

STA442F05 Final Printout

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```

/***** cars.sas *****/
options linesize=79 pagesize=200 noovp formdlim='-';
title 'Metric Cars Data: STA442/1008 Final Exam';

proc format; /* Used to label values of the categorical variables */
  value carfmt 1 = 'US'
              2 = 'Japanese'
              3 = 'European' ;

data auto;
  infile 'mcars.dat' firstobs=2; /* Skip the first line */
  input id country kpl weight length;
  /* Cell Means Indicator dummy vars */
  if country = 1 then c1=1; else c1=0;
  if country = 2 then c2=1; else c2=0;
  if country = 3 then c3=1; else c3=0;
  label country = 'Country of Origin'
        kpl = 'Kilometers per Litre';
  format country carfmt.;

proc reg simple;
  title 'ANCOVA with cell means coding using proc reg';
  model kpl = weight length c1 c2 c3 / noint;
  TestA: test c1 = c2 = c3 = 0;
  TestB: test c1 = c2 = c3;
  TestC: test c1 = c2;
  TestD: test c1 = c3;
  TestE: test c2 = c3;
  TestF: test c1 = c2 = 0;
  TestG: test c1 = c3 = 0;
  TestH: test c2 = c3 = 0;
  TestI: test weight=length=0;
  TestJ: test weight=length=0, c1 = c2 = c3;
  TestK: test weight=length=0, c1 = c2 = c3 = 0;
  
```

cars.lst

```

-----
ANCOVA with cell means coding using proc reg 1
15:56 Sunday, December 4, 2005
  
```

The REG Procedure

Descriptive Statistics

Variable	Sum	Mean	Uncorrected SS	Variance	Standard Deviation
Intercept	100.00000	1.00000	100.00000	0	0
weight	141345	1413.45000	212754681	131016	361.96142
length	48489	484.88600	23811410	3029.97113	55.04517
c1	73.00000	0.73000	73.00000	0.19909	0.44620
c2	13.00000	0.13000	13.00000	0.11424	0.33800
c3	14.00000	0.14000	14.00000	0.12162	0.34874
kpl	879.48000	8.79480	8440.74000	7.13019	2.67024

```

-----
ANCOVA with cell means coding using proc reg 2
15:56 Sunday, December 4, 2005
  
```

The REG Procedure

Model: MODEL1

Dependent Variable: kpl Kilometers per Litre

NOTE: No intercept in model. R-Square is redefined.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	8195.93850	1639.18770	636.12	<.0001
Error	95	244.80150	2.57686		
Uncorrected Total	100	8440.74000			

Root MSE	1.60526	R-Square	0.9710
Dependent Mean	8.79480	Adj R-Sq	0.9695
Coeff Var	18.25237		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
weight		1	-0.00207	0.00139	-1.49
length		1	-0.02874	0.00925	-3.11
c1		1	25.85295	2.83493	9.12
c2		1	24.49010	2.75828	8.88
c3		1	25.73537	2.69159	9.56

Parameter Estimates

Variable	Label	DF	Pr > t
weight		1	0.1389
length		1	0.0025
c1		1	<.0001
c2		1	<.0001
c3		1	<.0001

Test TestA Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	3	81.87863	31.77	<.0001
Denominator	95	2.57686		

Test TestB Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	8.50611	3.30	0.0411
Denominator	95	2.57686		

Test TestC Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	1	15.74243	6.11	0.0152
Denominator	95	2.57686		

Test TestD Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	1	0.12092	0.05	0.8290
Denominator	95	2.57686		

Test TestE Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	1	10.32125	4.01	0.0482
Denominator	95	2.57686		

Test TestF Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	107.30322	41.64	<.0001
Denominator	95	2.57686		

Test TestG Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	120.43287	46.74	<.0001
Denominator	95	2.57686		

Test TestH Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	122.60725	47.58	<.0001
Denominator	95	2.57686		

Test TestI Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	169.74773	65.87	<.0001
Denominator	95	2.57686		

Test TestJ Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	4	115.27195	44.73	<.0001
Denominator	95	2.57686		

Test TestK Results for Dependent Variable kpl

Source	DF	Mean Square	F Value	Pr > F
Numerator	5	1639.18770	636.12	<.0001
Denominator	95	2.57686		

