

STA442s12 Final Exam Printout

1. Furnace Data (3 pages)
2. Salmon Data (3 pages)
3. Poverty Data (6 pages)
4. Mantids Data (3 pages)

Total = 16 pages, including this cover page

STA442s12 Final Exam Printout

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```
/* 442s12FinalFurnace.sas */
options nodate;
%include '442s12furnaceread.sas';

/* Creating dummy variables: The data step continues ... */
if liner ne .; /* Eliminate cases with liner missing for this job */
if liner=1 then L1=1; else L1=0;
if liner=2 then L2=1; else L2=0;

proc freq; tables (L1 L2)*liner / norow nocol nopercent;

/* Centering dampout and area */
proc standard out=hotair mean=0;
var dampout area;

proc reg simple data=hotair;
model dampin = dampout area L1 L2;
TestA: test L1=L2;
TestB: test L1=L2=0;
```

Furnace Data

1

The FREQ Procedure

Table of L1 by liner

L1	liner(Type of Chimney liner)			
Frequency	Unlined	Tile	Metal	Total
0	24	0	25	49
1	0	40	0	40
Total	24	40	25	89

Table of L2 by liner

L2	liner(Type of Chimney liner)			
Frequency	Unlined	Tile	Metal	Total
0	24	40	0	64
1	0	0	25	25
Total	24	40	25	89

The REG Procedure

Number of Observations Read 89
 Number of Observations Used 89

Descriptive Statistics

Variable	Sum	Mean	Uncorrected SS	Variance	Standard Deviation
Intercept	89.00000	1.00000	89.00000	0	0
dampout	-5.862E-14	-6.5865E-16	818.46091	9.30069	3.04970
area	4.83169E-13	5.42887E-15	93126	1058.24898	32.53074
L1	40.00000	0.44944	40.00000	0.25026	0.50026
L2	25.00000	0.28090	25.00000	0.20429	0.45198
dampin	888.22000	9.98000	9569.13320	8.00793	2.82983

Descriptive Statistics

Variable	Label
Intercept	Intercept
dampout	Energy consumpt with damper inactive
area	Chimney area
L1	
L2	
dampin	Energy consumpt with damper active

The REG Procedure

Model: MODEL1

Dependent Variable: dampin Energy consumpt with damper active

Number of Observations Read 89
 Number of Observations Used 89

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	680.04630	170.01157	579.32	<.0001
Error	84	24.65130	0.29347		
Corrected Total	88	704.69760			

Root MSE 0.54173 R-Square 0.9650
 Dependent Mean 9.98000 Adj R-Sq 0.9634
 Coeff Var 5.42812

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error
Intercept	Intercept	1	9.72596	0.12775
dampout	Energy consumpt with damper inactive	1	0.91538	0.01994
area	Chimney area	1	0.00649	0.00245
L1		1	0.18987	0.14864
L2		1	0.60059	0.21402

Parameter Estimates

Variable	Label	DF	t Value	Pr > t
Intercept	Intercept	1	76.13	<.0001
dampout	Energy consumpt with damper inactive	1	45.91	<.0001
area	Chimney area	1	2.65	0.0096
L1		1	1.28	0.2050
L2		1	2.81	0.0062

Furnace Data

4

The REG Procedure
Model: MODEL1

Test TestA Results for Dependent Variable dampin

Source	DF	Mean Square	F Value	Pr > F
Numerator	1	1.72347	5.87	0.0175
Denominator	84	0.29347		

Furnace Data

5

The REG Procedure
Model: MODEL1

Test TestB Results for Dependent Variable dampin

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	1.20344	4.10	0.0200
Denominator	84	0.29347		

