

```

/*****
* Chapter 5 Example 5.5 in Johnson and Wichern 5th ed      *
* Testing Multivariate Mean Vector                        *
*****/
DM "output;clear;log;clear";
Options pagesize=45 linesize=80 PageNo=1 NoDate;
OPTIONS FORMCHAR="|---+|+---+|=|-\<>*" ;
    *To make your document display correctly without SAS Monospace font;
Title1 "Example 5.5 (Data Table 5.2)";
ODS HTML body=      "e5_5-body.html"
      contents="e5_5-contents.html"
      frame=      "e5_5-frame.html"
      page=      "e5_5-page.html"
      headtext="<title>Simultaneous inference on mean vector</title>"
      anchor="e5_5";
Data e5_5;
  infile 'C:\Teaching\Math593\Data\t5-2.dat';
  individual+1;
  Input Y1-Y3;

title "Simultaneous Inference and Confidence Ellipse for College Test Data";
Proc IML;
  Use e5_5;
  Read ALL var{Y1 Y2 Y3} into X; N=NROW(X); P=NCOL(X);
  close e5_5;
  One=SHAPE(1,N,1);
  MeanVec=(One`*X)/N;          *Calculate Mean Vector;
  M=REPEAT(MeanVec,N,1);
  Sigma=(X-M)`*(X-M)/(N-1);   *Calculate Cov Matrix;
  print MeanVec, Sigma;
  C=((N-1)*P)/(N-P)*FINV(0.95, P, N-P);
  print N P C;

  Start SCI(Mean,S,a,level,P,N); *begin module named SCI;
  C=((N-1)*P)/(N-P)*FINV(level, P, N-P);
  Margin=sqrt(C*(a`*S*a)/N);    *margin of error for T-sq simultaneous CI;
  LB=a`*Mean-Margin;
  UB=a`*Mean+Margin;
  contr=a`;
  Print contr LB UB;
  Finish;

  reset noprint;          * turns off auto printing;

  Mean=MeanVec`;
  S=Sigma;
  a={1 0 0}`;
  Run SCI(Mean,S,a,0.95,P,N); *execute module SCI for various coefficient vectors;
  a={0 1 0}`;
  Run SCI(Mean,S,a,0.95,P,N);
  a={0 0 1}`;
  Run SCI(Mean,S,a,0.95,P,N);
  a={0 1 -1}`;
  Run SCI(Mean,S,a,0.95,P,N);
run;

/* There are several ways of drawing confident ellipse. One way is the use of ODS for
creating graphics with the CORR procedure.
To have SAS successfully generate the confidence ellipse remove any version of the
JRE (Java runtime environment) that is higher than 1.4.1. This can be done from
ADD/REMOVE PROGRAMS within the Control Panel on your Windows operating system.
*/

```

```
ODS graphics on;
proc corr data=e5_5 nomiss noprint
  plots=matrix plots=scatter(ellipse=mean alpha=0.05);
  var Y1 Y2 Y3; run;
ODS graphics off;
```

```
/* You may also use SAS Macro named conlip which is available at
http://support.sas.com/ctx/samples/index.jsp.
Search "conlip". */
```

```
ODS HTML Close;
```

```
/* Probably the easiest way for confidence ellipse is an use of Insight. Run the following and
while you at the Multivariate output window choose Curves/scatter plot conf ellipse. While you
are
at one of the plot right click and change the options, for example removing the observations and
rescaling the axis, etc */
```

```
proc insight data=e5_5 File;
Mult X1 X2 X3; run;
```

