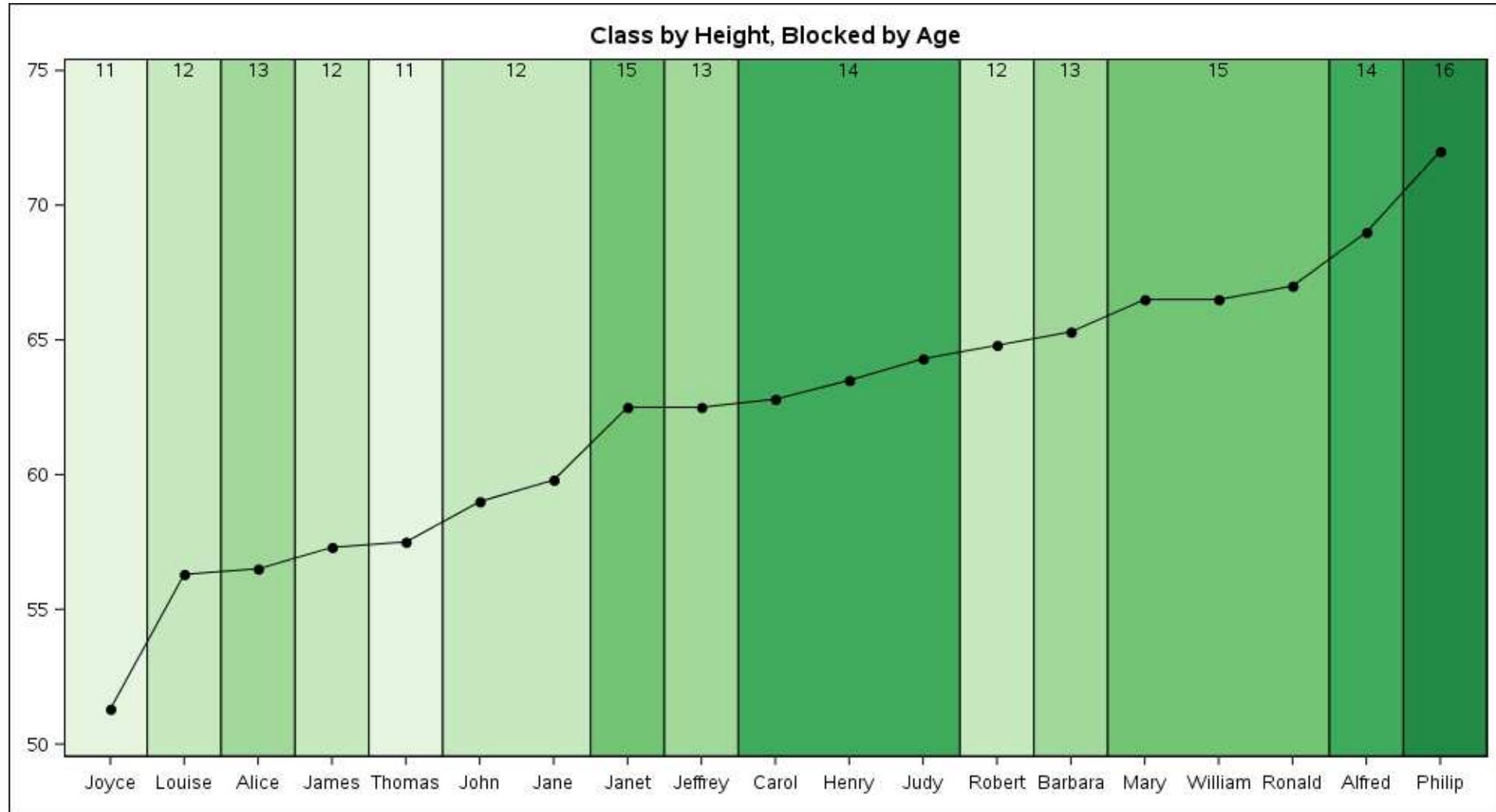
```
proc sgplot data=sashelp.class;  
title "Class, Blocked by Age";  
block x=name block=age;
```



BLOCK CHARTS: EXERCISE 2

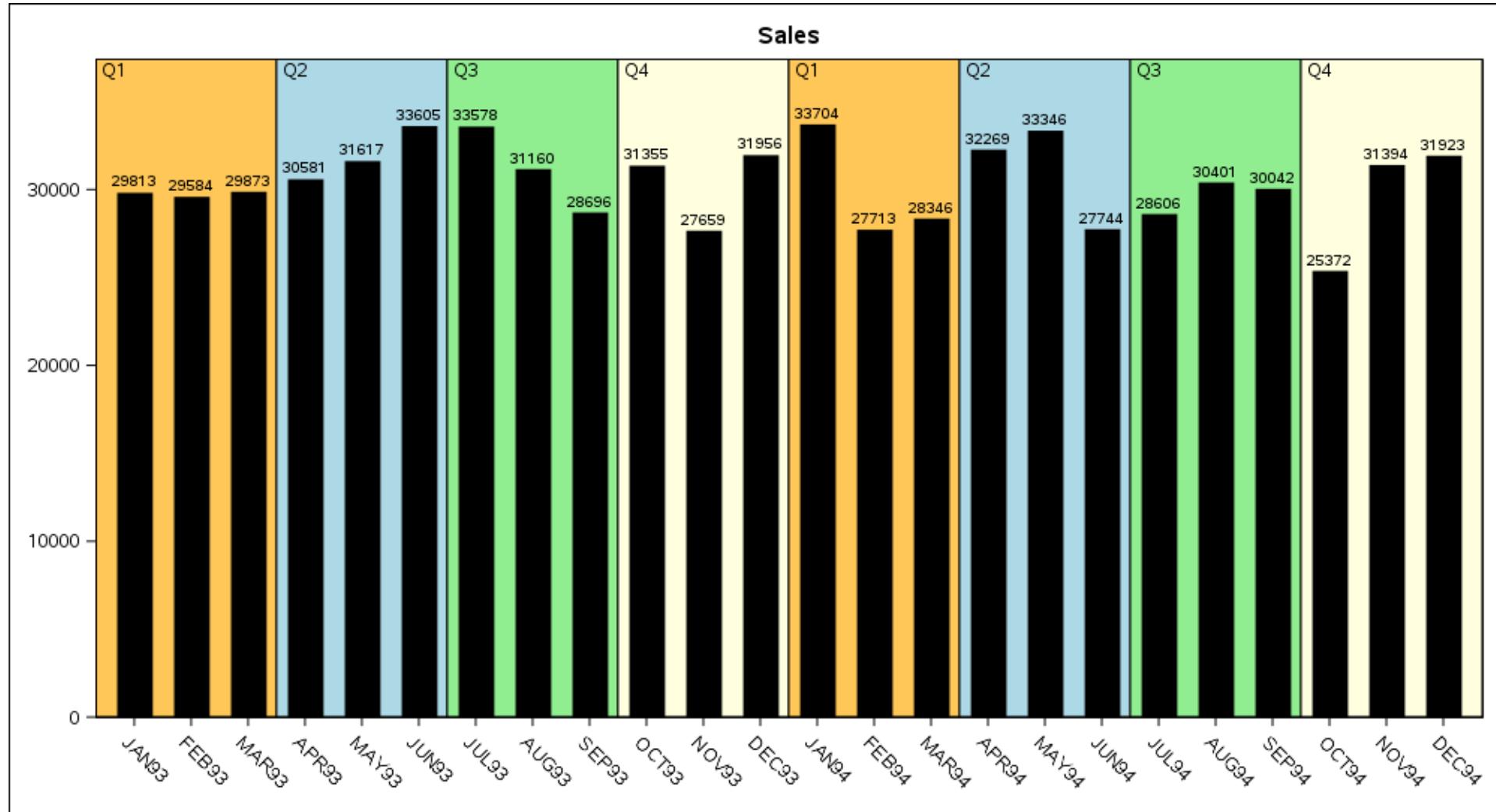
```
proc sort data=sashelp.class out=classSort;
by height;

proc sgplot data=classSort;
styleattrs datacolors=(cx6f5e0 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;
```



BLOCK CHARTS: EXERCISE 3

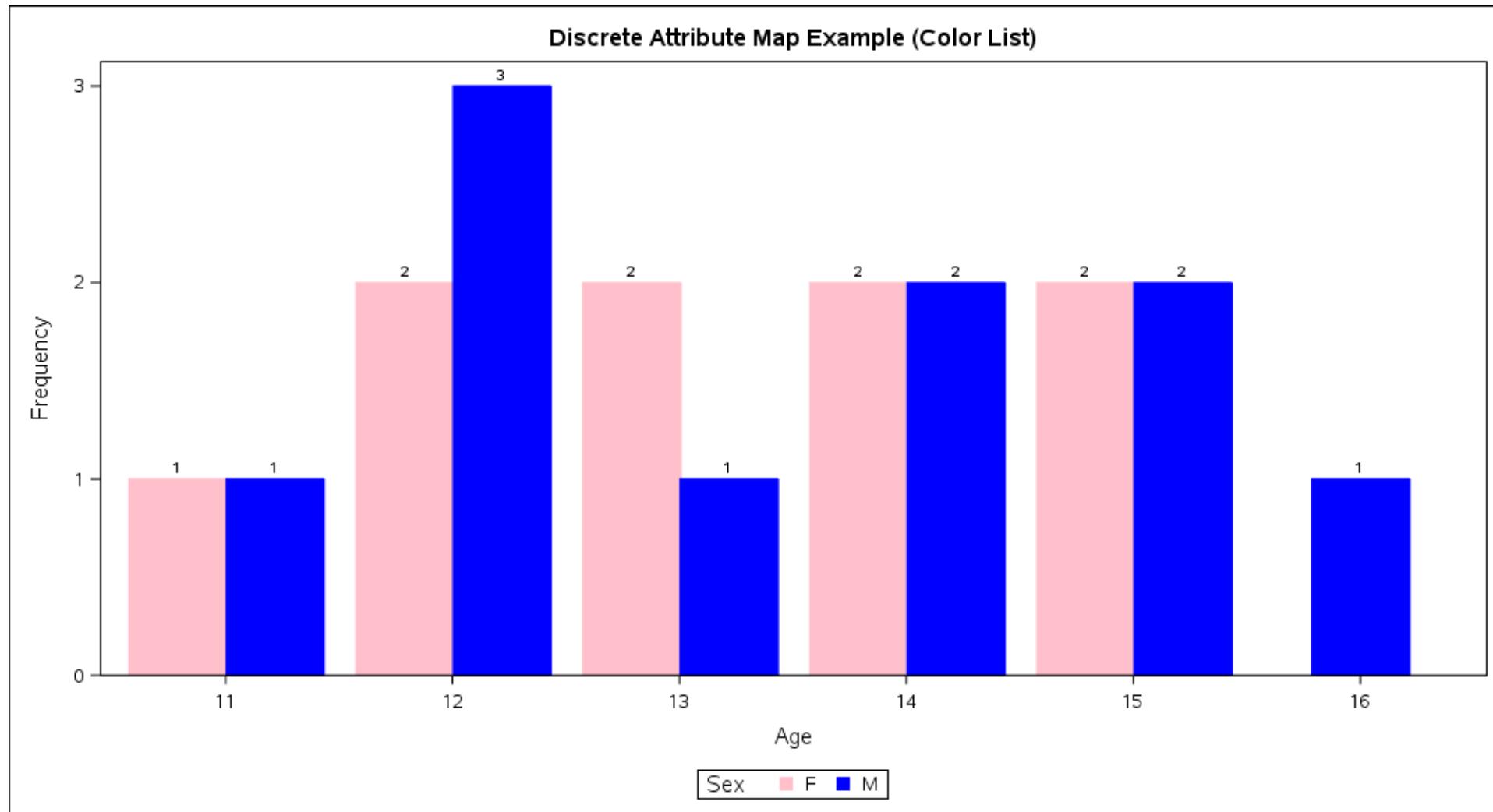
```
proc sql;
create table prdsalemth as
select month, put(month,monyy5.) as monyy, "Q"
put(quarter,1.) as qtr, sum(actual) as actual
from sashelp.prdsale group by 1, 2, 3 order by 1, 2, 3;
proc sgplot data=prdsalemth;
styleattrs datacolors=(lightorange lightblue lightgreen lightyellow);
title "Sales";
block x=monyy block=qtr / valuealign=left;
vbarparm category=monyy response=actual /
    fillattrs=(color=black) fill barwidth=.6 datalabel;
xaxis display=(nolabel) discreteorder=data;
yaxis display=(nolabel) offsetmax=0.1;
```



