

**ภาคผนวก 1**  
**ตัวอย่างการใช้โปรแกรมสำเร็จรูป**  
**SPSS/PC<sup>+</sup> เพื่อช่วยการคำนวณ**

- ก. ข้อมูลจากตัวอย่างที่ 1.3, 1.4, 2.1, 2.4, 2.6, 3.1, 3.2, 4.2-4.4, 4.5, 4.6-4.7, 4.8-4.9
- ข. ข้อมูลจากตารางที่ 6.9-6.10
- ค. ข้อมูลจากแบบฝึกหัดข้อ 3.1, 4.1, 4.5, 6.1

ที่มาของข้อมูล : ตัวอย่างที่ 1.3

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.
* INPUT DATA FROM EXAMPLE 1.3 ST 437.
DATA LIST FREE/Y1 TO Y3.
BEGIN DATA.
10 3.4 2.11
35 4.1 2.36
2 1.9 2.13
6 3.3 2.78
2 1.7 2.17
6 1.1 1.76
6 1.7 1.68
2 0.9 1.89
2 1.9 1.98
2 0.8 1.76
35 3.5 2.8
35 4.9 2.7
40 30.0 4.38
10 2.8 3.21
6 2.7 2.73
20 2.8 2.81
35 4.6 2.88
35 10.9 2.9
35 8.0 3.28
30 1.6 3.2
4 1.7 2.17
2 0.9 1.38
15 2.9 2.44
35 11.8 2.34
35 3.9 2.21
35 5.4 2.14
2 1.6 2.69
4 2.3 2.02
35 3.7 2.46
END DATA.
VARIABLE LABELS Y1 'AVAILABLE CA'//
                Y2 'EXCHANGEABLE CA'//
                Y3 'PLANT CA'.
COMPUTE Z1=Y1-15.0.
COMPUTE Z2=Y2-6.0.
COMPUTE Z3=Y3-2.85.
CORRELATION VARIABLES=Z1 TO Z3/OPTION 1 2 3 4/
                        /STATISTICS=ALL.
MANOVA Z1 TO Z3
  /PRINT=ERROR(SSCP)
        SIGNIF(HYPOTH MULTIV)
        CELLINFO(MEANS)
  /DESIGN.
FINISH.
```

## Output

29 cases are written to the uncompressed active file.

This procedure was completed at 0:12:06  
The raw data or transformation pass is proceeding  
29 cases are written to the uncompressed active file.

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Page	2	SPSS/PC+	1/1
Variable	Cases	Mean	Std Dev
Z1	29	2.9655	15.1410
Z2	29	-1.6103	5.6147
Z3	29	-.3893	.6111

---

Page	3	SPSS/PC+	1/1
Variables	Cases	Cross-Prod Dev	Variance-Covar
Z1	Z2	29	1341.6897
Z1	Z3	29	146.0907
Z2	Z3	29	66.2882
			47.9175
			5.2175
			2.3674

---

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Correlations:	Z1	Z2	Z3
	Z1	1.0000	.5637*
	Z2	.5637*	1.0000
	Z3	.5639*	.6900**
		.6900**	1.0000

Minimum pairwise N of cases: 29      2-tailed Signif: \* - .01 \*\* -

“ . ” is printed if a coefficient cannot be computed

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This procedure was completed at 0:12:40

29 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
1 non-empty cells.

1 design will be processed.

-----  
Cell Means and Standard Deviations

Variable .. Z1		Mean	Std. Dev.	N
For entire sample		2.966	15.141	29
Variable .. Z2		Mean	Std. Dev.	N
For entire sample		-1.610	5.615	29

---

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Means and Standard Deviations (CONT.)  
Variable .. Z3

	Mean	Std. Dev.	N
For entire sample	-.389	.611	29

-----  
WITHIN CELLS Sum-of-Squares and Cross-Products

	Z1	Z2	Z3
Z1	6418.966		
Z2	1341.690	882.687	
Z3	146.091	66.288	10.456

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Z1	Z2	Z3
Z1	255.034		
Z2	-138.490	75.203	
Z3	-33.481	18.181	4.395

-----  
Multivariate Tests of Significance (S = 1, M = 1/2, N = 12)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.47051	7.70120	3.00	26.00	.001
Hotellings $T^2/MS$	=.88860	7.70120	3.00	26.00	.001
Wilks	.52949	7.70120	3.00	26.00	.001
Roys	.47051				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)  
Univariate F-tests with (1.28) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of
Z1	255.03448	6418.96552	255.03448	229.24877	1.11248	.30
Z2	75.20310	882.68690	75.20310	31.52453	2.38554	.13
Z3	4.39531	10.45579	4.39531	.37342	11.77040	.00

-----  
4168 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

This procedure was completed at 0:13:53

ที่มาของข้อมูล : ตัวอย่างที่ 1.4

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.
SET RESULT='A:STUDENT.MAT'.
* INPUT DATA FROM EXAMPLE 1.4 ST 437.
DATA LIST FREE/Y1 TO Y4.
BEGIN DATA.
523 609 515 631
407 615 487 554
538 655 389 625
556 661 598 612
690 710 611 575
427 572 404 544
486 615 383 591
618 585 634 647
453 568 388 565
604 632 538 641
569 575 592 660
556 661 465 583
545 664 487 679
562 642 517 658
639 679 655 602
END DATA.
VARIABLE LABELS Y1 'SAT-VERBAL'/
                Y2 'SAT-MATH'/
                Y3 'ACHIVE-ENGLISH'/
                Y4 'ACHIVE-MATH'.
COMPUTE Z1=Y1-553.
COMPUTE Z2=Y2-635.
COMPUTE Z3=Y3-532.
COMPUTE Z4=Y4-613.
CORRELATION VARIABLES=Z1 TO Z4/OPTION 1 2 3 4/
                        /STATISTICS=ALL.
MANOVA Z1 TO Z4
  /PRINT=ERROR(SSCP)
        SIGNIF(HYPOTH MULTIV)
        CELLINFO(MEANS)
  /DESIGN.
FINISH.
```

ข้อมูลใน STUDENT.MAT (ผลจากคำสั่ง SET RESULT = 'A : STUDENT.MAT'.)

1.0000000	.6049806	.7527661	.4536841
.6049806	1.0000000	.3321239	.0910745
.7527661	.3321239	1.0000000	.3565875
.4536841	.0910745	.3565875	1.0000000
15	15	15	15
15	15	15	15
15	15	15	15
15	15	15	15

Output

15 cases are written to the uncompressed active file.

This procedure was completed at 0:50:34  
 The raw data or transformation pass is proceeding  
 15 cases are written to the uncompressed active file.

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Variable	Cases	Mean	Std Dev
Z1	15	-8.0000	77.9835
Z2	15	-5.4667	42.9266
Z3	15	-21.1333	93.3081
Z4	15	-1.8667	41.7832

-----  
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Variables	Cases	Cross-Prod Dev	Variance-Covar
Z1 Z2	15	28353.0000	2025.2143
Z1 Z3	15	76685.0000	5477.5000
Z1 Z4	15	20696.0000	1478.2857
Z2 Z3	15	18624.0667	1330.2905
Z2 Z4	15	2286.9333	163.3524
Z3 Z4	15	19463.2667	1390.2333

-----  
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Correlations:	Z1	Z2	Z3	Z4
Z1	1.0000	.6050	.7528*	.4537
Z2	.6050	1.0000	.3321	.0911
Z3	.7528*	.3321	1.0000	.3566
Z4	.4537	.0911	.3566	1.0000

Minimum pairwise N of cases: 15 2-tailed Signif: \* - .01 \*\* - .00

. . . is printed if a coefficient cannot be computed

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This procedure was completed at 0:51:15

15 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 1 non-empty cells.