Simultaneous Inference and Confidence Ellipse for College Test Data

MEANVEC		
526.58621	54.689655	25.126437

SIGMA		
5808.0593	597.8352	222.02967
597.8352	126.05373	23.388532
222.02967	23.388532	23.111735

N	P	C
87	3	8.3334833

CONTR			LB	UB
1	0	0	502.9994	550.17302

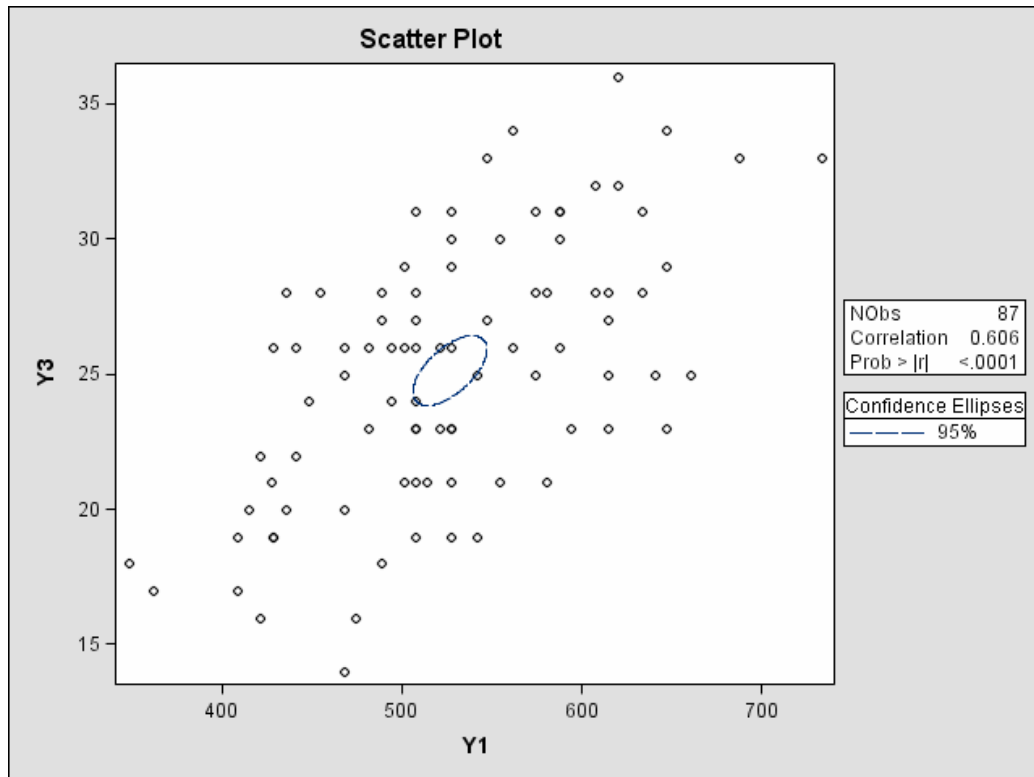
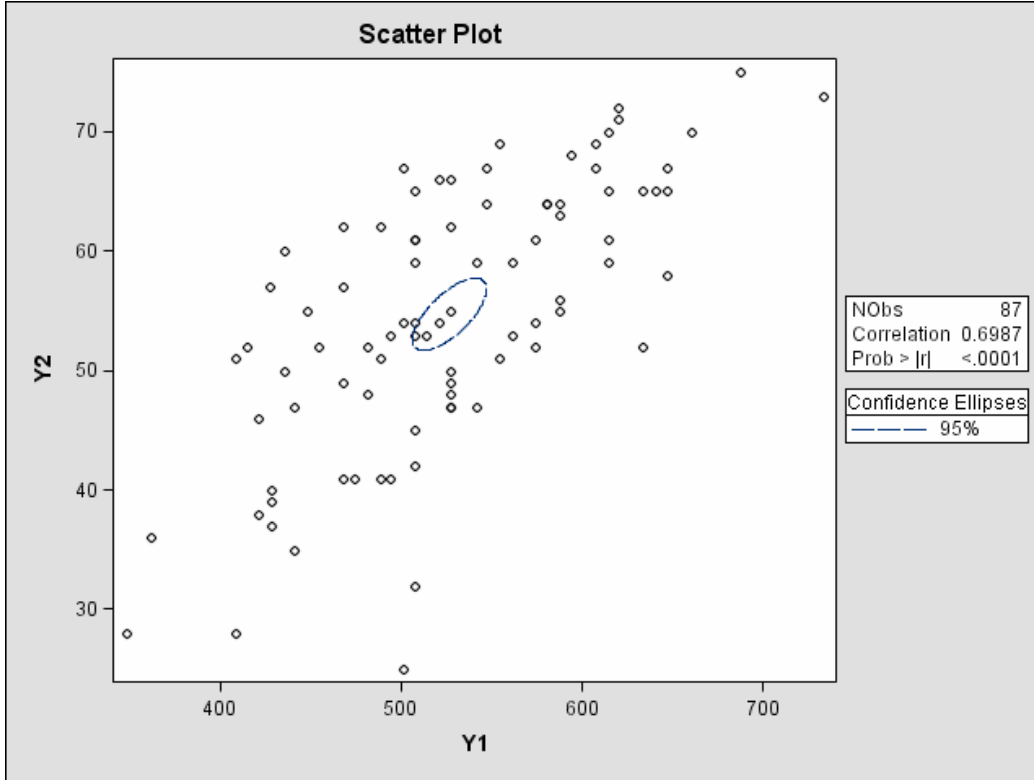
CONTR			LB	UB
0	1	0	51.214842	58.164469