ATTRIBUTE MAPS CHARTS

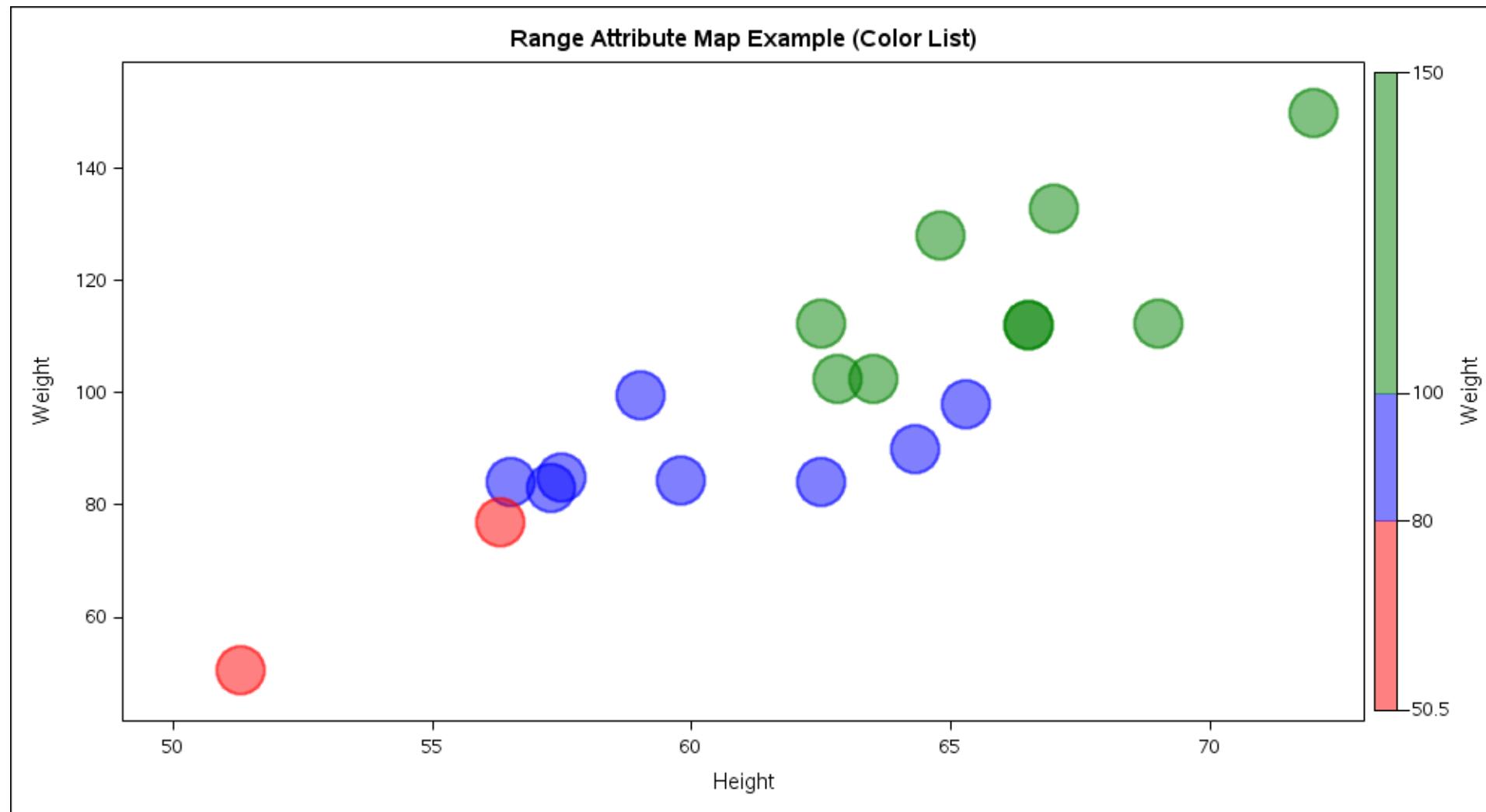
ATTRIBUTE MAPS CHARTS: EXERCISE 1

```
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;
```



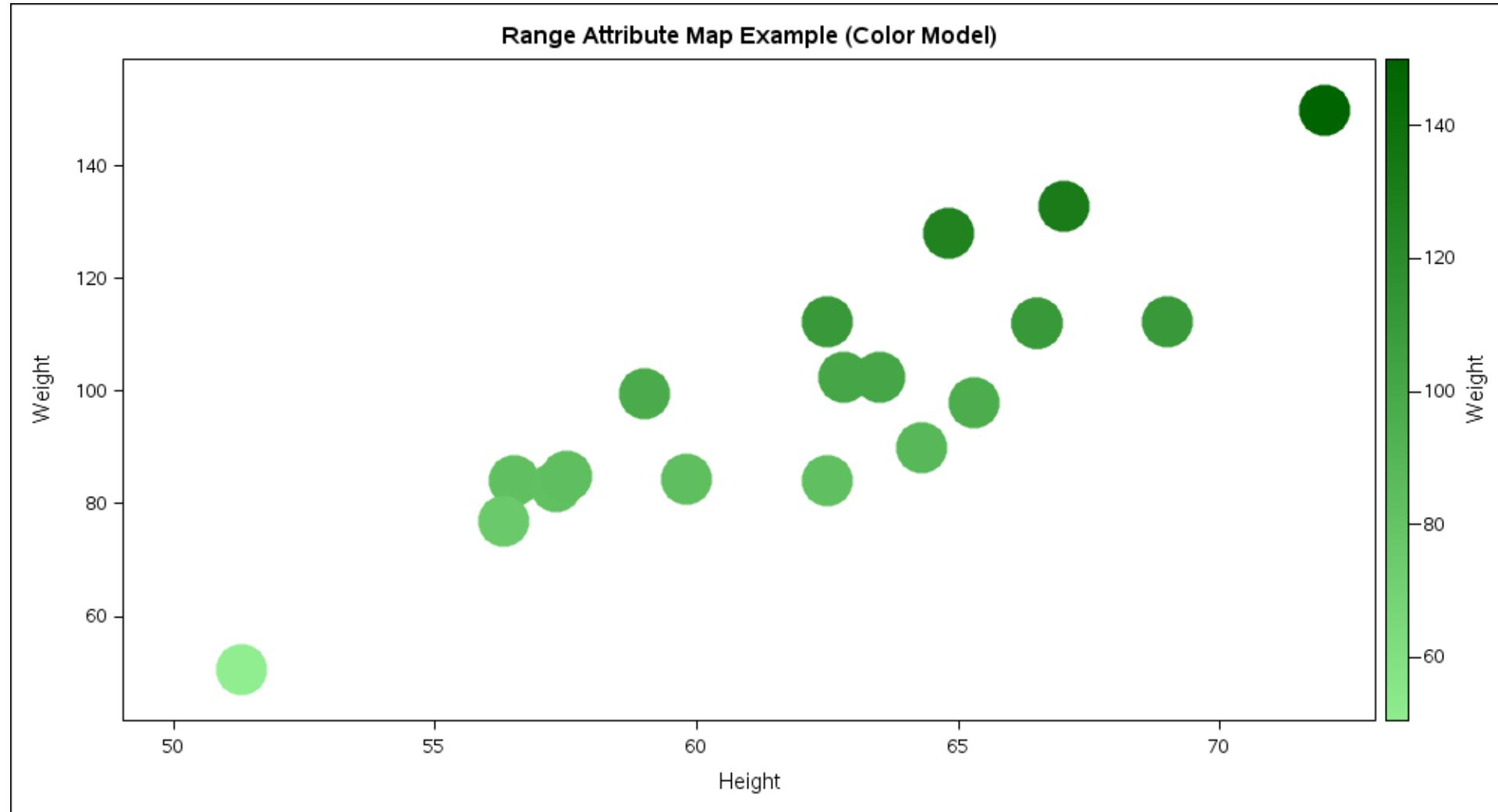
ATTRIBUTE MAPS CHARTS: EXERCISE 2

```
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);
```