1 design will be processed.

-----  
 Cell Means and Standard Deviations

Variable .. Z1	Mean	Std. Dev.	N
For entire sample	-8.000	77.984	15
Variable .. Z2	Mean	Std. Dev.	N
For entire sample	-5.467	42.927	15

Variable .. Z3

	Mean	Std. Dev.	N
For entire sample	-21.133	93.308	15

-----

Variable .. Z4

	Mean	Std. Dev.	N
For entire sample	-1.867	41.783	15

-----

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

WITHIN CELLS Sum-of-Squares and Cross-Products

	Z1	Z2	Z3	Z4
Z1	85140.000			
Z2	28353.000	25797.733		
Z3	76685.000	18624.067	121889.733	
Z4	20696.000	2286.933	19463.267	24441.733

-----

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Z1	Z2	Z3	Z4
Z1	960.000			
Z2	656.000	448.267		
Z3	2536.000	1732.933	6699.267	
Z4	224.000	153.067	591.733	52.267

-----

Multivariate Tests of Significance (S = 1, M = 1, N = 4 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.08093	.24214	4.00	11.00	.908
Hotellings	.08805	.24214	4.00	11.00	.908
Wilks	.91907	.24214	4.00	11.00	.908
Roys	.08093				

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)

Univariate F-tests with (1,14) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Z1	960.00000	85140.0000	960.00000	6081.42857	.15786	.697
Z2	448.26667	25797.7333	448.26667	1842.69524	.24327	.630
Z3	6699.26667	121889.733	6699.26667	8706.40952	.76946	.395
Z4	52.26667	24441.7333	52.26667	1745.83810	.02994	.865

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5528 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

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ที่มาของข้อมูล : ตัวอย่างที่ 2.1

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.  
* INPUT DATA FROM EXAMPLE 2.1 ST 437.  
DATA LIST FREE/GROUP Y1 Y2.  
BEGIN DATA.  
1 33 60 1 36 61 1 35 64 1 38 63 1 40 65  
2 35 57 2 36 59 2 38 59 2 39 61 2 41 63 2 43 65 2 41 59  
END DATA.  
MANOVA Y1 Y2 BY GROUP(1,2)  
  /PRINT=CELLINFO(MEANS)  
        CELLINFO(COR)  
        CELLINFO(SSCP)  
        CELLINFO(COV)  
        HOMOGENEITY(BOXM)  
        SIGNIF(HYPOTH MULTIV EIGEN)  
  /DESIGN.
```



Output

12 cases are written to the uncompressed active file.

This procedure was completed at 0:20:11

12 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 2 non-empty cells.

1 design will be processed.

```

-----
                CELL NUMBER
                1     2
Variable
GROUP           1     2
-----

```

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Means and Standard Deviations

```

Variable .. Y1
  FACTOR      CODE      Mean  Std. Dev.      N
GROUP         1      36.400   2.702         5
GROUP         2      39.000   2.887         7
For entire sample      37.917   2.999        12
-----

```

```

Variable .. Y2
  FACTOR      CODE      Mean  Std. Dev.      N
GROUP         1      62.600   2.074         5
GROUP         2      60.429   2.760         7
For entire sample      61.333   2.640        12
-----

```

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1

Sum of Squares and Cross-Products matrix

```

          Y1      Y2
Y1      29.200
Y2      16.800   17.200
Variance-Covariance matrix

```

```

          Y1      Y2
Y1      7.300
Y2      4.200   4.300
-----

```

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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1 (CONT.)

Correlation matrix with Standard Deviations on Diagonal

```

          Y1      Y2
Y1      2.702
Y2      .750   2.074
-----

```

Determinant of Variance-Covariance matrix = 13.75000  
 LOG(Determinant) = 2.62104

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 2  
Sum of Squares and Cross-Products matrix

	Y1	Y2
Y1	50.000	
Y2	40.000	45.714

Variance-Covariance matrix

	Y1	Y2
Y1	8.333	
Y2	6.667	7.619

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 2 (CONT.)  
Correlation matrix with Standard Deviations on Diagonal

	Y1	Y2
Y1	2.887	
Y2	.837	2.760

Determinant of Variance-Covariance matrix = 19.04762  
LOG(Determinant) = 2.94694

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Pooled within-cells Variance-Covariance matrix

	Y1	Y2
Y1	7.920	
Y2	5.680	6.291

Determinant of pooled Variance-Covariance matrix = 17.56571  
LOG(Determinant) = 2.86595

Multivariate test for Homogeneity of Dispersion matrices

Box's M = .49368  
F WITH (3,4121) DF = .12681, P = .944 (Approx.)  
Chi-Square with 3 DF = .38077, P = .944 (Approx.)

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	19.717	
Y2	-16.467	13.752

Multivariate Tests of Significance (S = 1, M = 0, N = 3 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.70512	10.76027	2.00	9.00	.004
Hotellings	2.39117	10.76027	2.00	9.00	.004
Wilks	.29488	10.76027	2.00	9.00	.004
Roys	.70512				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	2.391	100.000	100.000	.840

Univariate F-tests with (1,10) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	19.71667	79.20000	19.71667	7.92000	2.48948	.146
Y2	13.75238	62.91429	13.75238	6.29143	2.18589	.170

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	16581.717	
Y2	27036.033	44146.752

Multivariate Tests of Significance (S = 1, M = 0, N = 3 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.99880	3755.82744	2.00	9.00	0.0
Hotellings	834.62832	3755.82744	2.00	9.00	0.0
Wilks	.00120	3755.82744	2.00	9.00	0.0
Roys	.99880				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	834.628	100.000	100.000	.999

-----  
Univariate F-tests with (1,10) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	16581.7167	79.20000	16581.7167	7.92000	2093.65109	0.0
Y2	44146.7524	62.91429	44146.7524	6.29143	7016.96791	0.0

3376 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

ที่มาของข้อมูล : ตัวอย่างที่ 2.4

SPSS/PC<sup>+</sup> Commands

คำสั่ง  
วิธีที่ 1

```
* INPUT DATA FROM (EXAMPLE 2.4) ST 437.
DATA LIST FREE/D1 TO D2.
BEGIN DATA.
11 5
-5 -1
-80 -8
-105 -15
-57 -7
-39 -9
-35 -1
-35 -3
-26 -5
3 4
-61 -2
0 5
-40 -6
-26 -2
3 -8
END DATA.
CORRELATION VARIABLES=D1 TO D2/OPTION 1 2 3 4/
/STATISTICS=ALL.
MANOVA D1 TO D2
/PRINT=ERROR(SSCP)
SIGNIF(HYPOTH MULTIV)
CELLINFO(MEANS)
/DESIGN.
} * (ใช้วิธีที่ 2)
```

คำสั่ง  
วิธีที่ 2