```

/* titanic2.sas */
title 'Titanic Data: STTA442 Final Check';
options linesize=79 pagesize=35 noovp formdlim='_';

proc format;
  value clfmt 0 = 'Crew';
  value agefmt 1 = 'Adult' 0 = 'Child';
  value sexfmt 1 = 'Male' 0 = 'Female';
  value ynfmt 0 = 'No' 1 = 'Yes';

data iceberg;
  infile 'titanic.dat';
  input class age sex survived;
  pasclass = class; if pasclass=0 then pasclass=.;
  manclass = class; if sex = 0 then manstat=.; if age=0 then manstat=.;
  adclass = class; if age=0 then adclass=.;
  label manclass = 'Class: Adult males only'
        adclass = 'Class: Adults only'
        pasclass = 'Passenger class';
  format class manclass adclass clfmt.;
  format age agefmt.; format sex sexfmt.; format survived ynfmt.;

proc freq;
  title2 'Just Adults';
  tables sex*survived*adclass
  / norow nopercent chisq expected;
  tables adclass*survived*sex
  / norow nopercent chisq expected;

data kids;
  set iceberg;
  if age=0;

proc freq;
  title2 'Just Children';
  tables survived * (class sex)
  / norow nopercent chisq expected;

```

titanic2.lst

Titanic Data: STTA442 Final Check 1
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table 1 of survived by adclass
 Controlling for sex=Female

survived		adclass(Class: Adults only)				
Frequency	Expected					
Col Pct		Crew	1	2	3	Total
No		3	4	13	89	109
	5.8988	36.932	23.852	42.318		
	13.04	2.78	13.98	53.94		
Yes		20	140	80	76	316
	17.101	107.07	69.148	122.68		
	86.96	97.22	86.02	46.06		
Total		23	144	93	165	425

Frequency Missing = 45

Titanic Data: STTA442 Final Check 2
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 1 of survived by adclass
 Controlling for sex=Female

Statistic	DF	Value	Prob
Chi-Square	3	117.3107	<.0001
Likelihood Ratio Chi-Square	3	126.6013	<.0001
Mantel-Haenszel Chi-Square	1	95.5274	<.0001
Phi Coefficient		0.5254	
Contingency Coefficient		0.4651	
Cramer's V		0.5254	

Effective Sample Size = 425
 Frequency Missing = 45

Titanic Data: STTA442 Final Check 3
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table 2 of survived by adclass
 Controlling for sex=Male

survived	adclass(Class: Adults only)				Total
	Crew	1	2	3	
Frequency					
Expected					
Col Pct					
No	670	118	154	387	1329
	687.22	139.52	133.94	368.33	
	77.73	67.43	91.67	83.77	
Yes	192	57	14	75	338
	174.78	35.483	34.064	93.675	
	22.27	32.57	8.33	16.23	
Total	862	175	168	462	1667

Frequency Missing = 64

Titanic Data: STTA442 Final Check 4
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 2 of survived by adclass
 Controlling for sex=Male

Statistic	DF	Value	Prob
Chi-Square	3	37.9879	<.0001
Likelihood Ratio Chi-Square	3	39.6102	<.0001