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);
```

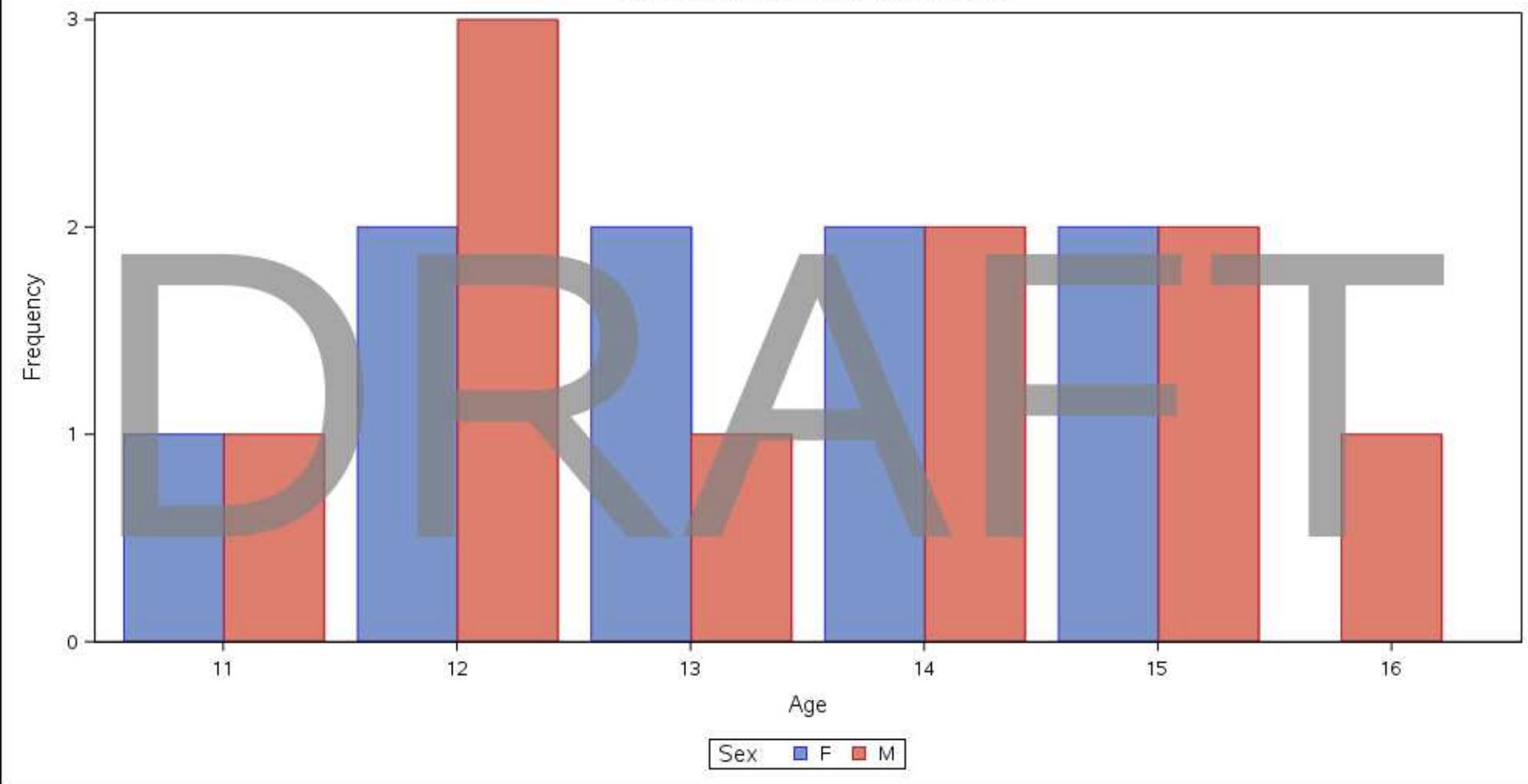


ANNOTATE CHARTS

ANNOTATE CHARTS: EXERCISE 1

```
data anno;  
retain function "text" label "DRAFT" textcolor "gray" justify "center"  
    textszie 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



SGPANEL CHARTS

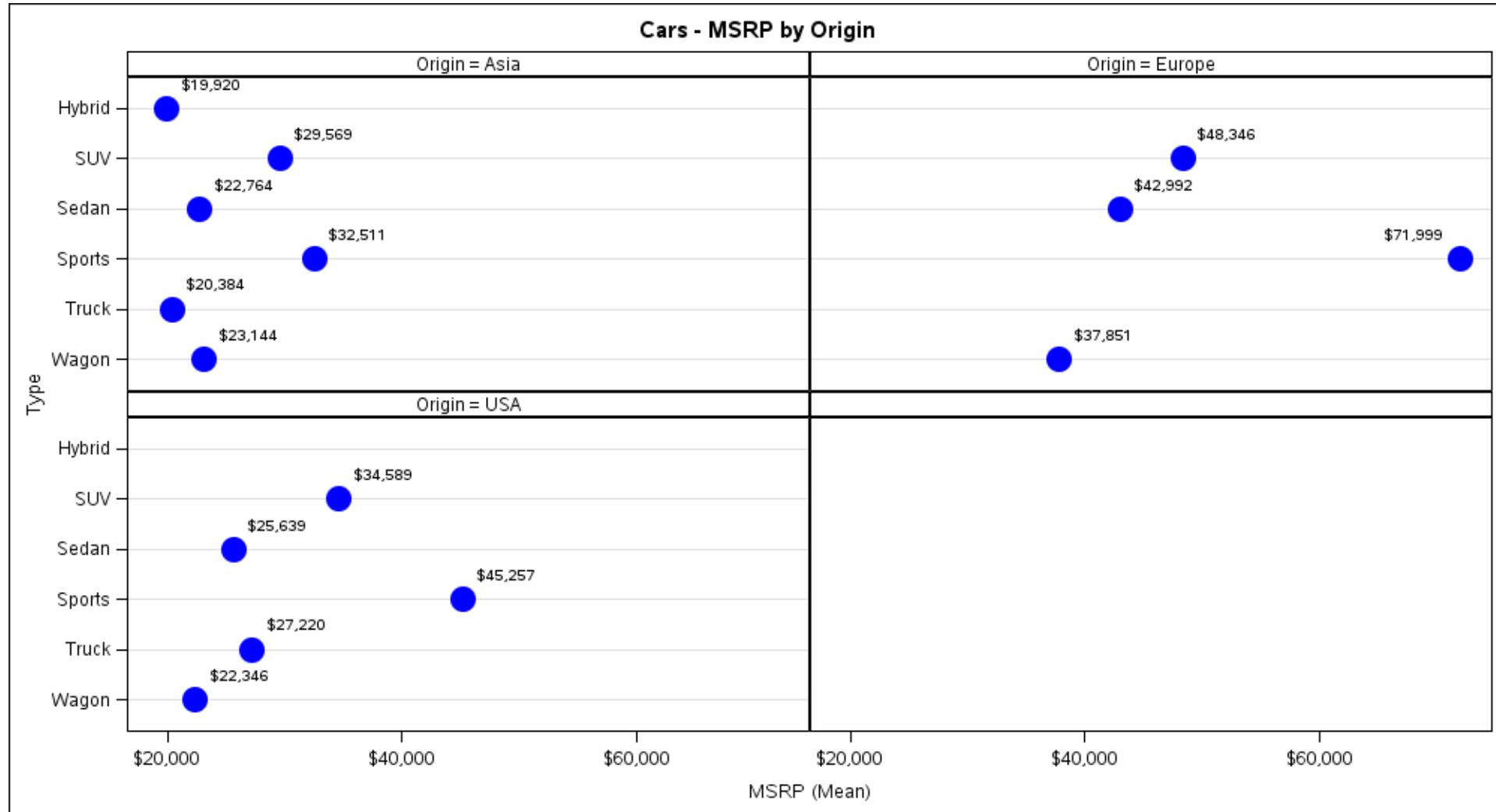
SGPANEL CHARTS: EXERCISE 1

```
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;
```



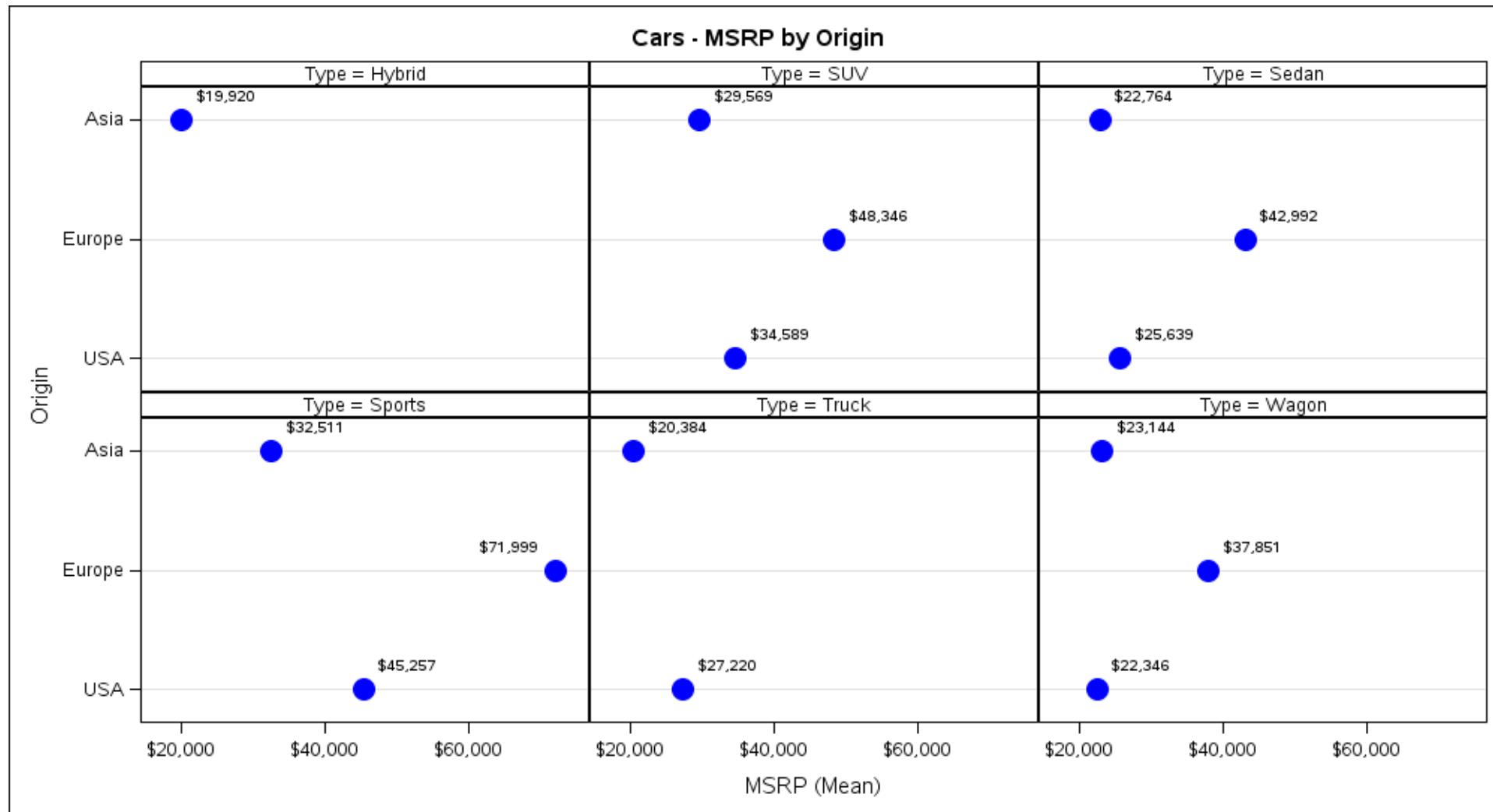
SGPANEL CHARTS: EXERCISE 2

```
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);
```