```
SET DISK=ON.
* INPUT DATA FROM (EXAMPLE 2.4) ST 437.
DATA LIST FREE/Y11 Y12 Y21 Y22.
BEGIN DATA.
148 20 137 15 159 24 164 25 144 19 224 27
103 18 208 33 121 17 178 24 89 11 128 20
119 17 154 18 123 13 158 16 76 16 102 21
217 29 214 25 148 22 209 24 151 21 151 16
83 7 123 13 135 20 161 22 178 15 175 23
END DATA.
COMPUTE D1=Y11-Y21.
COMPUTE D2=Y12-Y22.
CORRELATION VARIABLES=D1 TO D2/OPTION 1 2 3 4/
/STATISTICS=ALL.
```

} \* (จากวิธีที่ 1)

ST 437

Output (แผนผังการทดลอง 2 ปัจจัย)

15 cases are written to the uncompressed active file.

This procedure was completed at 12:12:44

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Variable	Cases	Mean	Std Dev
D1	15	-32.8000	33.1063
D2	15	-3.5333	5.6172

---

Page 3 SPSS/PC+

Variables	Cases	Cross-Prod Dev	Variance-Covar
D1 D2	15	1958.6000	139.9000

---

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Correlations: D1 D2

D1	1.0000	.7523*
D2	.7523*	1.0000

Minimum pairwise N of cases: 15 2-tailed Signif: \* - .01 \*\* - .001

". ." is printed if a coefficient cannot be computed

---

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This procedure was completed at 12:12:48

1 design will be processed.

Cell Means and Standard Deviations

Variable .. (D1)	Mean	Std. Dev.	N
For entire sample	$\bar{d}_1 = -32.800$	33.106	15
Variable .. (D2)	Mean	Std. Dev.	N
For entire sample	$\bar{d}_2 = -3.533$	5.617	15

---

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Means and Standard Deviations (CONT.)  
 WITHIN CELLS Sum-of-Squares and Cross-Products

$$\begin{matrix} & D1 & D2 \\ D1 & 15344.400 & \\ D2 & 1958.600 & 441.733 \end{matrix} \Rightarrow \underline{S} = \frac{1}{14} \underline{E} = \begin{bmatrix} 1096.03 & 134.40 \\ 134.90 & 31.55 \end{bmatrix}$$

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
 Adjusted Hypothesis Sum-of-Squares and Cross-Products

	D1	D2
D1	16137.600	
D2	1736.400	187.267

$T_c^2 / 14 = 1.08509$   
 $T_c^2 = 15.19126$

Multivariate Tests of Significance (S = 1, M = 0, N = 5 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.52040	7.05307	2.00	13.00	.008
Hotellings	<u>1.08509</u>	7.05307	2.00	13.00	.008
Wilks	.47960	7.05307	2.00	13.00	.008
Roys	.52040				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)  
 Univariate F-tests with (1,14) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
D1	16137.6000	15344.4000	16137.6000	1096.02857	14.72370	.002
D2	187.26667	441.73333	187.26667	31.55238	5.93510	.029

ที่มาของข้อมูล : ตัวอย่างที่ 2.6

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.  
* INPUT DATA FROM EXAMPLE 2.6 ST 437.  
DATA LIST FREE/GROUP Y1 Y2.  
BEGIN DATA.  
1 55 91 1 49 95 1 48 81 1 53 83 1 44 76  
1 57 108 1 50 89 1 59 97 1 52 88 1 50 92  
2 30 84 2 37 106 2 34 90 2 34 93 2 27 76  
2 57 77 2 54 75 2 57 74 2 64 82 2 56 72  
END DATA.  
MANOVA Y1 Y2 BY GROUP(1 2)  
/PRINT=CELLINFO(MEANS SSCP COV COR)  
ERROR(SSCP COV COR STDDEV)  
HOMOGENEITY(BOXM)  
SIGNIF(HYPOTH MULTIV UNIV EIGEN)  
/DESIGN.
```



Output

20 cases are written to the uncompressed active file.

This procedure was completed at 0:42:41

20 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 2 non-empty cells.

1 design will be processed.

CELL NUMBER  
 1 2  
 Variable  
 GROUP 1 2

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Means and Standard Deviations

Variable .. Y1	FACTOR	CODE	Mean	Std. Dev.	N
GROUP		1	51.700	4.473	10
GROUP		2	45.000	13.768	10
For entire sample			48.350	10.540	20

Variable .. Y2	FACTOR	CODE	Mean	Std. Dev.	N
GROUP		1	90.000	9.031	10
GROUP		2	82.900	10.703	10
For entire sample			86.450	10.303	20

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1

Sum of Squares and Cross-Products matrix

	Y1	Y2
Y1	180.100	
Y2	266.000	734.000

Variance-Covariance matrix

	Y1	Y2
Y1	20.011	
Y2	29.556	81.556

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1 (CONT.)

Correlation matrix with Standard Deviations on Diagonal

	Y1	Y2
Y1	4.473	
Y2	.732	9.031

Determinant of Variance-Covariance matrix = 758.48642  
 LOG(Determinant) = 6.63132

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 2  
Sum of Squares and Cross-Products matrix

	Y1	Y2
Y1	1706.000	
Y2	-652.000	1030.900

Variance-Covariance matrix

	Y1	Y2
Y1	189.556	
Y2	-72.444	114.544

-----

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 2 (CONT.)  
Correlation matrix with Standard Deviations on Diagonal

	Y1	Y2
Y1	13.768	
Y2	-.492	10.703

Determinant of Variance-Covariance matrix = 16464.33827  
LOG(Determinant) = 9.70895

-----

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Pooled within-cells Variance-Covariance matrix

	Y1	Y2
Y1	104.783	
Y2	-21.444	98.050

Determinant of pooled Variance-Covariance matrix = 9814.14164  
LOG(Determinant) = 9.19158

-----

Multivariate test for Homogeneity of Dispersion matrices

Boxs M = 18.38594  
F WITH (3,58320) DF = 5.39265, P = .001 (Approx.)  
Chi-Square with 3 DF = 16.17282, P = .001 (Approx.)

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

WITHIN CELLS Correlations with Std. Devs. on Diagonal

	Y1	Y2
Y1	10.236	
Y2	-.212	9.902

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Statistics for WITHIN CELLS correlations

Determinant =	.95524
Bartlett test of sphericity =	.75558 with 1 D. F.
Significance =	.385
F(max) criterion =	1.06867 with (2,18) D. F.

WITHIN CELLS Variances and Covariances

	Y1	Y2
Y1	104.783	
Y2	-21.444	98.050

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

WITHIN CELLS Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	1886.100	
Y2	-386.000	1764.900

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	224.450	
Y2	237.850	252.050

Multivariate Tests of Significance (S = 1, M = 0, N = 7 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.24915	2.82055	2.00	17.00	.088
Hotellings	.33183	2.82055	2.00	17.00	.088
Wilks	.75085	2.82055	2.00	17.00	.088
Roys	.24915				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1.	.332	100.000	100.000	.499

-----  
Univariate F-tests with (1,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	224.45000	1886.10000	224.45000	104.78333	2.14204	.161
Y2	252.05000	1764.90000	252.05000	98.05000	2.57063	.126

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	46754.450	
Y2	83597.150	149472.050

-----  
Multivariate Tests of Significance (S = 1, M = 0, N = 7 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.99264	1146.70503	2.00	17.00	0.0
Hotelling's	134.90447	1146.70503	2.00	17.00	0.0
Wilks	.00736	1146.70503	2.00	17.00	0.0
Roys	.99264				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	134.906	100.000	100.000	.996

-----  
Univariate F-tests with (1,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	46754.4500	1886.10000	46754.4500	104.78333	446.20121	0.0
Y2	149472.050	1764.90000	149472.050	98.05000	1524.44722	0.0

3344 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

ที่มาของข้อมูล : ตัวอย่างที่ 3.1

SPSS/PC+ Commands

```
          SET PRINT=ON/MORE=OFF/DISK=ON.
* INPUT DATA FROM EXAMPLE 3.1 ST 437.
DATA LIST FREE/GROUP BAC.
BEGIN DATA.
1 24.0 1 13.3 1 12.2 1 14.0 1 22.2 1 16.1 1 27.9
2 7.4 2 13.2 2 8.5 2 10.1 2 9.3 2 8.5 2 4.3
3 16.4 3 24.0 3 53.0 3 32.7 3 42.8
4 25.1 4 5.9
END DATA.
VALUE LABELS GROUP 1 'CONTROL GROUP'
                2 'DEPRESSION GROUP'
                3 'HEIGHTENED ACTIVITY'
                4 'NORMAL GROUP'.
VARIABLE LABELS BAC 'BACILLI INHALED PER TUBERCLE FORMED'/
GROUP 'EXPERIMENTAL GROUP'.
DISPLAY.
ONEWAY VARIABLES=BAC BY GROUP(1,4)
        /STATISTICS=ALL.
```

Output

21 cases are written to the uncompressed active file.

