Homework Ten

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STA4702
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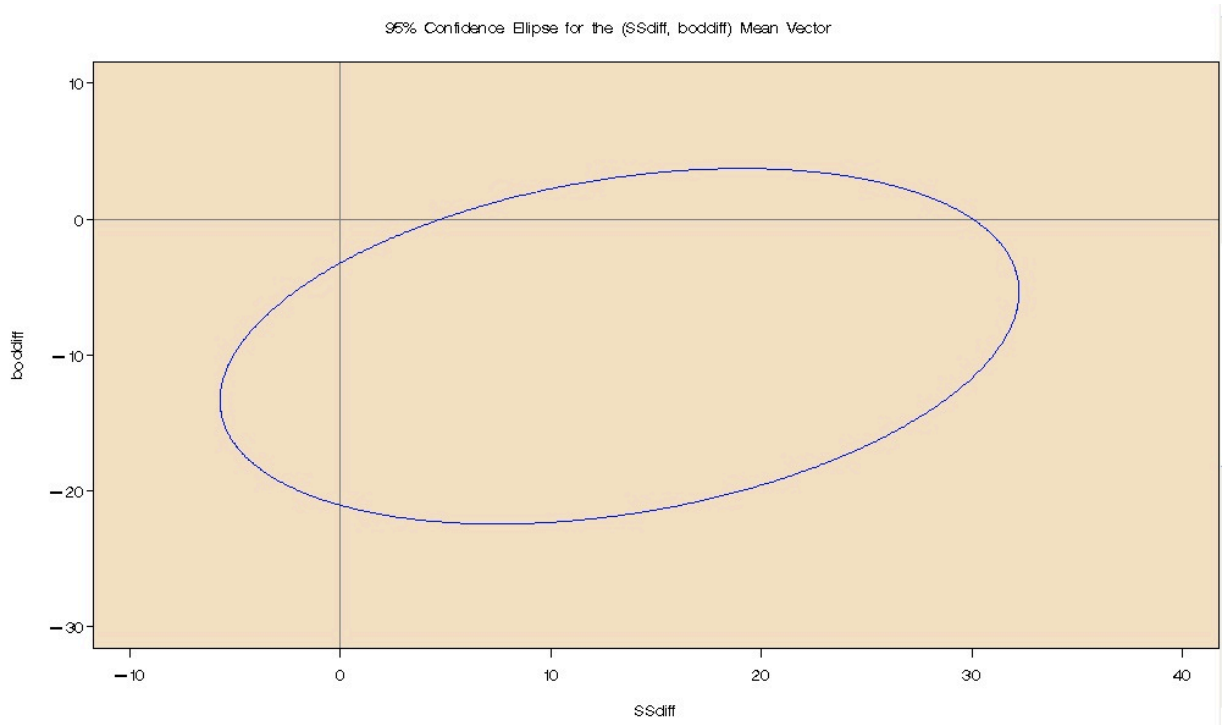
6.1



Yes, the result that point δ = 0 falls outside of the confidence region is consistent with the T^2 - test that δ ≠ 0, as the region does not contain δ = 0.

6.6a

```
        y1                  y2                  x1                  x2
s1

         3          3         2          3         2          4         3
2          1       -1.5
         1          6         5          1
-1.5          3
         2          3         3          1
                              2          3

                            s2                  n1         n2      spool

                             2 -1.333333         3          4       1.6
-1.4
                    -1.333333 1.3333333                          -1.4
```

6.6b $T^2 = 3.87$. Compared to $\frac{(n_1 + n_2 - 2)p}{(n_1 + n_2 - p - 1)} F_{p,n_1+n_2-p-1}$, or $(10/4)F_{2,4}(.01)$ = 45. As 3.87 < 45, there is no evidence against the hypothesis $H_0 = \mu_1 - \mu_2 = 0$.

6.6c The 99% simultaneous confidence intervals for the differences $\mu_{1i} - \mu_{2i}$ for $i = 1, 2$ are

$$(\bar{x}_{11} - \bar{x}_{21}) \pm \sqrt{\frac{(n_1+n_2-2)p}{n_1+n_2-p-1}F_{p,n_1+n_2-p-1}(\alpha)}\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)\mathbf{S}_{11,\text{pooled}}}$$

(2–3) ± sqrt(45*(1/3+1/4)*1.6) = -1 ± 6.481

and

$$(\bar{x}_{12} - \bar{x}_{22}) \pm \sqrt{\frac{(n_1+n_2-2)p}{n_1+n_2-p-1}F_{p,n_1+n_2-p-1}(\alpha)}\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)\mathbf{S}_{22,\text{pooled}}}$$