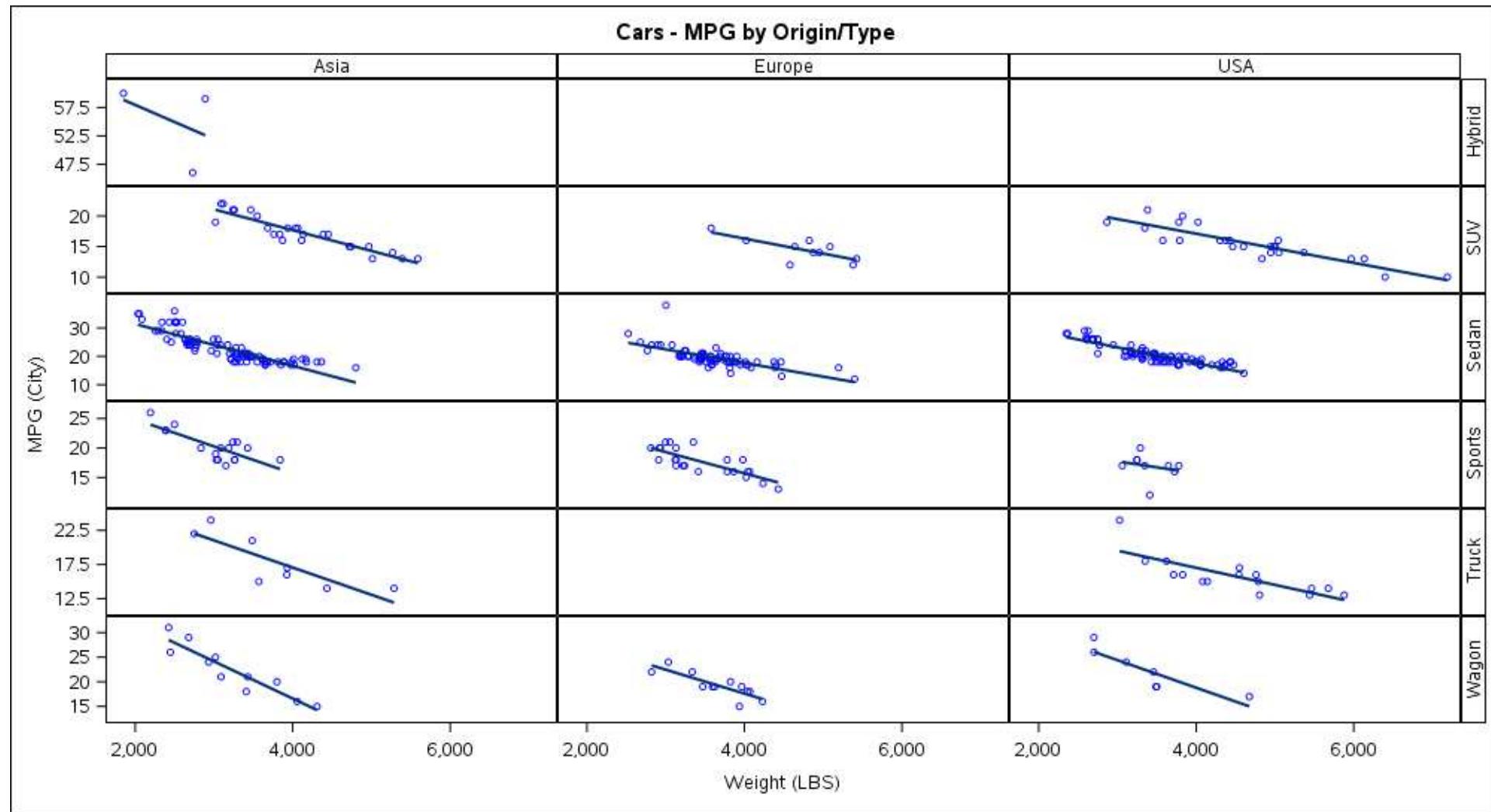
SGPANEL CHARTS: EXERCISE 3

```
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);
```



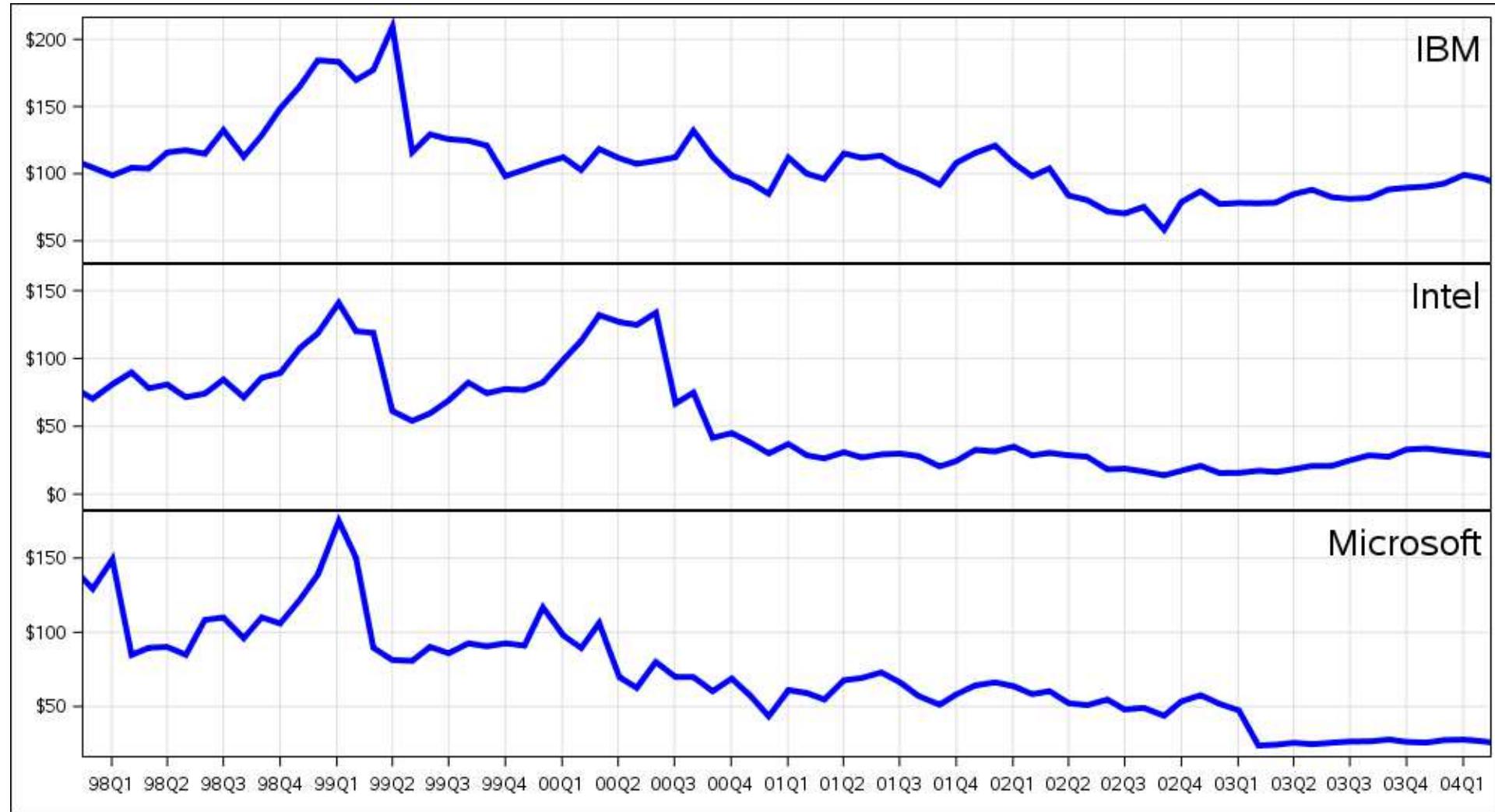
SGPANEL CHARTS: EXERCISE 4

```
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.;
```