This procedure was completed at 0:36:32

-----  
 Page 2           GROUP    -                   SPSS/PC+                   1/1/80  
                   BAC    -                   EXPERIMENTAL GROUP  
   BACILLI INHALED PER TUBERCLE FORMED  
 -----

Page 3                                   SPSS/PC+                   1/1/80

----- O N E W A Y -----

Variable   BAC                   BACILLI INHALED PER TUBERCLE FORMED  
 BY Variable   GROUP           EXPERIMENTAL GROUP

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	1849.5863	616.5288	8.0457	.0015
Within Groups	17	1302.6794	76.6282		
Total	20	3152.2657			

-----  
 Page 4                                   SPSS/PC+                   1/1/80

----- O N E W A Y -----

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	7	18.5286	6.1242	2.3147	12.8647 To 24.1925
Grp 2	7	8.7571	2.6981	1.0198	6.2619 To 11.2524
Grp 3	5	33.7800	14.5744	6.5179	15.6838 To 51.8762
Grp 4	2	15.5000	13.5745	9.6000	-106.4795 To 137.4795
Total	21	18.6143	12.5544	2.7396	12.8996 To 24.3290
Fixed Effects Model			8.7538	1.9102	14.5841 To 22.6445
Random Effects Model				5.9029	-.1711 To 37.3997

Random Effects Model - Estimate of Between Component Variance           108.3240

-----  
 Page 5                                   SPSS/PC+                   1/1/80

----- O N E W A Y -----

Group	Minimum	Maximum
Grp 1	12.2000	27.9000
Grp 2	4.3000	13.2000
Grp 3	16.4000	53.0000
Grp 4	5.9000	25.1000
Total	4.3000	53.0000

Tests for Homogeneity of Variances

Cochrans C = Max. Variance/Sum(Variances) = .4811, P = .303 (Approx.)  
 Bartlett-Box F = 4.039, P = .008  
 Maximum Variance / Minimum Variance           29.179

ที่มาของข้อมูล : ตัวอย่างที่ 3.2

SPSS/PC+ Commands

```
* INPUT DATA FROM EXAMPLE 3.2 ST 437.
DATA LIST FREE/GROUP Y1 Y2.
BEGIN DATA.
1 24.0 3.5 1 13.3 3.5 1 12.2 4.0 1 14.0 4.0 1 22.2 3.6
1 16.1 4.3 1 27.9 5.2
2 7.4 3.5 2 13.2 3.0 2 8.5 3.0 2 10.1 3.0 2 9.3 2.0
2 8.5 2.5 2 4.3 1.5
3 16.4 3.2 3 24.0 2.5 3 53.0 1.5 3 32.7 2.6 3 42.8 2.0
4 25.1 2.7 4 5.9 2.3
END DATA.
MANOVA Y1 Y2 BY GROUP(1,4)
/PRINT=ERROR(COR)
CELLINFO(MEANS)
HOMOGENEITY(BOXM)
ERROR(SSCP)
SIGNIF(HYPOTH MULTIV UNIV EIGEN)
/DESIGN.
```

Output

21 cases are written to the uncompressed active file.

This procedure was completed at 0:00:55

21 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
4 non-empty cells.

1 design will be processed.

-----  
Cell Means and Standard Deviations

Variable .. Y1

FACTOR	CODE	Mean	Std. Dev.	N
GROUP	1	18.529	6.124	7
GROUP	2	8.757	2.698	7
GROUP	3	33.780	14.574	5
GROUP	4	15.500	13.576	2
For entire sample		18.614	12.554	21

-----  
Page 2 SPSS/PC+ 1/1/80

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Means and Standard Deviations (CONT.)

Variable .. Y2

FACTOR	CODE	Mean	Std. Dev.	N
GROUP	1	4.014	.604	7
GROUP	2	2.643	.690	7
GROUP	3	2.360	.643	5
GROUP	4	2.500	.283	2
For entire sample		3.019	.933	21

-----  
Page 3 SPSS/PC+ 1/1/80

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1

Determinant of Variance-Covariance matrix = 11.46694  
LOG(Determinant) = 2.43947

-----  
Cell Number .. 2

Determinant of Variance-Covariance matrix = 2.59755  
LOG(Determinant) = .95457  
-----



\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 3

Determinant of Variance-Covariance matrix = 6.70815  
LOG(Determinant) = 1.90332

-----  
Cell Number .. 4

NOTE 12171  
SINGULAR VARIANCE-COVARIANCE MATRIX FOR THIS CELL.

0 CELLS with only one observation.  
1 CELL with singular Variance-Covariance matrix.

Determinant of pooled Variance-Covariance matrix 27.45660  
LOG(Determinant) = 3.31261

Multivariate test for Homogeneity of Dispersion matrices

Boxs M = 25.02419  
F WITH (4,2989) DF = 3.37791, P = .003 (Approx.)  
Chi-Square with 6 DF = 20.31767, P = .002 (Approx.)

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

WITHIN CELLS Correlations with Std. Devs. on Diagonal

	Y1	Y2
Y1	8.754	
Y2	-.188	.631

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Statistics for WITHIN CELLS correlations

Determinant = .96474  
Bartlett test of sphericity = .55639 with 1 D. F.  
Significance = .456

F(max) criterion = 192.20041 with (2,17) D. F.

-----  
WITHIN CELLS Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	1302.679	
Y2	-17.644	6.778

## \* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	1849.586	
Y2	-21.382	10.635

-----  
Multivariate Tests of Significance (S = 2, M = 0, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	1.20040	8.50717	6.00	34.00	.000
Hotellings	3.00955	7.52388	6.00	30.00	.000
Wilks	.15961	8.01611	6.00	32.00	.000
Roys	.61517				

## \* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. GROUP (CONT.)

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	1.599	53.116	53.116	.784
2	1.411	46.884	100.000	.765

-----  
Univariate F-tests with (3,17) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	1849.58626	1302.67943	616.52875	76.62820	8.04572	.001
Y2	10.63467	6.77771	3.54489	.39869	8.89136	.001

\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2
Y1	5947.270	
Y2	894.598	134.567

Multivariate Tests of Significance (S = 1, M = 0, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.96669	232.14712	2.00	16.00	0.0
Hotellings	29.01839	232.14712	2.00	16.00	0.0
Wilks	.03331	232.14712	2.00	16.00	0.0
Roys	.96669				

\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	29.018	100.000	100.000	.983

Univariate F-tests with (1,17) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	5947.26966	1302.67943	5947.26966	76.62820	77.61202	.000
Y2	134.56696	6.77771	134.56696	.39869	337.52359	0.0