Mantel-Haenszel Chi-Square	1	12.0997	0.0005
Phi Coefficient		0.1510	
Contingency Coefficient		0.1493	
Cramer's V		0.1510	

Effective Sample Size = 1667
 Frequency Missing = 64

Titanic Data: STTA442 Final Check 5
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table 1 of survived by sex
 Controlling for adclass=Crew

survived	sex		Total
	Female	Male	
Frequency			
Expected			
Col Pct			
No	3	670	673
	17.49	655.51	
	13.04	77.73	
Yes	20	192	212
	5.5096	206.49	
	86.96	22.27	
Total	23	862	885

Titanic Data: STTA442 Final Check 6
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 1 of survived by sex
 Controlling for adclass=Crew

Statistic	DF	Value	Prob
Chi-Square	1	51.4522	<.0001
Likelihood Ratio Chi-Square	1	42.3508	<.0001
Continuity Adj. Chi-Square	1	47.9627	<.0001
Mantel-Haenszel Chi-Square	1	51.3941	<.0001
Phi Coefficient		-0.2411	
Contingency Coefficient		0.2344	
Cramer's V		-0.2411	

Fisher's Exact Test

Cell (1,1) Frequency (F)	3
Left-sided Pr <= F	1.655E-10
Right-sided Pr >= F	1.0000
Table Probability (P)	1.588E-10
Two-sided Pr <= P	1.655E-10

Sample Size = 885

Titanic Data: STTA442 Final Check 7
 Just Adults 17:05 Sunday, December 4, 2005

Table 2 of survived by sex
 Controlling for adclass=1

survived	sex		Total
	Female	Male	
No	4	118	122
	55.072	66.928	
	2.78	67.43	
Yes	140	57	197
	88.928	108.07	
	97.22	32.57	
Total	144	175	319

Titanic Data: STTA442 Final Check 8
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 2 of survived by sex
 Controlling for adclass=1

Statistic	DF	Value	Prob
Chi-Square	1	139.8018	<.0001
Likelihood Ratio Chi-Square	1	166.9868	<.0001
Continuity Adj. Chi-Square	1	137.0779	<.0001
Mantel-Haenszel Chi-Square	1	139.3636	<.0001
Phi Coefficient		-0.6620	
Contingency Coefficient		0.5520	
Cramer's V		-0.6620	

Fisher's Exact Test

Cell (1,1) Frequency (F)	4
Left-sided Pr <= F	1.541E-37
Right-sided Pr >= F	1.0000

Table Probability (P)	1.521E-37
Two-sided Pr <= P	1.625E-37

Sample Size = 319

Titanic Data: STTA442 Final Check 9
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table 3 of survived by sex
 Controlling for adclass=2

survived	sex		Total
	Female	Male	
No	13	154	167
	59.506	107.49	
	13.98	91.67	
Yes	80	14	94
	33.494	60.506	
	86.02	8.33	
Total	93	168	261

Titanic Data: STTA442 Final Check 10
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 3 of survived by sex
 Controlling for adclass=2

Statistic	DF	Value	Prob
Chi-Square	1	156.7827	<.0001
Likelihood Ratio Chi-Square	1	169.5028	<.0001
Continuity Adj. Chi-Square	1	153.4296	<.0001
Mantel-Haenszel Chi-Square	1	156.1820	<.0001
Phi Coefficient		-0.7750	
Contingency Coefficient		0.6126	
Cramer's V		-0.7750	