SGPANEL CHARTS: EXERCISE 5

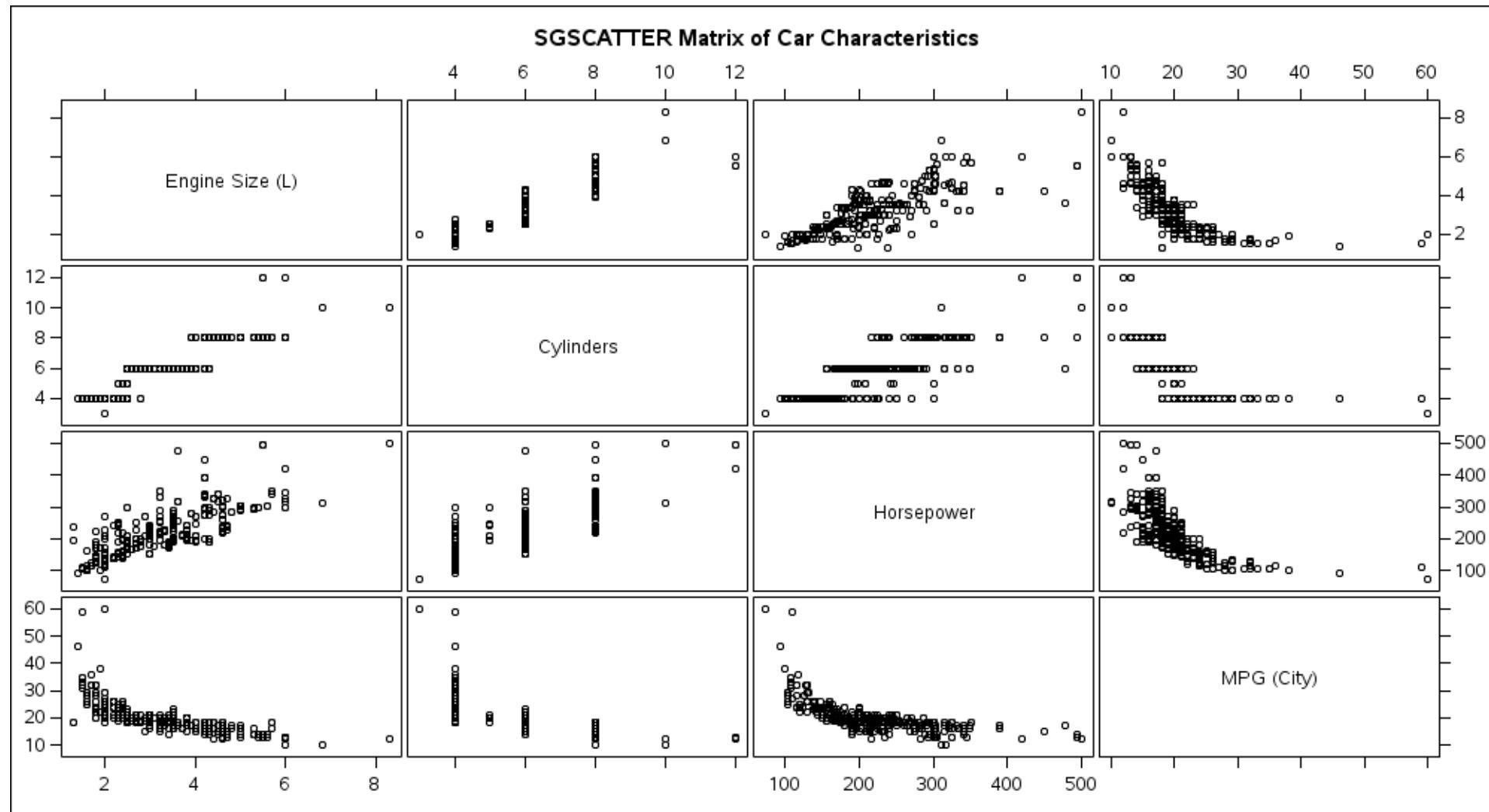
```
proc sgpanel data= sashelp.stocks;
title "Stock Closing Prices by Quarter (1998-2003)";
panelby stock / rows=3 novarname uniscale=column noheader;
title;
inset stock / nolabel textattrs=(size=18pt);
series x=date y=close / lineattrs=(thickness=3pt) lineattrs=(color=blue);
colaxis values=('01jan1998'd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



SGSCATTER CHARTS

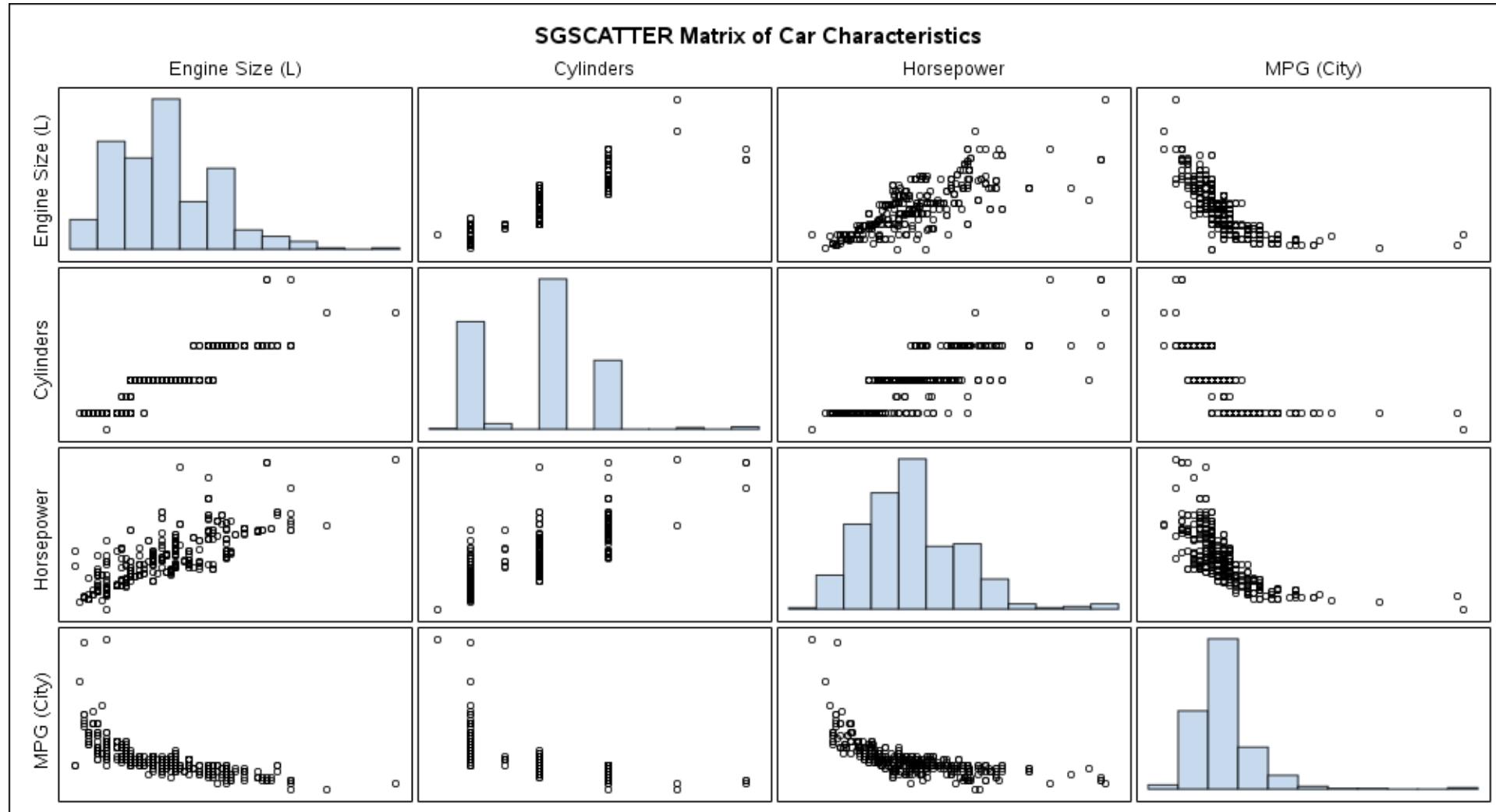
SGSCATTER CHARTS: EXERCISE 1

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



SGSCATTER CHARTS: EXERCISE 2

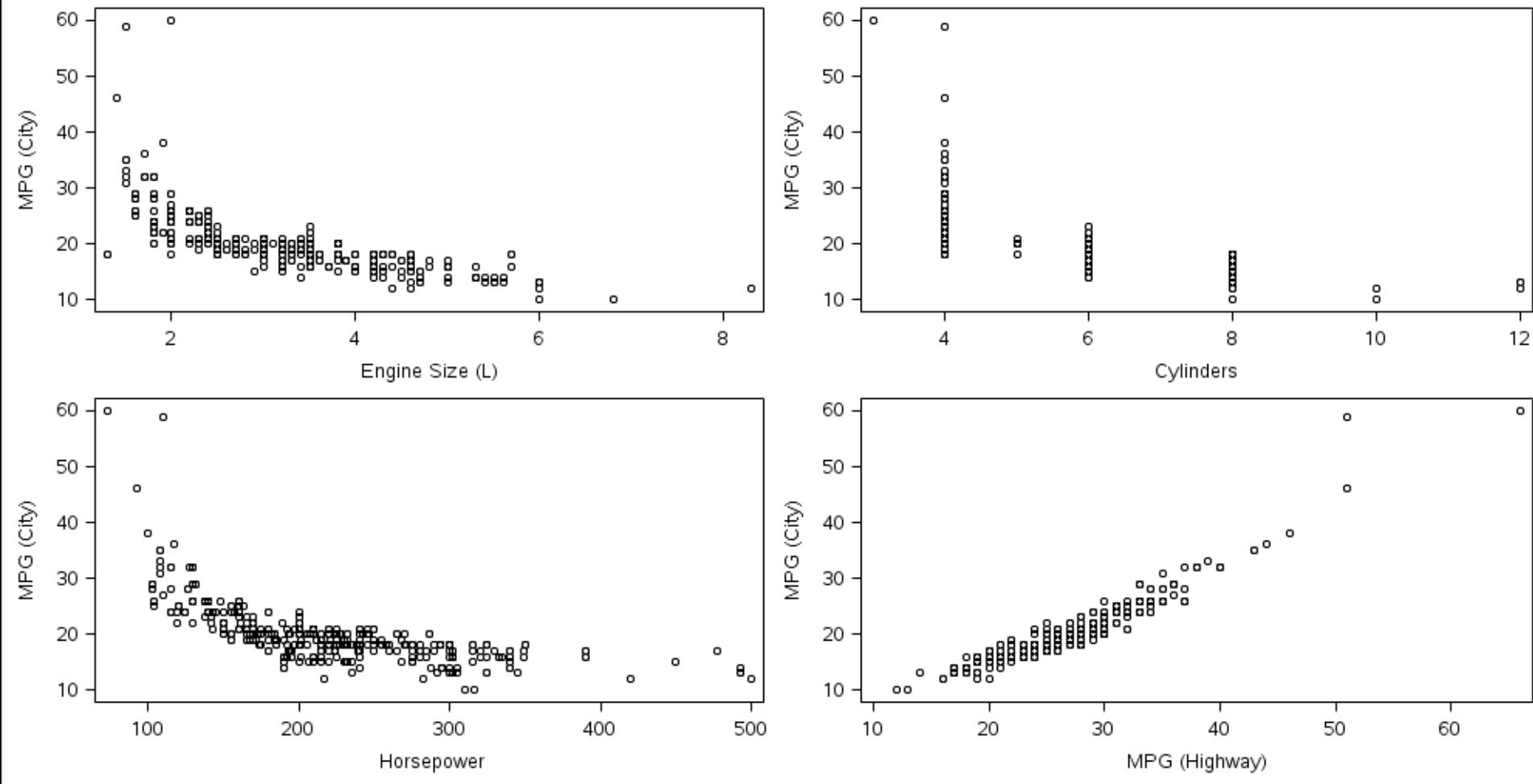
```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Matrix of Car Characteristics";
matrix enginesize cylinders horsepower mpg_city /