4528 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

## ที่มาของข้อมูล : ตัวอย่างที่ 4.2

### SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.
* INPUT DATA FROM EXAMPLE 4.2 ST 437.
DATA LIST FILE='A:EX42.DAT' FREE/FERTI BLOCK Y1 Y2 Y3.
VARIABLE LABELS FERTI 'FERTILIZER TYPE'
                /BLOCK 'POTATO BREED TYPE'
                /Y1 'NUMBER OF 100 LBS BAGS OF NO.1 POTATOES'
                /Y2 'NUMBER OF 100 LBS BAGS OF NO.2 POTATOES'
                /Y3 'SPECIFIC GRAVITY'
VALUE LABELS FERTI 1 'FERTILIZER A'
              2 'FERTILIZER B'
              3 'FERTILIZER C'
              4 'FERTILIZER D'
              5 'FERTILIZER E'
              BLOCK 1 'BREED 1' 2 'BREED 2' 3 'BREED 3' 4 'BREED 4'.
DISPLAY.
ANOVA VARIABLES=Y1.Y2.Y3 BY FERTI(1,5) BLOCK(1,4)/OPTION=3.
CORRELATION VARIABLES= Y1 TO Y3/OPTIONS=1 2 3 4/STATISTICS=ALL.
MANOVA Y1 Y2 Y3 BY FERTI(1,5) BLOCK(1,4)
        /PRINT=ERROR(COR)
        /PRINT=ERROR(SSCP)
        /PRINT=SIGNIF(HYPOTH MULTIV UNIV)
        /PRINT=SIGNIF(EIGEN DIMENR)
        /DESIGN=BLOCK.FERTI.
FINISH.
```

### ข้อมูลเข้า (ในแฟ้ม EX42.DAT)

```
1 1 96 10 725 1 2 142 16 700 1 3 122 13 655 1 4 111 13 680
2 1 102 15 695 2 2 106 10 710 2 3 95 14 705 2 4 93 12 680
3 1 109 15 690 3 2 113 15 690 3 3 101 14 680 3 4 100 19 685
4 1 103 17 680 4 2 97 16 690 4 3 99 13 730 4 4 135 12 670
5 1 98 17 680 5 2 97 14 695 5 3 105 16 680 5 4 86 22 710
```

Output

```
-----
Page 2                               SPSS/PC+                               1/1/8
      FERTI - FERTILIZER TYPE
      BLOCK - POTATO BREED TYPE
      Y1 - NUMBER OF 100 LBS BAGS OF NO.1 POTATOES
      Y2 - NUMBER OF 100 LBS BAGS OF NO.2 POTATOES
      Y3 - SPECIFIC GRAVITY
```

The raw data on transformation pass is proceeding  
20 cases are written to the uncompressed active file.

'ANOVA' PROBLEM REQUIRES 1376 BYTES OF MEMORY.

```
-----
Page 3                               SPSS/PC+                               1/1/8
```

\*\*\* ANALYSIS OF VARIANCE \*\*\*

```
BY Y1 NUMBER OF 100 LBS BAGS OF NO.1 POTATOES
   FERTI FERTILIZER TYPE
   BLOCK POTATO BREED TYPE
```

Source of Variation	Sum of Squares	DF	Mean Square	F	Sign of
Main Effects	1364.100	7	194.871	1.035	.48
FERTI	1129.500	4	282.375	1.500	.2
BLOCK	234.600	3	78.200	.415	.7
Explained	1364.100	7	194.871	1.035	.48
Residual	2258.900	12	188.242		
Total	3623.000	19	190.684		

20 Cases were processed.  
0 CASES ( .0 PCT) were missing.

```
-----
Page 4                               SPSS/PC+                               1/1/80
```

\*\*\* ANALYSIS OF VARIANCE \*\*\*