(4 – 2) ± sqrt(45*(1/3+1/4)*2) = 2 ± 7.246

CODE

```
/* 6.1a */

data t61;
  infile "\
\psf\Home\Documents\University\Spring_2012\STA4702\Datasets\T6-1.dat";
  input x1 x2 x3 x4;
  boddiff = x1-x3;
  SSdiff  = x2-x4;
run;

title '95% Confidence Elipse for the (SSdiff, BODdiff) Mean Vector';
proc sgscatter data = T61;
      compare y = boddiff x = SSdiff / ellipse = (type=mean);
run; title '';

/* Program to graph the confidence ellipse for the mean vector */
%let inputdata = T61;  /* this line must be edited */
%let var1      = SSdiff  ;           /* this line must be edited */
%let var2      = boddiff    ;           /* this line must be edited */
%let conf      = 95    ;           /* Confidence level desired*/
proc corr data=&inputdata noprint nocorr cov outp=covout(type=cov);
    var &var1 &var2;
run;
data covonly;
```

```
   set covout;
   if _type_='COV';
   keep &var1 &var2;
run;
data meanonly;
   set covout;
   if _type_='MEAN';
   keep &var1 &var2;
run;
data nonly;
   set covout;
   if _type_='N';
   keep &var1 &var2;
run;
proc iml;
   use covonly;
   read all into S;
   p = ncol(S);
   use meanonly;
   read all into xbar;
   xbar = xbar`;
   use nonly;
   read all into n;  n=n[1,1];
  A = S/n;
  Evec = Eigvec(A);
  Eval = diag(Eigval(A));
  EvecS = Eigvec(S);
  EvalS = diag(Eigval(S));
  try1 = Evec*Eval*Evec`;
  center = xbar;
  F = finv(&conf/100, p, n-p);
  one = (p*(n-1));
  two = (n*(n-p));
  diff = ((p*(n-1))/(n*(n-p)))*F;
  diffT = sqrt(((p*(n-1))/(n-p))*finv(&conf/100, p, n-p));
  ss = sqrt(diag(S)/n);
  distances = sqrt(diag(EvalS))*sqrt(((p*(n-1))/(n*(n-p)))*finv(&conf/100, p,
n-p));
  distance = sqrt((n-1)*p*finv(&conf/100, p, n-p) /(n-p));
  T2distminus   = xbar - sqrt(((p*(n-1))/(n-p))*finv(&conf/100, p, n-
p))*sqrt(diag(S)/n);
  T2distplus   = xbar + sqrt(((p*(n-1))/(n-p))*finv(&conf/100, p, n-
p))*sqrt(diag(S)/n);
  print xbar distance distances center EvecS EvalS F one two diff diffT S
T2distminus T2distplus ss;


npoints = 1000;
free xbig;
do r = 1 to npoints;
    angle = 2*3.14159265 * (r/npoints);
    w1 = sin(angle);
    w2 = cos(angle);
    w = w1//w2;
    x = Evec*sqrt(Eval)*distance*w + center;
```

```
    xbig = xbig//x`;
end;
create plotdata from xbig;
append from xbig;
quit;
goptions ftext=SWISS ctext=BLACK htext=1 cells;
axis1 width=1 offset=(3 pct) label=(a=90 r=0) ;
axis2 width=1 offset=(3 pct) ;
symbol1 c=BLUE ci=BLUE v=none height=1 cells
        interpol=spline l=1 w=1;
proc gplot data=Work.Plotdata(rename=(Col1=&var1 Col2=&var2)) ;
   title "&conf% Confidence Ellipse for the (&var1, &var2) Mean Vector";
   plot &var2 * &var1  /
      caxis = BLACK
      ctext = BLACK
      cframe = CXF7E1C2
      href=0
      vref=0
      hminor = 0
      vminor = 0
      vaxis = axis1
      haxis = axis2
      ;
      run;
quit;
goptions ftext= ctext= htext=;
symbol1;
axis1; axis2;
title;

/* 6.6a */

proc iml;
      y1 = {3 3, 1 6, 2 3};
      y2 = {2 3, 5 1, 3 1, 2 3};
      x1 = mean(y1);
      x2 = mean(y2);
      n1 = nrow(y1);
      n2 = nrow(y2);
      s1 = cov(y1);
      s2 = cov(y2);
      spool = (((n1-1)/(n1+n2-2))*s1) + (((n2-1)/(n1+n2-2))*s2);
      print y1 y2 x1 x2 s1 s2 n1 n2 spool; quit;
run;

/* 6.6b */

proc iml;
      y1 = {3 3, 1 6, 2 3};
      y2 = {2 3, 5 1, 3 1, 2 3};
      x1t = mean(y1);
      x2t = mean(y2);
      x1 = (x1t)`;
      x2 = (x2t)`;
      n1 = nrow(y1);
```

```
      n2 = nrow(y2);
      s1 = cov(y1);
      s2 = cov(y2);
      spool = (((n1-1)/(n1+n2-2))*s1) + (((n2-1)/(n1+n2-2))*s2);
      t2 = (x1-x2)`*inv(((1/n1)+(1/n2))*spool)*(x1-x2);
      print spool t2; quit;
run;
```