diagonal=(histogram) transparency=.2;
```



SGSCATTER CHARTS: EXERCISE 3

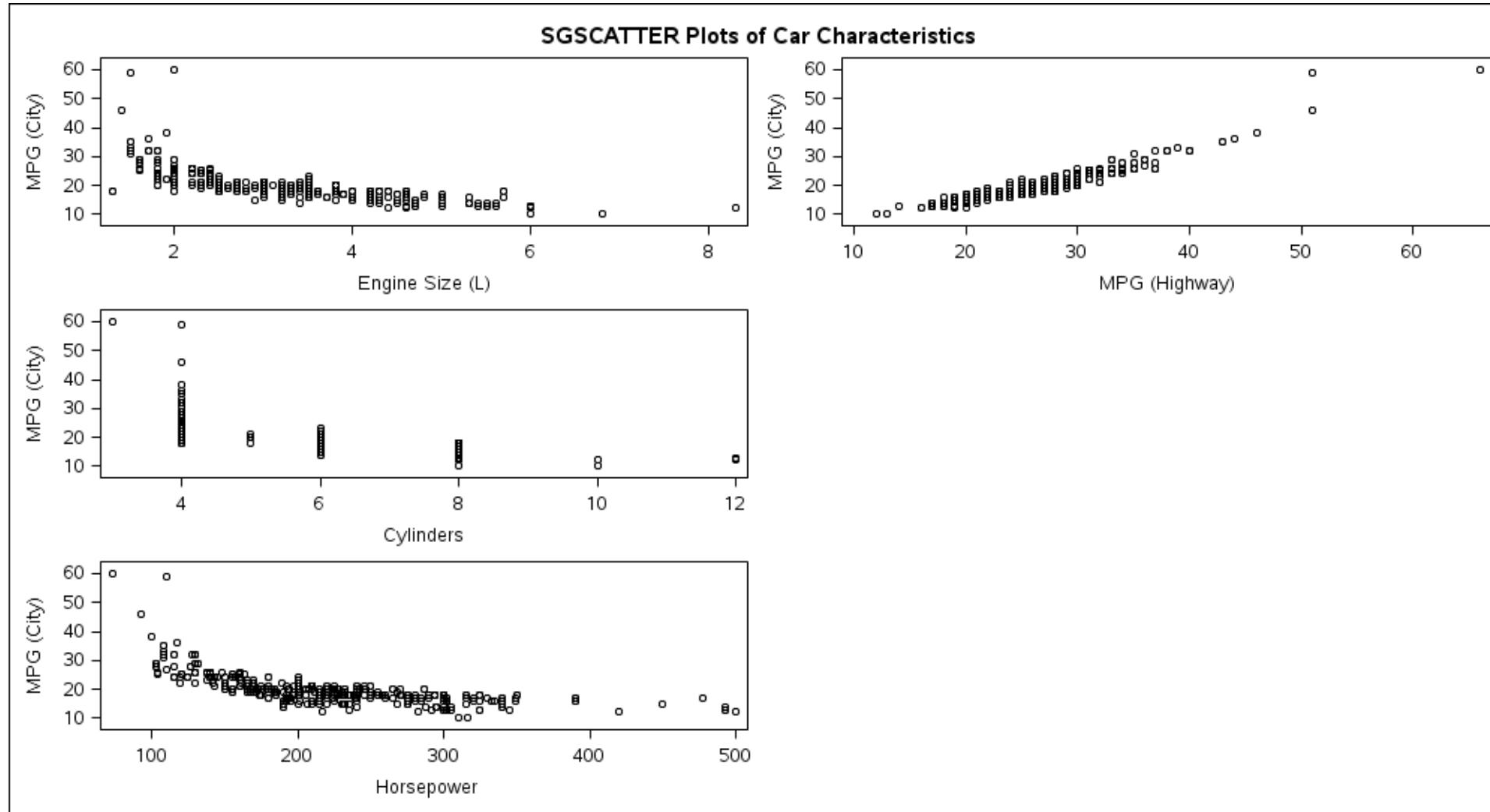
```
proc sgscatter data=sashelp.cars;
title "SGSCATTER Plots of Car Characteristics";
plot mpg_city*(enginesize cylinders horsepower mpg_highway);
```

SGSCATTER Plots of Car Characteristics



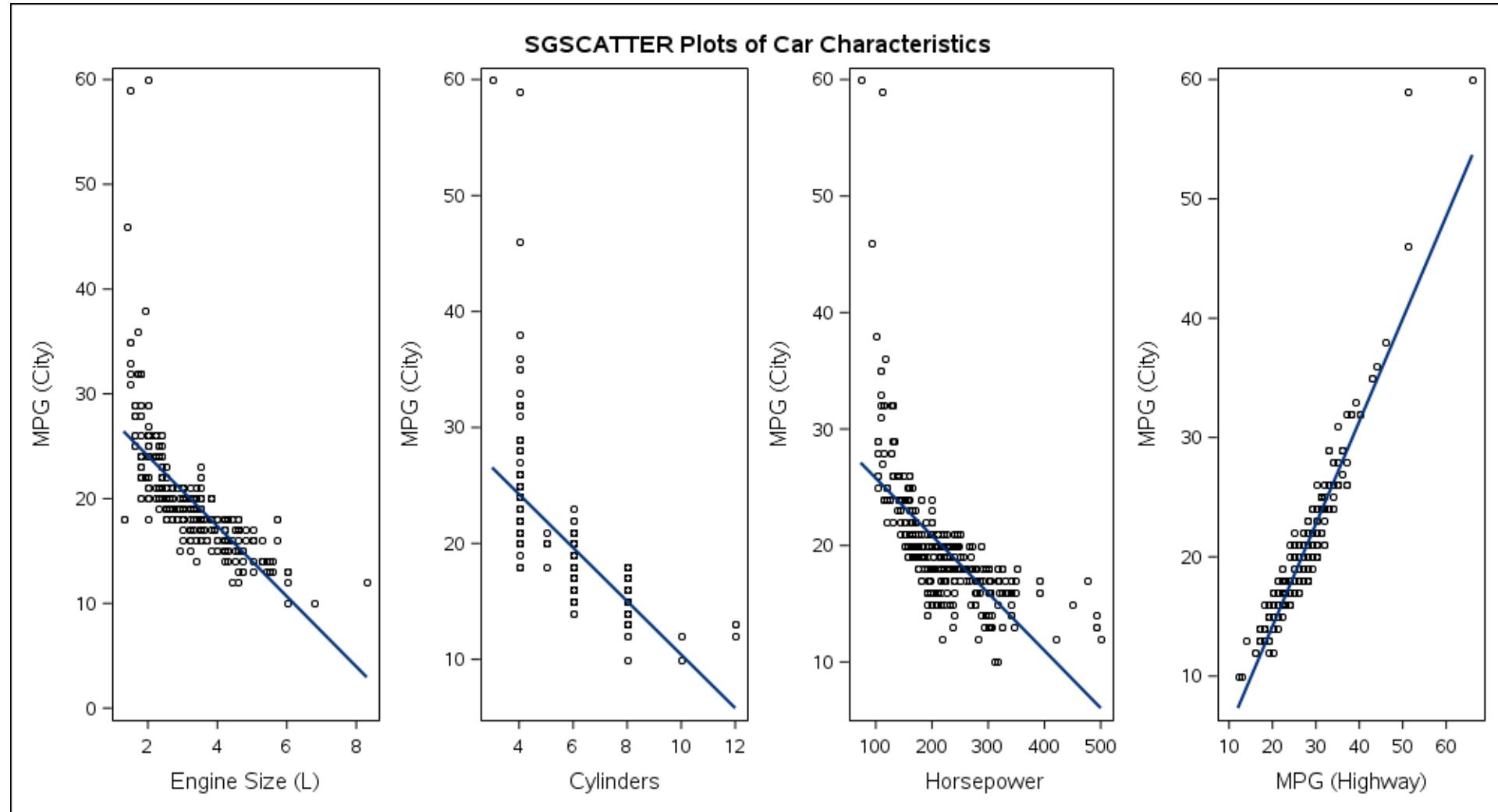
SGSCATTER CHARTS: EXERCISE 4

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



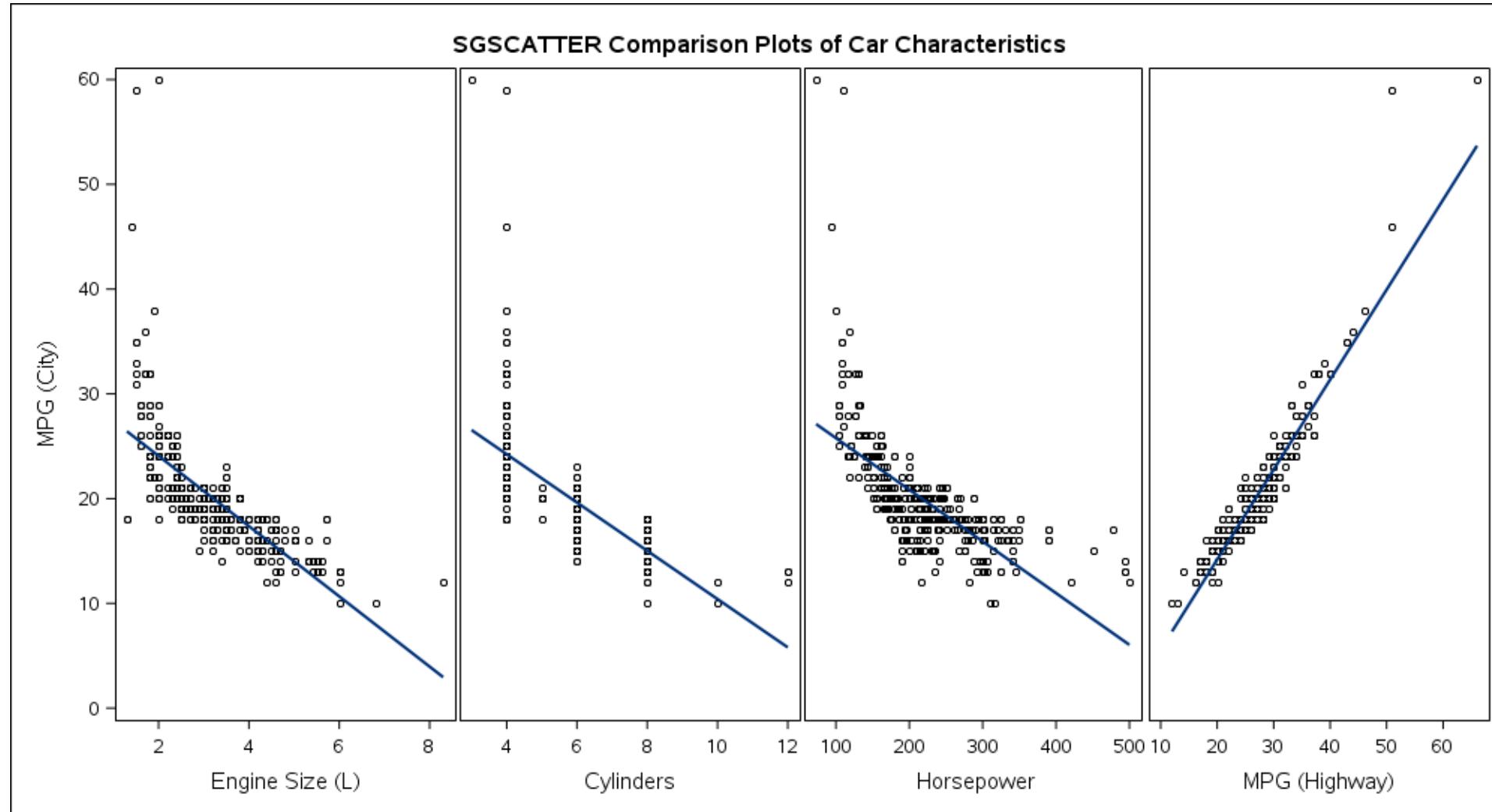
SGSCATTER CHARTS: EXERCISE 5

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



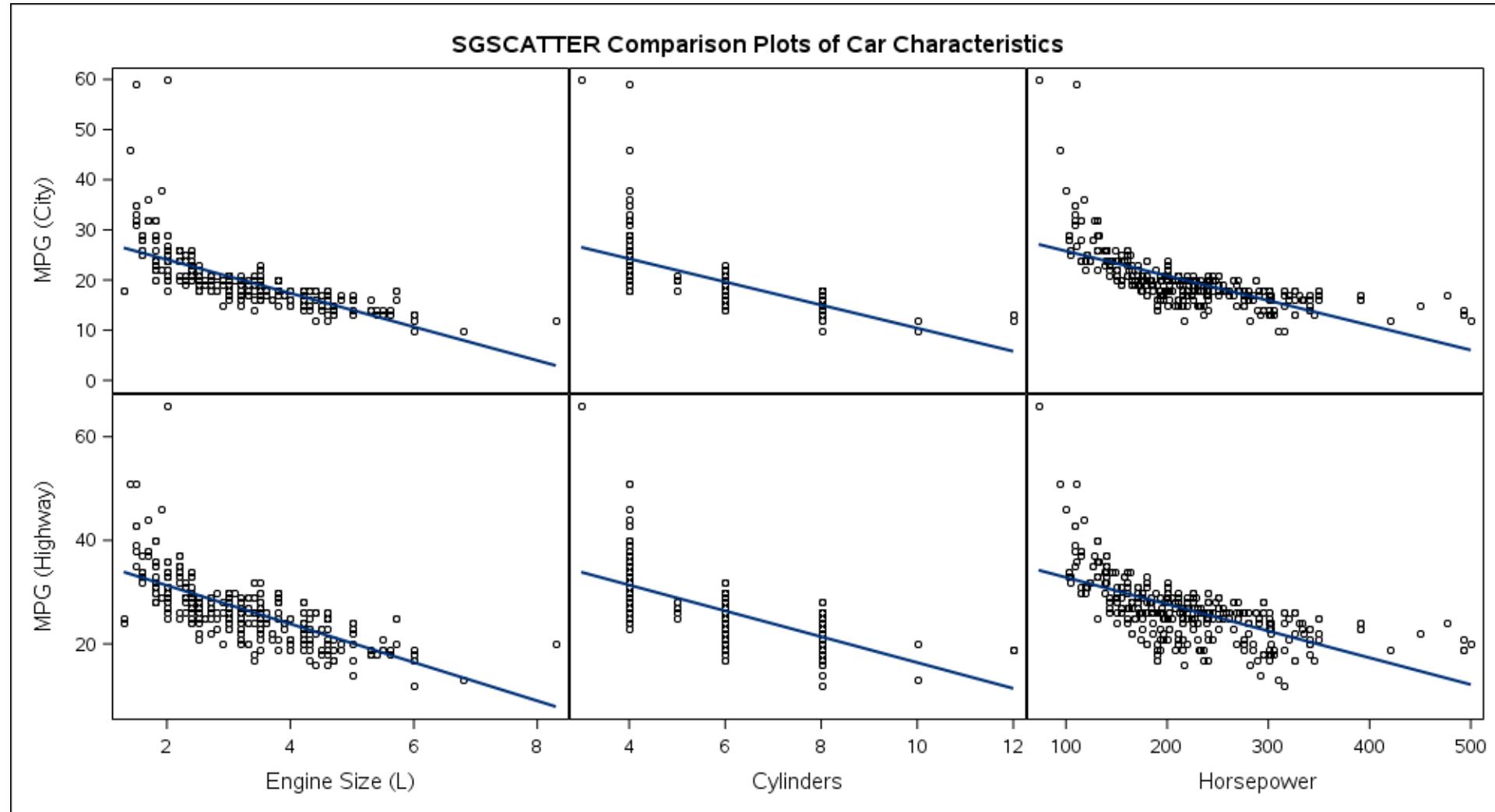
SGSCATTER CHARTS: EXERCISE 6

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



SGSCATTER 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;
```