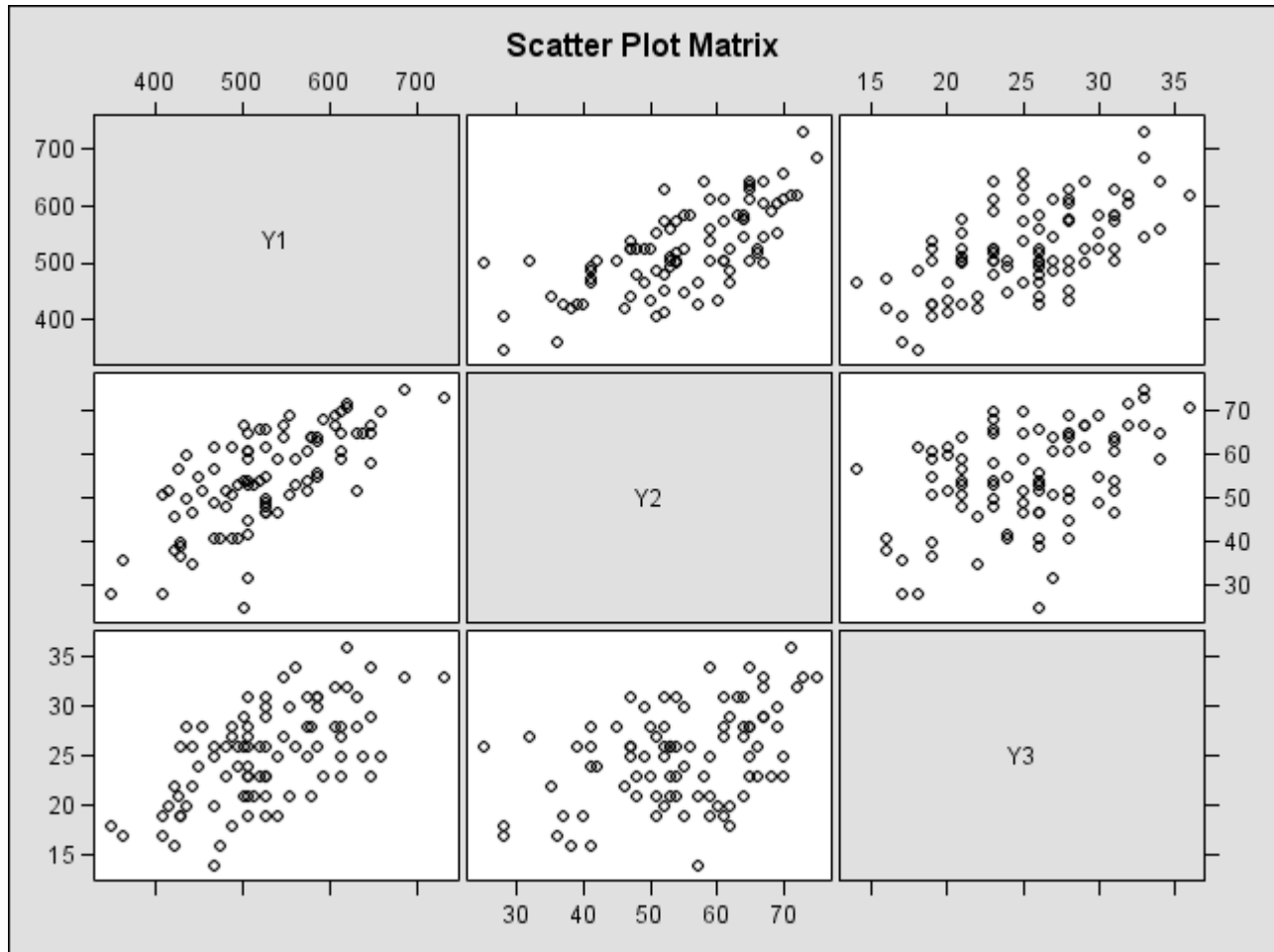
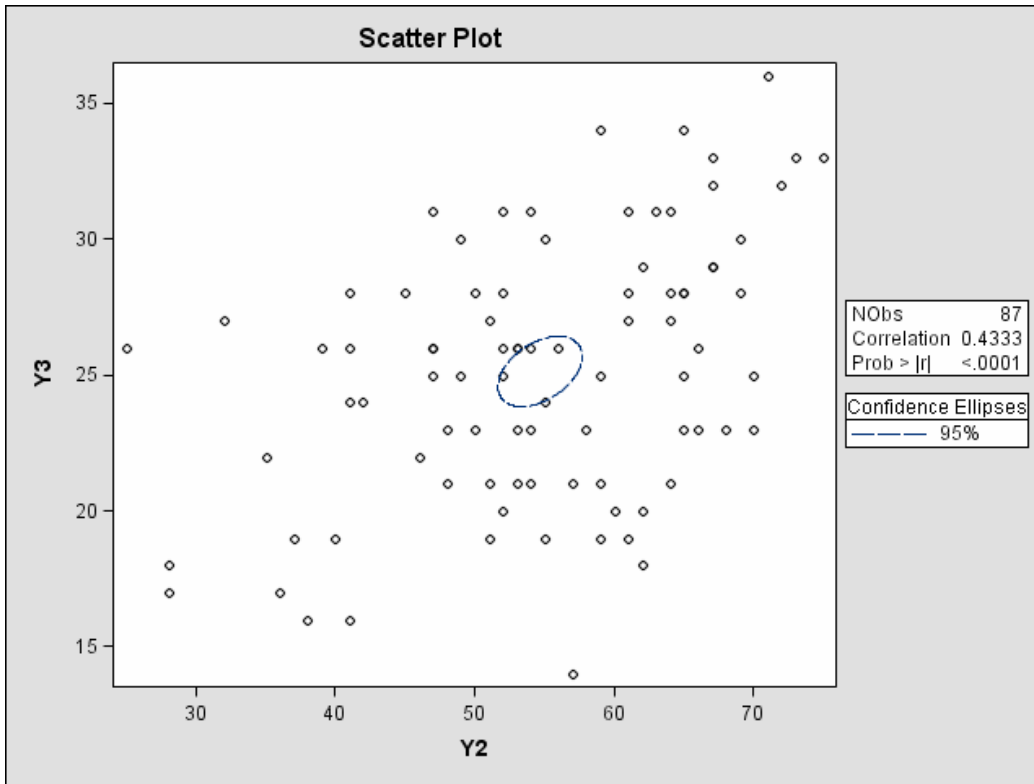
CONTR			LB	UB
0	0	1	23.63855	26.614324