Fisher's Exact Test

Cell (1,1) Frequency (F)	13
Left-sided Pr <= F	4.040E-38
Right-sided Pr >= F	1.0000

Table Probability (P)	3.981E-38
Two-sided Pr <= P	4.040E-38

Sample Size = 261

Titanic Data: STTA442 Final Check 11
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table 4 of survived by sex
 Controlling for adclass=3

survived	sex		Total
	Female	Male	
No	89	387	476
	125.26	350.74	
	53.94	83.77	
Yes	76	75	151
	39.737	111.26	
	46.06	16.23	
Total	165	462	627

Titanic Data: STTA442 Final Check 12
 Just Adults 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table 4 of survived by sex
 Controlling for adclass=3

Statistic	DF	Value	Prob
Chi-Square	1	59.1594	<.0001
Likelihood Ratio Chi-Square	1	54.7194	<.0001
Continuity Adj. Chi-Square	1	57.5393	<.0001
Mantel-Haenszel Chi-Square	1	59.0651	<.0001
Phi Coefficient		-0.3072	
Contingency Coefficient		0.2936	
Cramer's V		-0.3072	

Fisher's Exact Test

Cell (1,1) Frequency (F)	89
Left-sided Pr <= F	1.414E-13
Right-sided Pr >= F	1.0000

Table Probability (P)	1.102E-13
Two-sided Pr <= P	2.336E-13

Sample Size = 627

Titanic Data: STTA442 Final Check 13
 Just Children 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table of survived by class

survived	class			Total
	1	2	3	
No	0	0	52	52
	2.8624	11.45	37.688	
	0.00	0.00	65.82	
Yes	6	24	27	57
	3.1376	12.55	41.312	
	100.00	100.00	34.18	
Total	6	24	79	109

Titanic Data: STTA442 Final Check 14
 Just Children 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table of survived by class

Statistic	DF	Value	Prob
Chi-Square	2	37.7615	<.0001
Likelihood Ratio Chi-Square	2	49.4084	<.0001
Mantel-Haenszel Chi-Square	1	32.4416	<.0001
Phi Coefficient		0.5886	
Contingency Coefficient		0.5072	
Cramer's V		0.5886	

WARNING: 33% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Sample Size = 109

Titanic Data: STTA442 Final Check 15
 Just Children 17:05 Sunday, December 4, 2005

The FREQ Procedure

Table of survived by sex

survived	sex		Total
	Female	Male	
No	17 21.468 37.78	35 30.532 54.69	52
Yes	28 23.532 62.22	29 33.468 45.31	57
Total	45	64	109

Titanic Data: STTA442 Final Check 16
 Just Children 17:05 Sunday, December 4, 2005

The FREQ Procedure

Statistics for Table of survived by sex

Statistic	DF	Value	Prob
Chi-Square	1	3.0284	0.0818
Likelihood Ratio Chi-Square	1	3.0502	0.0807
Continuity Adj. Chi-Square	1	2.3885	0.1222
Mantel-Haenszel Chi-Square	1	3.0006	0.0832
Phi Coefficient		-0.1667	
Contingency Coefficient		0.1644	
Cramer's V		-0.1667	

Fisher's Exact Test

Cell (1,1) Frequency (F)	17
Left-sided Pr <= F	0.0608
Right-sided Pr >= F	0.9739
Table Probability (P)	0.0347
Two-sided Pr <= P	0.1188

Sample Size = 109