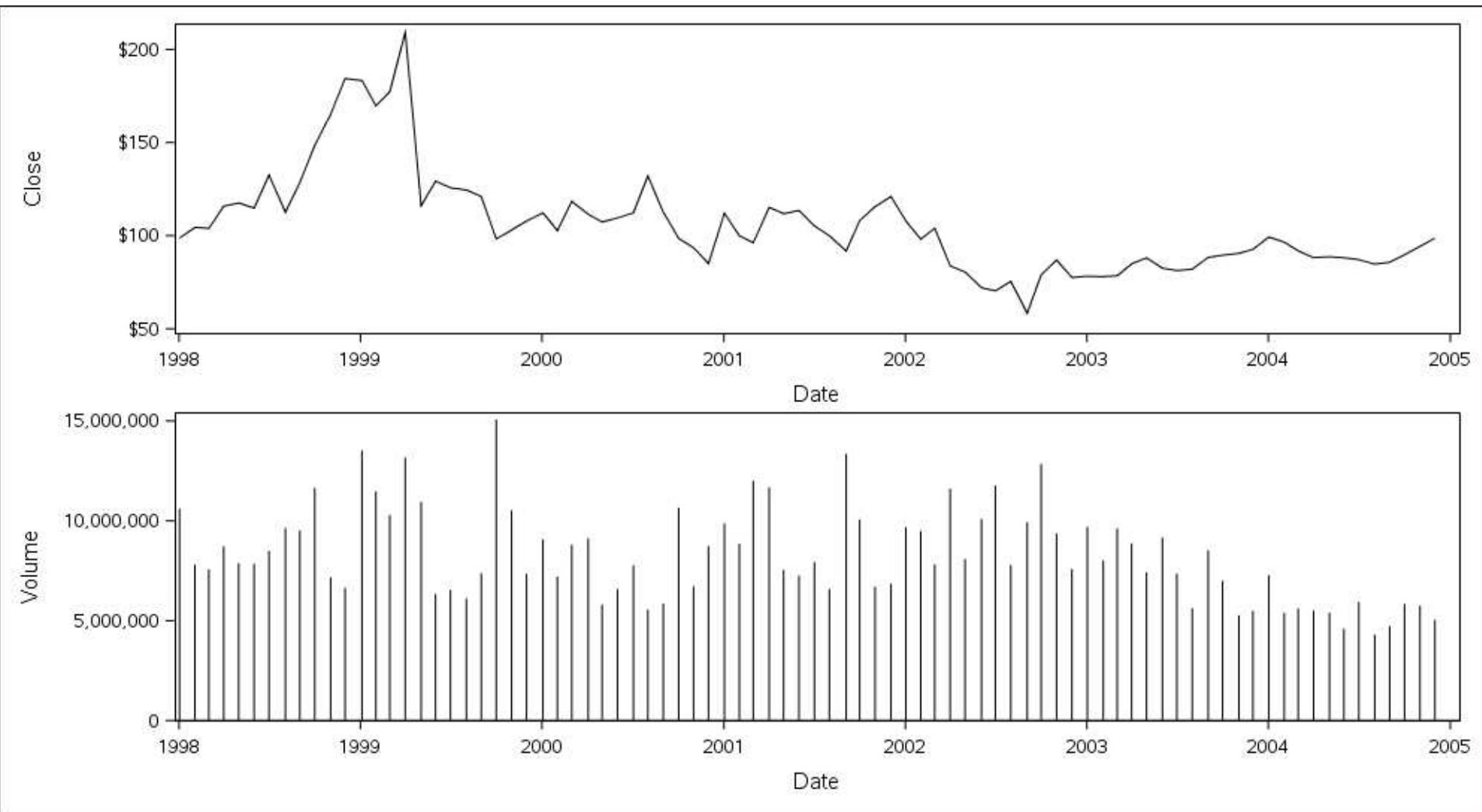


GTL CHARTS

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;

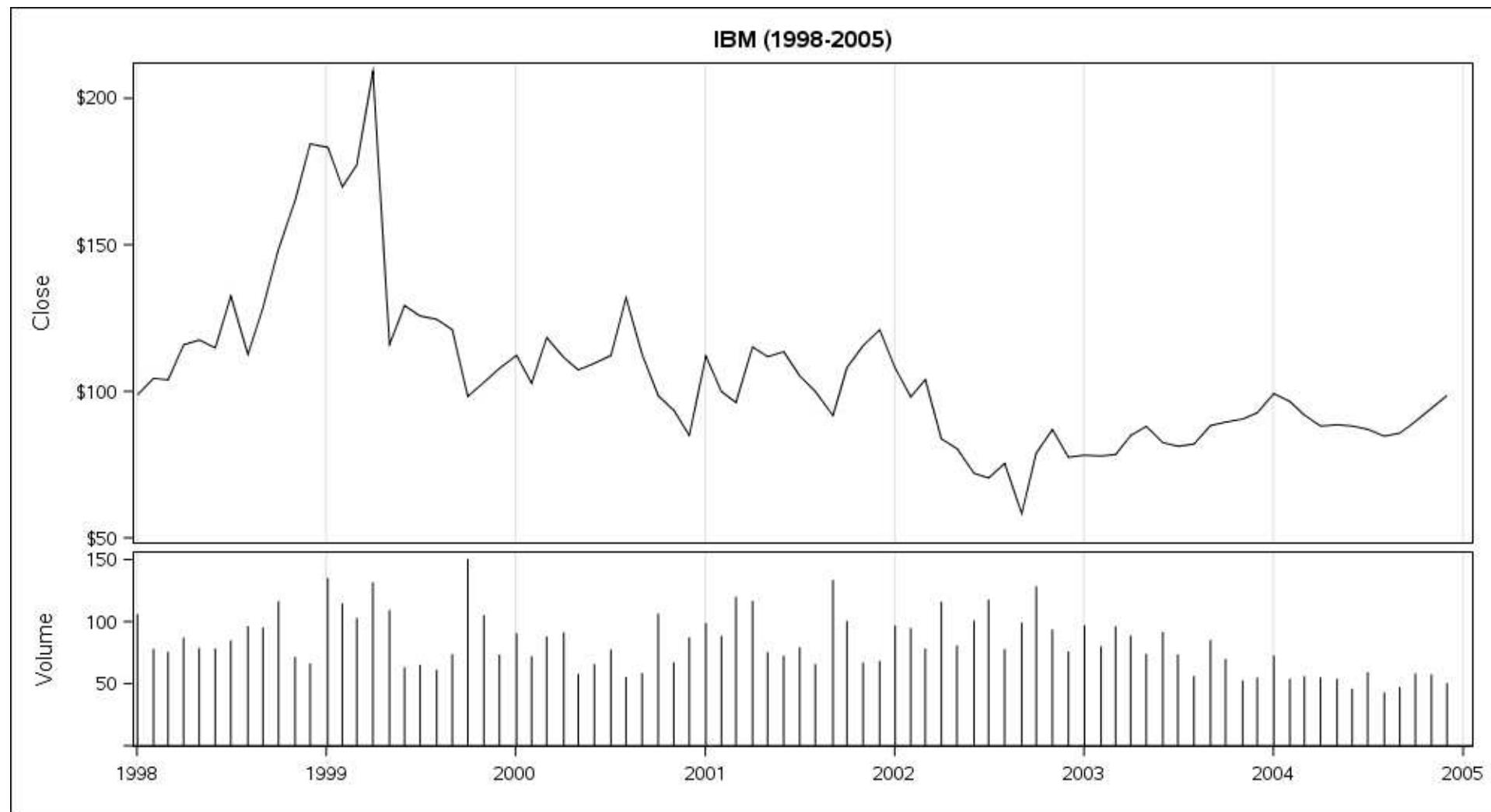
proc sgrender data=sashelp.stocks template=gtlStock;
title height=10pt "IBM Closing Stock Prices and Volume (1998-2005)";
where stock="IBM" and '01jan1998'd<=date<'01jan2005'd;
```



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.;
```



