Within-Cases: Multivariate approach part one

```
/* sleep2.sas */
options linesize=79 noovp formdlim=' ';
title "Student's Sleep data: Matched t-tests with proc reg";

data bedtime;
     infile 'studentsleep.data' firstobs=2; /* Skip the header */
     input patient xsleep1 xsleep2;
     sleepdif = xsleep2-xsleep1; /* Create a new variable */

proc means n mean stddev t probt;
     var sleepdif;

proc reg;
     model sleepdif = ; /* Just the intercept: beta0 = mu */
     Unnecessary: test intercept = 0;
```

```
Student's Sleep data: Matched t-tests with proc reg             1

                            The MEANS Procedure

                      Analysis Variable : sleepdif

            N            Mean         Std Dev    t Value    Pr > |t|
           ----------------------------------------------------------
           10       1.5800000       1.2299955       4.06      0.0028
           ----------------------------------------------------------


              Student's Sleep data: Matched t-tests with proc reg             2

                            The REG Procedure
                              Model: MODEL1
                          Dependent Variable: sleepdif

                    Number of Observations Read          10
                    Number of Observations Used          10


                               Analysis of Variance

                                       Sum of           Mean
Source                     DF        Squares         Square    F Value    Pr > F

Model                       0              0              .        .       .
Error                       9       13.61600        1.51289
Corrected Total             9       13.61600


             Root MSE              1.23000    R-Square     0.0000
             Dependent Mean        1.58000    Adj R-Sq     0.0000
             Coeff Var            77.84782
```

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1.58000	0.38896	4.06	0.0028

The REG Procedure
Model: MODEL1

Test Unnecessary Results for Dependent Variable sleepdif

Source	DF	Mean Square	F Value	Pr > F
Numerator	1	24.96400	16.50	0.0028
Denominator	9	1.51289		

Compare

Analysis Variable : sleepdif

N	Mean	Std Dev	t Value	Pr > |t|
10	1.5800000	1.2299955	4.06	0.0028

```
/* grapefruit1.sas */
options linesize=79 pagesize=100 noovp formdlim='_' nodate;
title "Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach";
title2 'Grapefruit data (Kutner et al. 5th ed. Prob 27.6)';

data grape1;
     infile 'grapefruit1.data' firstobs=2; /* Skip the labels */
     input store sales1-sales3;
     label sales1 = 'Sales at Price 1'
           sales2 = 'Sales at Price 2'
           sales3 = 'Sales at Price 3';
     d12 = sales1-sales2; d13 = sales1-sales3; d23=sales2-sales3;

proc means n mean stddev;
     var sales1-sales3;

proc reg;
     title3 'Test H0: mu1=mu2=mu3';
     model d12 d13 = ;
     Price: mtest intercept=0;

proc means mean t probt;
     title3 'Pairwise matched t-tests';
     var d12--d23;
```

Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach 1

The MEANS Procedure

Variable	Label	N	Mean	Std Dev
sales1	Sales at Price 1	8	55.4375000	5.4413595
sales2	Sales at Price 2	8	53.6000000	6.1309519
sales3	Sales at Price 3	8	51.3375000	6.3738164

Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach 2

Test H0: mu1=mu2=mu3

The REG Procedure
Model: MODEL1
Dependent Variable: d12

Number of Observations Read	8
Number of Observations Used	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	0	0	.	.	.
Error	7	8.21875	1.17411		
Corrected Total	7	8.21875			

Root MSE	1.08356	R-Square	0.0000
Dependent Mean	1.83750	Adj R-Sq	0.0000
Coeff Var	58.96937		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1.83750	0.38310	4.80	0.0020

Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach 3

Test H0: mu1=mu2=mu3

The REG Procedure
Model: MODEL1
Dependent Variable: d13

Number of Observations Read	8
Number of Observations Used	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	0	0	.	.	.
Error	7	14.80000	2.11429		
Corrected Total	7	14.80000			

Root MSE	1.45406	R-Square	0.0000
Dependent Mean	4.10000	Adj R-Sq	0.0000
Coeff Var	35.46484		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	4.10000	0.51409	7.98	<.0001

Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach 4

Test H0: mu1=mu2=mu3

The REG Procedure
Model: MODEL1
Multivariate Test: Price

Multivariate Statistics and Exact F Statistics

S=1 M=0 N=2

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.09185282	29.66	2	6	0.0008
Pillai's Trace	0.90814718	29.66	2	6	0.0008
Hotelling-Lawley Trace	9.88698145	29.66	2	6	0.0008
Roy's Greatest Root	9.88698145	29.66	2	6	0.0008

Oneway ANOVA with repeated measures: Hotelling's T-Squared Approach 5

Pairwise matched t-tests

The MEANS Procedure

Variable	Mean	t Value	Pr > |t|
d12	1.8375000	4.80	0.0020
d13	4.1000000	7.98	<.0001
d23	2.2625000	7.09	0.0002