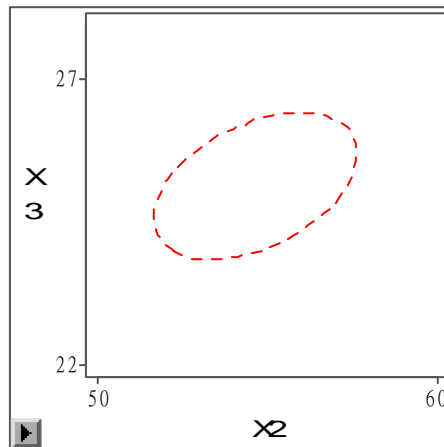
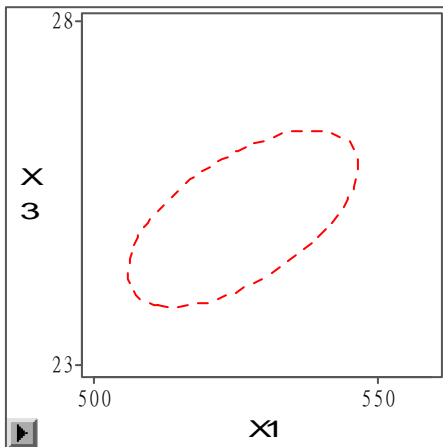
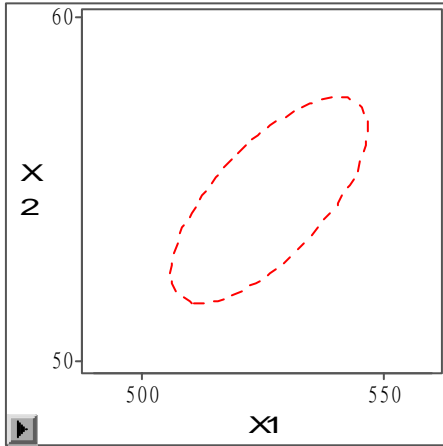
CONTR			LB	UB
0	1	-1	26.431526	32.69491

Simultaneous Inference and Confidence Ellipse for College Test Data

The CORR Procedure







Confidence Ellipses	
Type	Coefficient
Mean	0.9500

Univariate Statistics					
Variable	N	Mean	Std Dev	Minimum	Maximum
X1	87	526.5862	76.2106	348.0000	733.0000
X2	87	54.6897	11.2274	25.0000	75.0000
X3	87	25.1264	4.8075	14.0000	36.0000

Correlation Matrix			
	X1	X2	X3
X1	1.0000	0.6987	0.6060
X2	0.6987	1.0000	0.4333
X3	0.6060	0.4333	1.0000