```
BY Y2 NUMBER OF 100 LBS BAGS OF NO.2 POTATOES
   FERTI FERTILIZER TYPE
   BLOCK POTATO BREED TYPE
```

Source of Variation	Sum of Squares	DF	Mean Square	F	Sign of
Main Effects	65.050	7	9.293	1.219	.36
FERTI	57.300	4	14.325	1.879	.17
BLOCK	7.750	3	2.583	.339	.79
Explained	65.050	7	9.293	1.219	.36
Residual	91.500	12	7.625		
Total	156.550	19	8.239		

20 Cases were processed.  
0 CASES ( .0 PCT) were missing.

\*\*\* ANALYSIS OF VARIANCE \*\*\*

BY Y3 SPECIFIC GRAVITY  
FERTI FERTILIZER TYPE  
BLOCK POTATO BREED TYPE

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	672.500	7	96.071	.208	.977
FERTI	267.500	4	66.875	.145	.962
BLOCK	405.000	3	135.000	.293	.830
Explained	672.500	7	96.071	.208	.977
Residual	5532.500	12	461.042		
Total	6205.000	19	326.579		

20 Cases were processed.  
0 CASES ( .0 PCT) were missing.

This procedure was completed at 0:02:29

WARNING 134  
COMMAND LINE TOO LONG--The command line is longer than 80 characters.  
Only the first 80 are read.

FERTI - FERTILIZER TYPE  
BLOCK - POTATO BREED TYPE  
Y1 - NUMBER OF 100 LBS BAGS OF NO.1 POTATOES  
Y2 - NUMBER OF 100 LBS BAGS OF NO.2 POTATOES  
Y3 - SPECIFIC GRAVITY

The raw data on transformation pass is proceeding  
20 cases are written to the uncompressed active file.

'ANOVA' PROBLEM REQUIRES 1376 BYTES OF MEMORY.

\*\*\* ANALYSIS OF VARIANCE \*\*\*

BY Y1 FERTI NUMBER OF 100 LBS BAGS OF NO.1 POTATOES  
 BLOCK FERTI FERTILIZER TYPE  
 POTATO BREED TYPE

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	1364.100	7	194.871	1.035	.456
FERTI	1129.500	4	282.375	1.500	.263
BLOCK	234.600	3	78.200	.415	.745
Explained	1364.100	7	194.871	1.035	.456
Residual	2258.900	12	188.242		
Total	3623.000	19	190.684		

20 Cases were processed.  
 0 CASES ( .0 PCT) were missing.

\*\*\* ANALYSIS OF VARIANCE \*\*\*

BY Y2 FERTI NUMBER OF 100 LBS BAGS OF NO.2 POTATOES  
 BLOCK FERTI FERTILIZER TYPE  
 POTATO BREED TYPE

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	65.050	7	9.293	1.219	.364
FERTI	57.300	4	14.325	1.879	.179
BLOCK	7.750	3	2.583	.339	.798
Explained	65.050	7	9.293	1.219	.364
Residual	91.500	12	7.625		
Total	156.550	19	8.239		

20 Cases were processed.  
 0 CASES ( .0 PCT) were missing.

\*\*\* ANALYSIS OF VARIANCE \*\*\*

BY Y3 SPECIFIC GRAVITY  
 FERTI FERTILIZER TYPE  
 BLOCK POTATO BREED TYPE

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	672.500	7	96.071	.208	.977
FERTI	267.500	4	66.875	.145	.962
BLOCK	405.000	3	135.000	.293	.830
Explained	672.500	7	96.071	.208	.977
Residual	5532.500	12	461.042		
Total	6205.000	19	326.579		

20 Cases were processed.  
 0 CASES ( .0 PCT) were missing.

This procedure was completed at 0:05:54

Variable	Cases	Mean	Std Dev
Y1	20	105.5000	13.8088
Y2	20	14.6500	2.8704
Y3	20	691.5000	18.0715

Variables	Cases	Cross-Prod Dev	Variance-Covar
Y1 Y2	20	-164.5000	-8.6579
Y1 Y3	20	-1745.0000	-91.8421
Y2 Y3	20	-94.5000	-4.9737

Correlations:	Y1	Y2	Y3
Y1	1.0000	-.2184	-.3680
Y2	-.2184	1.0000	-.0959
Y3	-.3680	-.0959	1.0000

Minimum pairwise N of cases: 20      2-tailed Signif: \* - .01    \*\* - .001

" ." is printed if a coefficient cannot be computed



This procedure was completed at 0:06:25

20 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 20 non-empty cells.

1 design will be processed.

RESIDUAL Correlations with Std. Devs. on Diagonal

	Y1	Y2	Y3
Y1	13.720		
Y2	-.054	2.761	
Y3	-.469	.006	21.472

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Statistics for RESIDUAL correlations

Determinant = .77728  
 Bartlett test of sphericity = 2.56148 with 3 D. F.  
 Significance = .464  
 F(max) criterion = 60.46448 with (3,12) D. F.

RESIDUAL Sum-of-Squares and Cross-Products

	Y1	Y2	Y3
Y1	2258.900		
Y2	-24.650	91.500	
Y3	-1658.250	4.000	5532.500

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. FERTI

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2	Y3
Y1	1129.500		
Y2	-125.750	57.300	
Y3	-213.750	-62.000	267.500

Multivariate Tests of Significance (S = 3, M = 0, N = 4)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.71661	.94151	12.00	36.00	.519
Hotellings	1.21960	.88083	12.00	26.00	.576
Wilks	.39901	.92550	12.00	26.75	.537
Roys	.47721				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. FERTI (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.913	74.844	74.844	.691
2	.295	24.200	99.045	.477
3	.012	.955	100.000	.107

-----  
Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F	
1 TO 3	.39901	.92550	12.00	26.75	.537
2 TO 3	.76322	.53041	6.00	22.00	.779
3 TO 3	.98848	.06990	2.00	12.00	.933

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. FERTI (CONT.)  
Univariate F-tests with (4,12) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	1129.50000	2258.90000	282.37500	188.24167	1.50007	.263
Y2	57.30000	91.50000	14.32500	7.62500	1.87869	.179
Y3	267.50000	5532.50000	66.87500	461.04167	.14505	.962

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. BLOCK  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2	Y3
Y1	234.600		
Y2	-14.100	7.750	
Y3	127.000	-36.500	405.000

-----  
Multivariate Tests of Significance (S = 3, M = -1/2, N = 4)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.29065	.42911	9.00	36.00	.910
Hotellings	.34910	.33617	9.00	26.00	.954
Wilks	.72778	.37948	9.00	24.49	.934
Roys	.20682				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. BLOCK (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.261	74.690	74.690	.455
2	.065	18.703	93.394	.248
3	.023	6.606	100.000	.150

Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F	
1 TO 3	.72778	.37948	9.00	24.49	.934
2 TO 3	.91755	.24181	4.00	22.00	.912
3 TO 3	.97746	.27676	1.00	12.00	.608

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. BLOCK (CONT.)  
Univariate F-tests with (3,12) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	234.60000	2258.90000	78.20000	188.24167	.41542	.745
Y2	7.75000	91.50000	2.58333	7.62500	.33880	.798
Y3	405.00000	5532.50000	135.00000	461.04167	.29282	.830

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	Y1	Y2	Y3
Y1	222605.000		
Y2	30911.500	4292.450	
Y3	1459065.00	202609.500	9563445.00

Multivariate Tests of Significance (S = 1, M = 1/2, N = 4)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.99966	9708.54594	3.00	10.00	0.0
Hotellings	2912.56378	9708.54594	3.00	10.00	0.0
Wilks	.00034	9708.54594	3.00	10.00	0.0
Roys	.99966				

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	2912.564	100.000	100.000	1.000

-----  
Univariate F-tests with (1,12) D.F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Y1	222605.000	2258.90000	222605.000	188.24167	1182.54903	0.0
Y2	4292.45000	91.50000	4292.45000	7.62500	562.94426	0.0
Y3	9563445.00	5532.50000	9563445.00	461.04167	20743.1252	0.0

11264 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

ที่มาของข้อมูล : ตัวอย่างที่ 4.5

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.  
* INPUT DATA FROM EXAMPLE 4.5 ST 437.  
DATA LIST FREE/IQ SCHOOL SCORE.  
BEGIN DATA.  
1 1 40.1 1 1 41.1 1 1 40.9 1 1 39.4  
1 2 63.0 1 2 61.9 1 2 61.6 1 2 64.0  
2 1 52.8 2 1 53.6 2 1 53.9 2 1 53.8  
2 2 68.6 2 2 70.7 2 2 69.1 2 2 73.3  
3 1 41.6 3 1 37.7 3 1 43.2 3 1 42.0  
3 2 62.8 3 2 56.6 3 2 63.3 3 2 60.9  
END DATA.  
VARIABLE LABELS IQ 'INTELLIGENT'/SCHOOL 'SCHOOL TYPE'.  
VALUE LABELS IQ 1 'IQ < 60' 2 '60 < IQ < 70' 3 'IQ > 70'.  
VALUE LABELS SCHOOL 1 'SPECIAL SCHOOL' 2 'PUBLIC SCHOOL'.  
DISPLAY.  
ANOVA VARIABLES=SCORE BY IQ(1,3),SCHOOL(1,2)/STATISTICS=ALL.  
FINISH.
```



\*\*\* ANALYSIS OF VARIANCE \*\*\*

BY SCORE  
IQ INTELLIGENT  
SCHOOL SCHOOL TYPE

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif- of F
Main Effects	2928.476	3	976.159	272.427	.000
IQ	613.706	2	306.853	85.637	.000
SCHOOL	2314.770	1	2314.770	646.007	.000
2-way Interactions	28.676	2	14.338	4.001	.030
IQ SCHOOL	28.676	2	14.338	4.001	.030
Explained	2957.152	5	591.430	165.057	.000
Residual	64.498	18	3.583		
Total	3021.650	23	131.376		

24 Cases were processed.  
0 CASES ( .0 PCT) were missing.

\*\*\* MULTIPLE CLASSIFICATION ANALYSIS \*\*\*

By SCORE  
IQ INTELLIGENT  
SCHOOL SCHOOL TYPE

Grand Mean = 54.829

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independents Dev'n	Beta	Adjusted for Independents + Covariates Dev'n	Beta
IQ							
1 IQ < 60	8	-3.33		-3.33			
2 60 < IQ < 70	8	7.15		7.15			
3 IQ > 70	8	-3.82		-3.82			
			.45		.45		
SCHOOL							
1 SPECIAL SCHOOL	12	-9.82		-9.82			
2 PUBLIC SCHOOL	12	9.82		9.82			
			.88		.88		
Multiple R Squared					.969		
Multiple R					.984		