```

/* extoler.sas */
title 'Exercise Tolerance Data: STTA442 Final Exam';
options linesize=79 pagesize=200 noovp formdlm='_';

proc format;
  value sexfmt 1 = 'Male' 2 = 'Female';
  value fatfmt 1 = 'Low' 2 = 'High';
  value smfmt 1 = 'Light' 2 = 'Heavy';

data nopain;
  infile 'extoler.dat' firstobs=2; /* Skip the first line */
  input Toler Sex Fat Smoke;
  format sex sexfmt.; format fat fatfmt.; format smoke smfmt.;
  label toler = 'Exercise tolerance in minutes';

proc glm;
  class Sex Fat Smoke;
  model toler = Sex|Fat|Smoke;
  means Sex|Fat|Smoke;

```

extoler.lst

Exercise Tolerance Data: STTA442 Final Exam 1
 23:36 Sunday, December 4, 2005

The GLM Procedure

Class Level Information

Class	Levels	Values
Sex	2	Female Male
Fat	2	High Low
Smoke	2	Heavy Light

Number of observations 24

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	588.5829167	84.0832738	9.01	0.0002
Error	16	149.3666667	9.3354167		
Corrected Total	23	737.9495833			

	R-Square	Coeff Var	Root MSE	Toler	Mean
	0.797592	18.77833	3.055391	16.27083	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Sex	1	176.5837500	176.5837500	18.92	0.0005
Fat	1	242.5704167	242.5704167	25.98	0.0001
Sex*Fat	1	13.6504167	13.6504167	1.46	0.2441
Smoke	1	70.3837500	70.3837500	7.54	0.0144
Sex*Smoke	1	11.0704167	11.0704167	1.19	0.2923
Fat*Smoke	1	72.4537500	72.4537500	7.76	0.0132
Sex*Fat*Smoke	1	1.8704167	1.8704167	0.20	0.6604

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Sex	1	176.5837500	176.5837500	18.92	0.0005
Fat	1	242.5704167	242.5704167	25.98	0.0001
Sex*Fat	1	13.6504167	13.6504167	1.46	0.2441
Smoke	1	70.3837500	70.3837500	7.54	0.0144
Sex*Smoke	1	11.0704167	11.0704167	1.19	0.2923
Fat*Smoke	1	72.4537500	72.4537500	7.76	0.0132
Sex*Fat*Smoke	1	1.8704167	1.8704167	0.20	0.6604

Exercise Tolerance Data: STTA442 Final Exam 3
 23:36 Sunday, December 4, 2005

The GLM Procedure

Level of Sex	N	-----Toler----- Mean	Std Dev
Female	12	13.5583333	4.72102807
Male	12	18.9833333	5.36145050

Level of Fat	N	-----Toler----- Mean	Std Dev
High	12	13.0916667	3.72667493
Low	12	19.4500000	5.58089273

Level of Sex	Level of Fat	N	-----Toler----- Mean	Std Dev
Female	High	6	11.1333333	3.61146323
Female	Low	6	15.9833333	4.67735680
Male	High	6	15.0500000	2.88218667
Male	Low	6	22.9166667	4.21920214

Level of Smoke	N	-----Toler----- Mean	Std Dev
Heavy	12	14.5583333	4.85713315
Light	12	17.9833333	6.09065355

Level of Sex	Level of Smoke	N	-----Toler----- Mean	Std Dev
Female	Heavy	6	11.1666667	3.20104150
Female	Light	6	15.9500000	5.00589652
Male	Heavy	6	17.9500000	3.74793276
Male	Light	6	20.0166667	6.82859185

Level of Fat	Level of Smoke	N	-----Toler----- Mean	Std Dev
High	Heavy	6	13.1166667	4.82303501
High	Light	6	13.0666667	2.70012345
Low	Heavy	6	16.0000000	4.86333219
Low	Light	6	22.9000000	4.03782119

Level of Sex	Level of Fat	Level of Smoke	N	-----Toler----- Mean	Std Dev
Female	High	Heavy	3	10.2000000	4.15090352
Female	High	Light	3	12.0666667	3.57258077
Female	Low	Heavy	3	12.1333333	2.36290781
Female	Low	Light	3	19.8333333	2.15483951
Male	High	Heavy	3	16.0333333	3.92470806
Male	High	Light	3	14.0666667	1.56950098
Male	Low	Heavy	3	19.8666667	2.94844592
Male	Low	Light	3	25.9666667	2.81128678


```

/* finalfarm.sas */
options linesize=79 pagesize=100 noovp formdlm='_';
title 'STA442F05 Final Exam: Farm data from NWK Prob 29.20, p. 1204';

data wheat;
  infile 'farm2.dat' firstobs=2; /* Skip the first line */
  input Field IgMethod Yield1 Yield2;
  label igmethod = 'Irrigation Method'
        yield1 = 'Crop Yield with Fertilizer 1'
        yield2 = 'Crop Yield with Fertilizer 2';

proc means mean stddev n;
  class igmethod;
  var Yield1 Yield2;

