```
1          TITLE1 'Two sample t-tests';
2          dm'log;clear;output;clear';
3
4          ODS HTML style=minimal body='C:\EXST 7005\SAS\Example04.html' ;
NOTE: Writing HTML Body file: C:\EXST 7005\SAS\Example04.html
5          ODS RTF style=minimal body='C:\EXST 7005\SAS\Example04.rtf';
NOTE: Writing RTF Body file: C:\EXST 7005\SAS\Example04.rtf
6          ODS PDF style=minimal body='C:\EXST 7005\SAS\Example04.PDF';
NOTE: Writing ODS PDF output to DISK destination
      "C:\EXST 7005\SAS\Example04.PDF", printer "PDF".
7
8          ************************************************;
9          *** Steele & Torrie (1980) Table 5.2           ***;
10         *** Percent digestability of corn silage was    ***;
11         ***  examined for sheep and steers.            ***;
12         ************************************************;
13         OPTIONS LS=99 PS=512 nocenter nodate nonumber;
14
15         data silage; infile cards missover;
16              TITLE2 'Percent digestability of corn silage';
17              LABEL animal = 'Type of animal tested';
18              LABEL percent = 'Percent digestability';
19            input sheep steers;
20             animal = 'Sheep '; percent = sheep; output;
21             animal = 'Steers'; percent = steers; output;
22         cards;
NOTE: The data set WORK.SILAGE has 14 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.03 seconds
22       !        run;
30         ;
31         proc print data=silage; var animal percent;
32            TITLE3 'Raw data listing';
33         run;
NOTE: There were 14 observations read from the data set WORK.SILAGE.
NOTE: The PROCEDURE PRINT printed page 1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.07 seconds
      cpu time            0.01 seconds

Two sample t-tests
Percent digestability of corn silage
Raw data listing

Obs    animal    percent
  1    Sheep       57.8
  2    Steers      64.2
  3    Sheep       56.2
  4    Steers      58.7
  5    Sheep       61.9
  6    Steers      63.1
  7    Sheep       54.4
  8    Steers      62.5
  9    Sheep       53.6
 10    Steers      59.8
 11    Sheep       56.4
 12    Steers      59.2
 13    Sheep       53.2
 14    Steers        .
```

```
34         proc ttest data=silage; class animal; var percent;
35            TITLE3 'PROC TTEST results';
36         run;
NOTE: There were 14 observations read from the data set WORK.SILAGE.
NOTE: The PROCEDURE TTEST printed page 2.
NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.07 seconds
      cpu time            0.00 seconds

Two sample t-tests
Percent digestability of corn silage
PROC TTEST results

The TTEST Procedure

Statistics
                          Lower CL          Upper CL  Lower CL           Upper CL
Variable  animal         N      Mean    Mean      Mean   Std Dev  Std Dev   Std Dev  Std Err

percent   Sheep          7    53.437  56.214    58.991    1.9348   3.0025    6.6116   1.1348
percent   Steers         6    58.834   61.25    63.666    1.4369    2.302    5.6458   0.9398
percent   Diff (1-2)          -8.35  -5.036    -1.721    1.9174   2.7066    4.5955   1.5058

T-Tests
Variable    Method           Variances      DF    t Value    Pr > |t|
percent     Pooled           Equal          11      -3.34      0.0065
percent     Satterthwaite    Unequal      10.9      -3.42      0.0058

Equality of Variances
Variable    Method      Num DF    Den DF    F Value    Pr > F
percent     Folded F         6         5       1.70    0.5764




37
38         ****************************************************;
39         *** Steele & Torrie (1980) Table 5.6               ***;
40         *** Percent fine gravel found in surface soils.    ***;
41         ***   Data from a study comparing characteristics ***;
42         ***   of soil catagorized as "good" or "poor".    ***;
43         ****************************************************;
44
45         data dirt; infile cards missover;
46              TITLE2 'Percent fine gravel in surface soils';
47              LABEL soilqual = 'Soil quality evaluation';
48              LABEL percent = 'Percent fine gravel';
49           input good poor;
50            soilqual = 'good '; percent = good; output;
51            soilqual = 'poor'; percent = poor; output;
52         cards;
NOTE: The data set WORK.DIRT has 14 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
52       !        run;
60         ;
61         proc print data=dirt; var soilqual percent;
62            TITLE3 'Raw data listing';
```

```
63         run;
NOTE: There were 14 observations read from the data set WORK.DIRT.
NOTE: The PROCEDURE PRINT printed page 3.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.07 seconds
      cpu time            0.01 seconds


Two sample t-tests
Percent fine gravel in surface soils
Raw data listing

Obs    soilqual    percent
  1      good         5.9                    8      poor         3.2
  2      poor         7.6                    9      good        18.2
  3      good         3.8                   10      poor         6.5
  4      poor         0.4                   11      good        16.1
  5      good         6.5                   12      poor         4.1
  6      poor         1.1                   13      good         7.6
  7      good        18.3                   14      poor         4.7



64         proc ttest data=dirt; class soilqual; var percent;
65            TITLE3 'PROC TTEST results';
66         run;
NOTE: There were 14 observations read from the data set WORK.DIRT.
NOTE: The PROCEDURE TTEST printed page 4.
NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.10 seconds
      cpu time            0.00 seconds

Two sample t-tests
Percent fine gravel in surface soils
PROC TTEST results

The TTEST Procedure

Statistics
                              Lower CL          Upper CL  Lower CL          Upper CL
Variable  soilqual       N      Mean    Mean      Mean   Std Dev  Std Dev   Std Dev  Std Err

percent   good           7    5.0559  10.914    16.773    4.0819   6.3344    13.949   2.3942
percent   poor           7    1.5048  3.9429    6.3809    1.6987   2.6362    5.8051   0.9964
percent   Diff (1-2)          1.3212  6.9714    12.622    3.4789   4.8515    8.0086   2.5932

T-Tests
Variable    Method           Variances      DF    t Value    Pr > |t|
percent     Pooled           Equal          12       2.69      0.0197
percent     Satterthwaite    Unequal      8.02       2.69      0.0275

Equality of Variances
Variable    Method      Num DF    Den DF    F Value    Pr > F
percent     Folded F         6         6       5.77    0.0509
```

```
68         ******************************************************;
69         *** Steele & Torrie (1980) Exercise 5.5.6           ***;
70         *** The weights in grams of 10 male and 10 female   ***;
71         *** juvenile ring-necked pheasants trapped in       ***;
72         *** January in Wisconsin are given.  Test the Ho    ***;
73         *** that males were 350 grams heavier than females. ***;
74         ******************************************************;
75
76         data birds; infile cards missover;
77              TITLE2 'Weight in gms of male & female pheasants';
78              LABEL sex = 'Sex of pheasant';
79              LABEL weight = 'Weight in grams';
80           input sex $ weight;
81              if sex eq 'Male' then AdjWT = Weight - 350;
82              else AdjWT = weight;
83         cards;

NOTE: The data set WORK.BIRDS has 20 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
83       !        run;
104        ;
105        proc print data=birds; var sex weight adjwt;
106           TITLE3 'Raw data listing';
107        run;
NOTE: There were 20 observations read from the data set WORK.BIRDS.
NOTE: The PROCEDURE PRINT printed page 5.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.09 seconds
      cpu time            0.01 seconds

Two sample t-tests
Weight in gms of male & female pheasants
Raw data listing

                           Adj
Obs     sex      weight     WT
  1    Female     1061     1061
  2    Female     1065     1065
  3    Female     1092     1092
  4    Female     1017     1017
  5    Female     1021     1021
  6    Female     1138     1138
  7    Female     1143     1143
  8    Female     1094     1094
  9    Female     1270     1270
 10    Female     1028     1028
 11    Male       1293      943
 12    Male       1380     1030
 13    Male       1614     1264
 14    Male       1497     1147
 15    Male       1340      990
 16    Male       1643     1293
 17    Male       1466     1116
 18    Male       1627     1277
 19    Male       1383     1033
 20    Male       1711     1361


109        proc ttest data=birds H0=-350; class sex; var weight;
110           TITLE3 'PROC TTEST results specifying a difference';
111        run;
NOTE: There were 20 observations read from the data set WORK.BIRDS.
NOTE: The PROCEDURE TTEST printed page 6.
NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.10 seconds
      cpu time            0.03 seconds
```

```
Two sample t-tests
Weight in gms of male & female pheasants
PROC TTEST results specifying a difference

The TTEST Procedure

Statistics
                              Lower CL          Upper CL  Lower CL          Upper CL
Variable  sex            N      Mean    Mean      Mean   Std Dev  Std Dev   Std Dev  Std Err

weight    Female        10    1038.1  1092.9    1147.7    52.709    76.63     139.9   24.232
weight    Male          10      1391  1495.4    1599.8    100.36    145.9    266.36   46.138
weight    Diff (1-2)              -512  -402.5      -293    88.053   116.53    172.33   52.115

T-Tests
Variable    Method           Variances      DF    t Value    Pr > |t|
weight      Pooled           Equal          18      -1.01      0.3271
weight      Satterthwaite    Unequal      13.6      -1.01      0.3313

Equality of Variances
Variable    Method      Num DF    Den DF    F Value    Pr > F
weight      Folded F         9         9       3.63    0.0686


112        proc ttest data=birds; class sex; var adjwt;
113           TITLE3 'PROC TTEST results on adjusted values';
114        run;
NOTE: There were 20 observations read from the data set WORK.BIRDS.
NOTE: The PROCEDURE TTEST printed page 7.
NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.12 seconds
      cpu time            0.01 seconds


Two sample t-tests
Weight in gms of male & female pheasants
PROC TTEST results on adjusted Values
The TTEST Procedure

Statistics
                              Lower CL          Upper CL  Lower CL          Upper CL
Variable  sex            N      Mean    Mean      Mean   Std Dev  Std Dev   Std Dev  Std Err

AdjWT     Female        10    1038.1  1092.9    1147.7    52.709    76.63     139.9   24.232
AdjWT     Male          10      1041  1145.4    1249.8    100.36    145.9    266.36   46.138
AdjWT     Diff (1-2)              -162   -52.5    56.989    88.053   116.53    172.33   52.115

T-Tests
Variable    Method           Variances      DF    t Value    Pr > |t|
AdjWT       Pooled           Equal          18      -1.01      0.3271
AdjWT       Satterthwaite    Unequal      13.6      -1.01      0.3313

Equality of Variances
Variable    Method      Num DF    Den DF    F Value    Pr > F
AdjWT       Folded F         9         9       3.63    0.0686
```