This procedure was completed at 0:15:13

ที่มาของข้อมูล : ตัวอย่างที่ 4.6

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.
* INPUT DATA FROM EXAMPLE 4.6 ST 437.
DATA LIST FREE/IQ SCHOOL ENG MAT SCI.
BEGIN DATA.
1 1 40.1 85.6 46.8 1 1 41.1 83.2 41.7
1 1 40.9 79.5 38.1 1 1 39.4 78.0 39.6
1 2 63.0 102.4 44.8 1 2 61.9 100.3 39.4
1 2 61.6 101.3 39.9 1 2 64.0 106.2 50.0
2 1 52.8 114.4 47.1 2 1 53.6 115.6 42.1
2 1 53.9 114.2 42.3 2 1 53.8 113.2 35.7
2 2 68.6 129.8 42.7 2 2 70.7 131.0 47.1
2 2 69.1 135.8 45.2 2 2 73.3 147.6 49.2
3 1 41.6 142.3 45.8 3 1 37.7 137.0 37.0
3 1 43.2 143.8 44.0 3 1 42.0 143.6 40.8
3 2 62.8 164.4 44.4 3 2 56.6 156.0 45.3
3 2 63.3 161.3 46.3 3 2 60.9 161.4 42.2
END DATA.
VARIABLE LABELS IQ 'INTELLIGENT'/SCHOOL 'SCHOOL TYPE'
                ENG 'ENGLISH SCORE'/MAT 'MATHEMATICS SCORE'
                SCI 'SCIENCE SCORE'.
VALUE LABELS IQ 1 'IQ < 60' 2 '60 < IQ < 70' 3 'IQ >70'.
VALUE LABELS SCHOOL 1 'SPECIAL SCHOOL' 2 'PUBLIC SCHOOL'.
MANOVA ENG MAT SCI BY IQ(1 3) SCHOOL(1 2)
  /PRINT=ERROR(SSCP)
  /PRINT=SIGNIF(HYPOTH MULTIV UNIV EIGEN DIMENR)
  /DESIGN.
MANOVA ENG BY IQ(1 3) SCHOOL(1 2)
  /DESIGN.
MANOVA MAT BY IQ(1 3) SCHOOL(1 2)
  /DESIGN.
MANOVA SCI BY IQ(1 3) SCHOOL(1 2)
  /DESIGN.
FINISH.
```



## \* \* ANALYSIS OF VARIANCE \* \*

24 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 6 non-empty cells.

1 design will be processed.

## WITHIN CELLS Sum-of-Squares and Cross-Products

	ENG	MAT	SCI
ENG	64.498		
MAT	104.665	323.913	
SCI	48.837	155.585	259.617

## \* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

## EFFECT .. IQ BY SCHOOL

## Adjusted Hypothesis Sum-of-Squares and Cross-Products

	ENG	MAT	SCI
ENG	28.676		
MAT	-4.475	7.201	
SCI	-12.295	3.029	5.461

## Multivariate Tests of Significance (S = 2, M = 0, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.54020	2.09697	6.00	34.00	.079
Hotellings	1.09388	2.73470	6.00	30.00	.031
Wilks	.47183	2.43100	6.00	32.00	.048
Roys	.51692				

## \* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

## EFFECT .. IQ BY SCHOOL (CONT.)

## Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	1.070	97.821	97.821	.719
2	.024	2.179	100.000	.153

## Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F	
1 TO 2	.47183	2.43100	6.00	32.00	.048
2 TO 2	.97671	.20264	2.00	17.00	.819

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. IQ BY SCHOOL (CONT.)  
 Univariate F-tests with (2,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
ENG	28.67584	64.49753	14.33792	3.58320	4.00143	.036
MAT	7.20089	323.91253	3.60044	17.99514	.20008	.820
SCI	5.46083	259.61744	2.73042	14.42319	.18931	.829

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. SCHOOL  
 Adjusted Hypothesis Sum-of-Squares and Cross-Products

	ENG	MAT	SCI
ENG	2314.770		
MAT	2426.728	2544.101	
SCI	348.640	365.502	52.510

Multivariate Tests of Significance (S = 1, M = 1/2, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.97682	224.77399	3.00	16.00	0.0
Hotellings	42.14512	224.77399	3.00	16.00	0.0
Wilks	.02318	224.77399	3.00	16.00	0.0
Roys	.97682				

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. SCHOOL (CONT.)  
 Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	42.145	100.000	100.000	.988

Univariate F-tests with (1,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
ENG	2314.77036	64.49753	2314.77036	3.58320	646.00718	0.0
MAT	2544.10054	323.91253	2544.10054	17.99514	141.37709	0.0
SCI	52.51045	259.61744	52.51045	14.42319	3.64070	.072

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. IQ

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	ENG	MAT	SCI
ENG	613.706		
MAT	87.932	14068.256	
SCI	58.327	182.493	7.701

-----  
Multivariate Tests of Significance (S = 2, M = 0, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	1.89988	107.53152	6.00	34.00	0.0
Hotellings	127.23056	318.07639	6.00	30.00	0.0
Wilks	.00077	186.27846	6.00	32.00	0.0
Roys	.99155				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. IQ (CONT.)

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	117.322	92.212	92.212	.996
2	9.909	7.788	100.000	.953

-----  
Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F	
1 TO 2	.00077	186.27846	6.00	32.00	0.0
2 TO 2	.09167	84.22607	2.00	17.00	0.0

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. IQ (CONT.)

Univariate F-tests with (2,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
ENG	613.70578	64.49753	306.85289	3.58320	85.63665	0.0
MAT	14068.2560	323.91253	7034.12802	17.99514	390.89042	0.0
SCI	7.70083	259.61744	3.85042	14.42319	.26696	.769

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	ENG	MAT	SCI
ENG	72149.700		
MAT	161630.900	362088.103	
SCI	56885.260	127435.260	44850.260

Multivariate Tests of Significance (S = 1, M = 1/2, N = 7)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.99925	7075.36654	3.00	16.00	0.0
Hotellings	1326.63123	7075.36654	3.00	16.00	0.0
Wilks	.00075	7075.36654	3.00	16.00	0.0
Roys	.99925				

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\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	1326.631	100.000	100.000	1.000

Univariate F-tests with (1,18) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
ENG	72149.6997	64.49753	72149.6997	3.58320	20135.5715	0.0
MAT	362088.103	323.91253	362088.103	17.99514	20121.4378	0.0
SCI	44850.2601	259.61744	44850.2601	14.42319	3109.59343	0.0

6160 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

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This procedure was completed at 0:23:39

24 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
6 non-empty cells.  
1 design will be processed.

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\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

Tests of Significance for ENG using UNIQUE sums of squares						
Source of Variation	SS	DF	MS	F	Sig of F	
WITHIN CELLS	64.50	18	3.58			
CONSTANT	72149.70	1	72149.70	20135.57	.000	
IQ	613.71	2	306.85	85.64	.000	
SCHOOL	2314.77	1	2314.77	646.01	.000	
IQ BY SCHOOL	28.68	2	14.34	4.00	.036	

3808 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

This procedure was completed at 0:24:16

24 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 6 non-empty cells.  
 1 design will be processed.

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	323.91	18	18.00		
CONSTANT	362088.10	1	362088.10	20121.44	.000
IQ	14068.26	2	7034.13	390.89	.000
SCHOOL	2544.10	1	2544.10	141.38	.000
IQ BY SCHOOL	7.20	2	3.60	.20	.820

3808 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

This procedure was completed at 0:24:53

24 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 6 non-empty cells.  
 1 design will be processed.

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	259.62	18	14.42		
CONSTANT	44850.26	1	44850.26	3109.59	.000
IQ	7.70	2	3.85	.27	.769
SCHOOL	52.51	1	52.51	3.64	.072
IQ BY SCHOOL	5.46	2	2.73	.19	.829

3808 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.

ที่มาของข้อมูล : ตัวอย่างที่ 4.8

SPSS/PC+ Commands