proc glm;
  class igmethod;
  model yield1 yield2 = igmethod;
  repeated Fertilizr / short summary;

```

finalfarm.lst

STA442F05 Final Exam: Farm data from NWK Prob 29.20, p. 1204 1
 20:38 Monday, December 5, 2005

The MEANS Procedure

Irrigation Method	N Obs	Variable	Label	Mean
1	5	Yield1	Crop Yield with Fertilizer 1	35.4000000
		Yield2	Crop Yield with Fertilizer 2	39.2000000
2	5	Yield1	Crop Yield with Fertilizer 1	52.2000000
		Yield2	Crop Yield with Fertilizer 2	55.8000000

Irrigation Method	N Obs	Variable	Label	Std Dev	N
1	5	Yield1	Crop Yield with Fertilizer 1	6.5038450	5
		Yield2	Crop Yield with Fertilizer 2	6.8337398	5
2	5	Yield1	Crop Yield with Fertilizer 1	7.0498227	5
		Yield2	Crop Yield with Fertilizer 2	8.5848704	5

STA442F05 Final Exam: Farm data from NWK Prob 29.20, p. 1204 2
 20:38 Monday, December 5, 2005

The GLM Procedure

Class Level Information

Class	Levels	Values
IgMethod	2	1 2

Number of observations	10
------------------------	----

STA442F05 Final Exam: Farm data from NWK Prob 29.20, p. 1204 3
 20:38 Monday, December 5, 2005

The GLM Procedure

Dependent Variable: Yield1 Crop Yield with Fertilizer 1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	705.600000	705.600000	15.34	0.0044
Error	8	368.000000	46.000000		
Corrected Total	9	1073.600000			

R-Square	Coeff Var	Root MSE	Yield1 Mean
0.657228	15.48477	6.782330	43.80000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
IgMethod	1	705.600000	705.600000	15.34	0.0044

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IgMethod	1	705.600000	705.600000	15.34	0.0044

The GLM Procedure

Dependent Variable: Yield2 Crop Yield with Fertilizer 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	688.900000	688.900000	11.44	0.0096
Error	8	481.600000	60.200000		
Corrected Total	9	1170.500000			

R-Square	Coeff Var	Root MSE	Yield2 Mean
0.588552	16.33445	7.758866	47.50000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
IgMethod	1	688.9000000	688.9000000	11.44	0.0096

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IgMethod	1	688.9000000	688.9000000	11.44	0.0096

The GLM Procedure
 Repeated Measures Analysis of Variance

Repeated Measures Level Information

Dependent Variable	Yield1	Yield2
Level of Fertilizr	1	2

Manova Test Criteria and Exact F Statistics for the Hypothesis of no Fertilizr Effect
 H = Type III SSCP Matrix for Fertilizr
 E = Error SSCP Matrix

Statistic	S=1	M=-0.5	N=3	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda				0.14916097	45.63	1	8	0.0001
Pillai's Trace				0.85083903	45.63	1	8	0.0001
Hotelling-Lawley Trace				5.70416667	45.63	1	8	0.0001
Roy's Greatest Root				5.70416667	45.63	1	8	0.0001

Manova Test Criteria and Exact F Statistics for the Hypothesis of no Fertilizr*IgMethod Effect
 H = Type III SSCP Matrix for Fertilizr*IgMethod
 E = Error SSCP Matrix

Statistic	S=1	M=-0.5	N=3	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda				0.99585062	0.03	1	8	0.8597
Pillai's Trace				0.00414938	0.03	1	8	0.8597
Hotelling-Lawley Trace				0.00416667	0.03	1	8	0.8597
Roy's Greatest Root				0.00416667	0.03	1	8	0.8597

The GLM Procedure
 Repeated Measures Analysis of Variance
 Tests of Hypotheses for Between Subjects Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IgMethod	1	1394.450000	1394.450000	13.32	0.0065
Error	8	837.600000	104.700000		

The GLM Procedure
 Repeated Measures Analysis of Variance
 Univariate Tests of Hypotheses for Within Subject Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Fertilizr	1	68.45000000	68.45000000	45.63	0.0001
Fertilizr*IgMethod	1	0.05000000	0.05000000	0.03	0.8597
Error(Fertilizr)	8	12.00000000	1.50000000		

```

/* finalshoe.sas */
options linesize=79 pagesize=100 noovp formdlm='_';
title 'STA442F05 Final Exam: Shoe data from NWK Table 29.10';

data uvfoot;
  infile 'shoes.dat' firstobs=2; /* Skip the first line */
  input row ident period campaign sales;