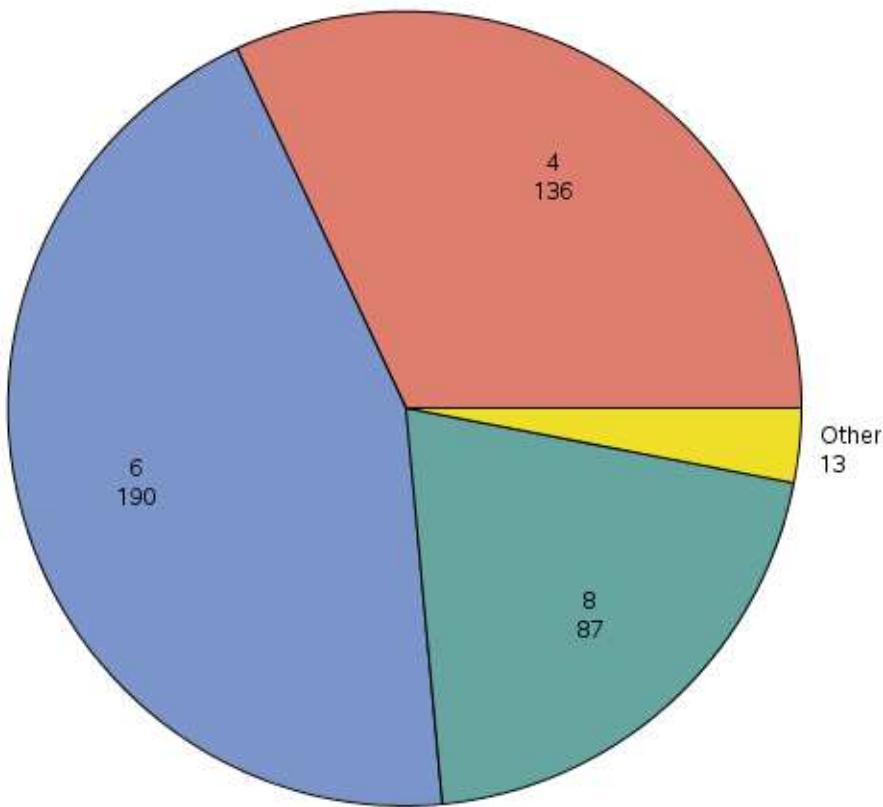
PIE CHARTS

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;
```

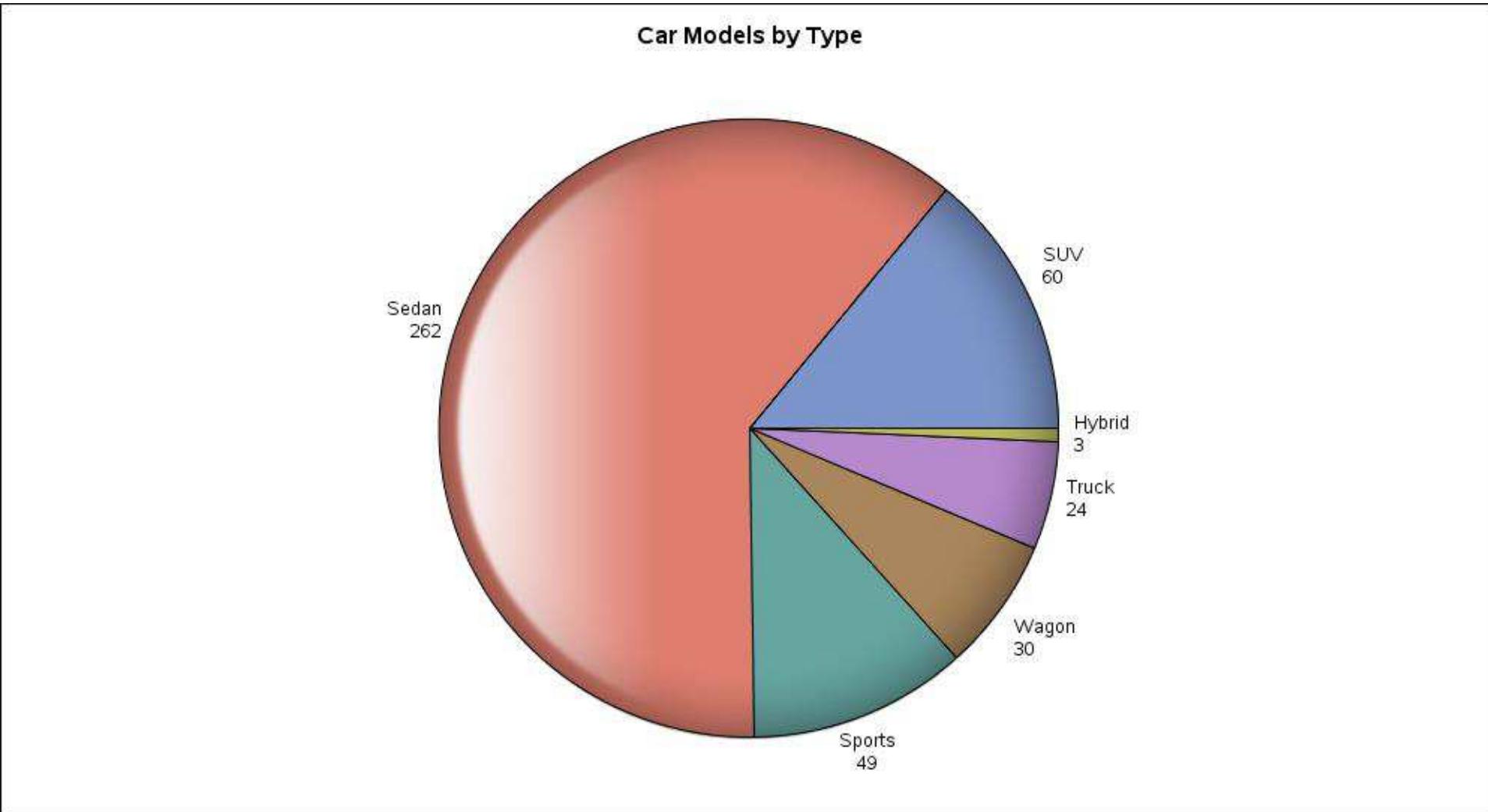
Car Models by Number of Cylinders



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;

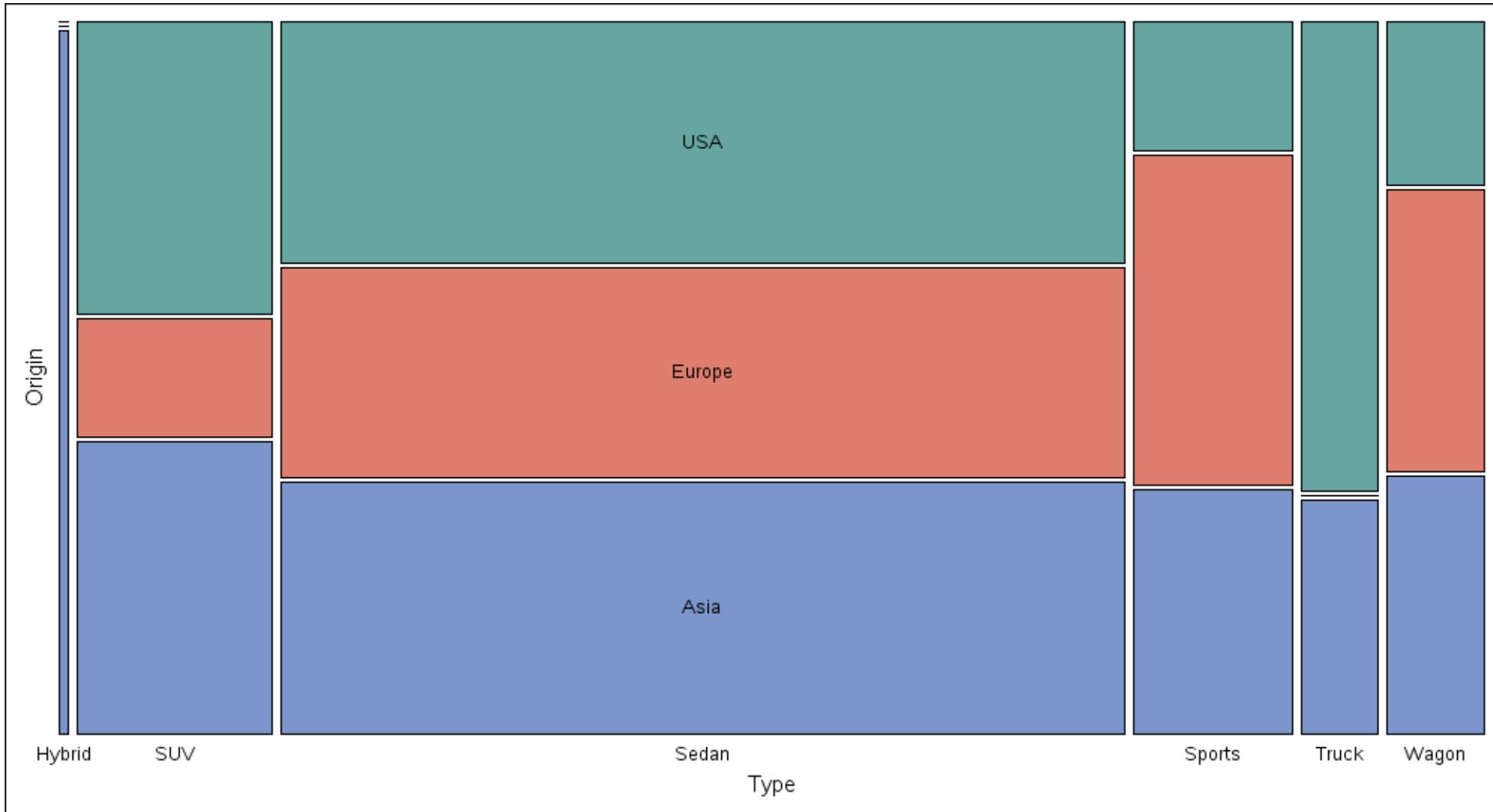
proc sgrender data=sashelp.cars template=pie;
```



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";
```



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 /
               fillatrs=(color=lightgreen) display=all;
endlayout;
endgraph;
end;

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

Avg MPG (City) by Weight and Horsepower