```
SET PRINT=ON/MORE=OFF/DISK=ON.
* INPUT DATA FROM EXAMPLE 4.8 ST 437.
DATA LIST FREE/LUB SP TORQUE STRAIN.
BEGIN DATA.
1 1 7.30 90.4 1 1 7.10 88.9 1 1 7.39 85.9 1 1 7.82 88.3
1 2 7.12 85.1 1 2 7.06 89.0 1 2 7.45 75.9 1 2 7.45 77.2
2 1 9.00 82.5 2 1 8.43 82.4 2 1 7.65 82.4 2 1 7.70 87.4
2 2 8.19 86.0 2 2 8.25 74.5 2 2 7.45 83.1 2 2 7.45 86.4
3 1 7.28 79.6 3 1 8.96 95.1 3 1 7.75 90.2 3 1 7.80 88.0
3 2 7.15 81.2 3 2 7.15 72.0 3 2 7.70 79.9 3 2 7.45 71.9
4 1 7.60 94.1 4 1 7.00 86.5 4 1 7.82 85.9 4 1 7.30 88.3
4 2 7.06 81.2 4 2 7.04 79.9 4 2 7.52 86.4 4 2 7.70 76.4
END DATA.
VARIABLE LABELS LUB (TYPE OF LUBRICANT)/SP (SPEED LEVEL).
VALUE LABELS LUB 1 (TYPE A) 2 (TYPE B) 3 (TYPE C) 4 (TYPE D)
VALUE LABELS SP 1 (FAST SPEED) 2 (LOW SPEED).
MANOVA TORQUE STRAIN BY LUB(1,4) SP(1,2)
/PRINT=ERROR(BSCP)
CELLINFO(COV)
HOMOGENEITY(BOXM)
/PRINT=SIGNIF(HYPOTH MULTIV UNIV EIGEN DIMENR)
/DESIGN.
```

32 cases are written to the uncompressed active file.

This procedure was completed at 0:38:18

32 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
8 non-empty cells.

1 design will be processed.

Variable	CELL NUMBER							
	1	2	3	4	5	6	7	8
LUB	1	1	2	2	3	3	4	4
SP	1	2	1	2	1	2	1	2

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 1  
Variance-Covariance matrix

	TORQUE	STRAIN
TORQUE	.137	
STRAIN	-.169	3.540

Determinant of Variance-Covariance matrix = .45687  
LOG(Determinant) = -.78336

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 2  
Variance-Covariance matrix

	TORQUE	STRAIN
TORQUE	.044	
STRAIN	-1.257	37.542

Determinant of Variance-Covariance matrix = .06431  
LOG(Determinant) = -2.74400

-----  
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\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

Cell Number .. 3  
Variance-Covariance matrix

	TORQUE	STRAIN
TORQUE	.415	
STRAIN	-.015	22.669

Determinant of Variance-Covariance matrix = 9.40975  
LOG(Determinant) = 2.24175





\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

Cell Number .. 8  
Variance-Covariance matrix

	TORQUE	STRAIN
TORQUE	.110	
STRAIN	-.137	17.189

Determinant of Variance-Covariance matrix = 1.87204  
LOG(Determinant) = .62703  
-----

\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

Pooled within-cells Variance-Covariance matrix

	TORQUE	STRAIN
TORQUE	.204	
STRAIN	-.079	30.683

Determinant of pooled Variance-Covariance matrix 6.25979  
LOG(Determinant) = 1.83319  
-----

Multivariate test for Homogeneity of Dispersion matrices

Boxs M = 34.21074  
F WITH (21,2064) DF = 1.17130, P = .267 (Approx.)  
Chi-Square with 21 DF = 24.94533, P = .250 (Approx.)

\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*

WITHIN CELLS Sum-of-Squares and Cross-Products

	TORQUE	STRAIN
TORQUE	4.897	
STRAIN	-1.890	736.390

-----

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. LUB BY SP  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	TORQUE	STRAIN
TORQUE	.132	
STRAIN	1.585	32.244

Multivariate Tests of Significance (S = 2, M = 0, N = 10 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.06853	.28383	6.00	48.00	.942
Hotellings	.07256	.26604	6.00	44.00	.950
Wilks	.93193	.27507	6.00	46.00	.946
Roys	.06108				

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. LUB BY SP (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.065	89.662	89.662	.247
2	.008	10.338	100.000	.086

Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F	
1 TO 2	.93193	.27507	6.00	46.00	.946
2 TO 2	.99256	.09001	2.00	24.00	.914

\*\*\* ANALYSIS OF VARIANCE -- DESIGN 1 \*\*\*

EFFECT .. LUB BY SP (CONT.)  
Univariate F-tests with (3,24) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TORQUE	.13238	4.89652	.04413	.20402	.21629	.884
STRAIN	32.24372	736.38992	10.74791	30.68291	.35029	.789

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. SP

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	TORQUE	STRAIN
TORQUE	1.205	
STRAIN	27.208	614.251

-----  
Multivariate Tests of Significance (S = 1, M = 0, N = 10 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.52604	12.76357	2.00	23.00	.000
Hotellings	1.10988	12.76357	2.00	23.00	.000
Wilks	.47396	12.76357	2.00	23.00	.000
Roys	.52604				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. SP (CONT.)

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	1.110	100.000	100.000	.725

-----  
Univariate F-tests with (1,24) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TORQUE	1.20513	4.89652	1.20513	.20402	5.90686	.023
STRAIN	614.25129	736.38992	614.25129	30.68291	20.01933	.000

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. LUB

Adjusted Hypothesis Sum-of-Squares and Cross-Products

	TORQUE	STRAIN
TORQUE	1.694	
STRAIN	-9.862	74.874

-----  
Multivariate Tests of Significance (S = 2, M = 0, N = 10 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.31410	1.49049	6.00	48.00	.202
Hotellings	.43775	1.60509	6.00	44.00	.168
Wilks	.69158	1.55237	6.00	46.00	.183
Roys	.29483				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. LUB (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.418	95.512	95.512	.543
2	.020	4.488	100.000	.139

Dimension Reduction Analysis

Roots	Wilks L.	F Hypoth. DF	Error DF	Sig. of F
1 TO 2	.69158	1.55237	6.00	.183
2 TO 2	.98073	.23578	2.00	.792

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. LUB (CONT.)  
Univariate F-tests with (3,24) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TORQUE	1.69408	4.89652	.56469	.20402	2.76781	.064
STRAIN	74.87379	736.38992	24.95793	30.68291	.81341	.499

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT  
Adjusted Hypothesis Sum-of-Squares and Cross-Products

	TORQUE	STRAIN
TORQUE	1869.508	
STRAIN	20437.023	223412.703

Multivariate Tests of Significance (S = 1, M = 0, N = 10 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.99859	8134.11649	2.00	23.00	0.0
Hotelling's	707.31448	8134.11649	2.00	23.00	0.0
Wilks	.00141	8134.11649	2.00	23.00	0.0
Roy's	.99859				

\* \* ANALYSIS OF VARIANCE -- DESIGN 1 \* \*

EFFECT .. CONSTANT (CONT.)  
Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	707.314	100.000	100.000	.999

Univariate F-tests with (1,24) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TORQUE	1869.50837	4.89652	1869.50837	.20402	9163.27434	0.0
STRAIN	223412.703	736.38992	223412.703	30.68291	7281.33929	0.0

6232 BYTES OF WORKSPACE NEEDED FOR MANOVA EXECUTION.