proc mixed cl;
  class period campaign;
  model sales = period|campaign;
  repeated / type = un subject = ident;
  lsmeans period / adjust=bon;

```

finalshoe.lst

STA442F05 Final Exam: Shoe data from NWK Table 29.10 1
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The Mixed Procedure

Model Information

Data Set	WORK.UVFOOT
Dependent Variable	sales
Covariance Structure	Unstructured
Subject Effect	ident
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Between-Within

Class Level Information

Class	Levels	Values
period	3	1 2 3
campaign	2	1 2

Dimensions

Covariance Parameters	6
Columns in X	12
Columns in Z	0
Subjects	10
Max Obs Per Subject	3
Observations Used	30
Observations Not Used	0
Total Observations	30

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	347.69129449	
1	1	256.26815630	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Subject	Estimate	Alpha	Lower	Upper
UN(1,1)	ident	75290	0.05	34350	276326
UN(2,1)	ident	79440	0.05	1502.45	157377
UN(2,2)	ident	84197	0.05	38414	309017
UN(3,1)	ident	72731	0.05	1410.04	144051
UN(3,2)	ident	76682	0.05	1373.22	151990
UN(3,3)	ident	70440	0.05	32138	258527

Fit Statistics

-2 Res Log Likelihood	256.3
AIC (smaller is better)	268.3
AICC (smaller is better)	273.2
BIC (smaller is better)	270.1

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	91.42	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
period	2	8	54.03	<.0001
campaign	1	8	0.73	0.4166
period*campaign	2	8	2.94	0.1101

Least Squares Means

Effect	period	Estimate	Standard Error	DF	t Value	Pr > t
period	1	648.40	86.7695	8	7.47	<.0001
period	2	728.80	91.7588	8	7.94	<.0001
period	3	616.40	83.9284	8	7.34	<.0001

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The Mixed Procedure

Differences of Least Squares Means

Effect	period	_period	Estimate	Standard Error	DF	t Value	Pr > t
period	1	2	-80.4000	7.7910	8	-10.32	<.0001
period	1	3	32.0000	5.1764	8	6.18	0.0003
period	2	3	112.40	11.2821	8	9.96	<.0001

Differences of Least Squares Means

Effect	period	_period	Adjustment	Adj P
period	1	2	Bonferroni	<.0001
period	1	3	Bonferroni	0.0008
period	2	3	Bonferroni	<.0001

```

/* finalwine.sas */
options linesize=79 pagesize=100 noovp formdlim='_';
title 'STA442F05 Final Exam: Wine tasting data from NWK p. 1169';

data wine;
  infile 'wine.dat' firstobs=2; /* Skip the first line (header) */
  input Judge Wine Rating;

proc means mean stddev;
  class wine;
  var rating;

proc mixed;
  class wine;
  model rating = wine;
  repeated / type = cs subject = judge;
  lsmeans wine / adjust=bon;

```

finalwine.lst

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The MEANS Procedure

Analysis Variable : Rating

Wine	N	Mean	Std Dev
1	6	20.0000000	3.7416574
2	6	22.0000000	3.1622777
3	6	26.6666667	2.6583203
4	6	26.0000000	2.6076810

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The Mixed Procedure

Model Information

Data Set	WORK.WINE
Dependent Variable	Rating
Covariance Structure	Compound Symmetry
Subject Effect	Judge
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Between-Within

Class Level Information

Class	Levels	Values
Wine	4	1 2 3 4

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	108.88011634	
1	1	82.62155007	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Subject	Estimate
CS	Judge	8.4000
Residual		1.0667

Fit Statistics

-2 Res Log Likelihood	82.6
AIC (smaller is better)	86.6
AICC (smaller is better)	87.3
BIC (smaller is better)	86.2

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
1	26.26	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Wine	3	15	57.50	<.0001

Least Squares Means

Effect	Wine	Estimate	Standard Error	DF	t Value	Pr > t
Wine	1	20.0000	1.2561	15	15.92	<.0001
Wine	2	22.0000	1.2561	15	17.51	<.0001
Wine	3	26.6667	1.2561	15	21.23	<.0001
Wine	4	26.0000	1.2561	15	20.70	<.0001

Differences of Least Squares Means

Effect	Wine	_Wine	Estimate	Standard Error	DF	t Value	Pr > t	Adjustment
Wine	1	2	-2.0000	0.5963	15	-3.35	0.0043	Bonferroni
Wine	1	3	-6.6667	0.5963	15	-11.18	<.0001	Bonferroni
Wine	1	4	-6.0000	0.5963	15	-10.06	<.0001	Bonferroni
Wine	2	3	-4.6667	0.5963	15	-7.83	<.0001	Bonferroni
Wine	2	4	-4.0000	0.5963	15	-6.71	<.0001	Bonferroni
Wine	3	4	0.6667	0.5963	15	1.12	0.2811	Bonferroni

The Mixed Procedure

Differences of Least Squares Means

Effect	Wine	_Wine	Adj P
Wine	1	2	0.0261
Wine	1	3	<.0001
Wine	1	4	<.0001
Wine	2	3	<.0001
Wine	2	4	<.0001
Wine	3	4	1.0000