```

/* 442s12FinalSalmon.sas */
options linesize=79 noovp formdlm='_' nodate;
title 'Salmon Data';

proc format;
  value cfmt    0 = 'Alaskan'  1 = 'Canadian';
  value sexfmt  0 = 'Female'   1 = 'Male';
data fish;
  infile 'salmon.data';
  input  country gender fresh marine;
  country = country-1; gender = gender-1;
  label  country = 'Country of origin'
         gender  = 'Sex of fish'
         fresh   = 'First-year freshwater growth in 100ths of an inch'
         marine  = 'First-year marine growth in 100ths of an inch';
  format country cfmt.;
  format gender sexfmt.;

data fishy; /* Two "cases" for each data line in fish: Needed for proc mixed */
  set fish;
  id = _n_;
  environment = 'Freshwater'; growth = fresh; output;
  environment = 'Seawater';   growth = marine; output;

proc print;
  var id country gender environment growth;
  where id < 6;

proc mixed;
  class country gender environment;
  model growth = country|gender|environment;
  repeated / type=un subject=id;
  lsmeans country|environment;

```

Salmon Data						1
Obs	id	country	gender	environment	growth	
1	1	Alaskan	Male	Freshwater	108	
2	1	Alaskan	Male	Seawater	368	
3	2	Alaskan	Female	Freshwater	131	
4	2	Alaskan	Female	Seawater	355	
5	3	Alaskan	Female	Freshwater	105	
6	3	Alaskan	Female	Seawater	469	
7	4	Alaskan	Male	Freshwater	86	
8	4	Alaskan	Male	Seawater	506	
9	5	Alaskan	Female	Freshwater	99	
10	5	Alaskan	Female	Seawater	402	

The Mixed Procedure

Model Information

Data Set	WORK.FISHY
Dependent Variable	growth
Covariance Structure	Unstructured
Subject Effect	id
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
country	2	Alaskan Canadian
gender	2	Female Male
environment	2	Freshwater Seawater

Dimensions

Covariance Parameters	3
Columns in X	27
Columns in Z	0
Subjects	100
Max Obs Per Subject	2

Number of Observations

Number of Observations Read	200
Number of Observations Used	200
Number of Observations Not Used	0

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	1834.05848158	
1	1	1792.51299387	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Subject	Estimate
UN(1,1)	id	295.19
UN(2,1)	id	-36.7641
UN(2,2)	id	1146.50

The Mixed Procedure

Fit Statistics

-2 Res Log Likelihood	1792.5
AIC (smaller is better)	1798.5
AICC (smaller is better)	1798.6
BIC (smaller is better)	1806.3

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
2	41.55	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
country	1	96	10.92	0.0013
gender	1	96	0.22	0.6384
country*gender	1	96	2.98	0.0876
environment	1	96	5177.02	<.0001
country*environment	1	96	172.42	<.0001
gender*environment	1	96	0.27	0.6031
countr*gender*enviro	1	96	0.36	0.5484

Least Squares Means

Effect	environment	Country of origin	Estimate	Standard Error	DF	t Value
country		Alaskan	264.18	2.6176	96	100.93
country		Canadian	251.95	2.6176	96	96.25
environment	Freshwater		117.91	1.7195	96	68.58
environment	Seawater		398.22	3.3887	96	117.51
country*environment	Freshwater	Alaskan	98.45	2.4317	96	40.49
country*environment	Seawater	Alaskan	429.91	4.7924	96	89.71
country*environment	Freshwater	Canadian	137.37	2.4317	96	56.49
country*environment	Seawater	Canadian	366.52	4.7924	96	76.48

Least Squares Means

Effect	environment	Country of origin	Pr > t
country		Alaskan	<.0001
country		Canadian	<.0001
environment	Freshwater		<.0001
environment	Seawater		<.0001
country*environment	Freshwater	Alaskan	<.0001
country*environment	Seawater	Alaskan	<.0001
country*environment	Freshwater	Canadian	<.0001
country*environment	Seawater	Canadian	<.0001

```

/***** 442s12FinalPoverty.sas *****/
options linesize=79 noovp formdlim='- ' nodate;
title 'Poverty Data';

proc format;
  value gfmt 1 = 'Eastern Europe' 2 = 'S. America & Mexico'
            3 = 'Industrialized' 4 = 'Middle East'
            5 = 'Asia'           6 = 'Africa';
data poverty;
  infile 'poverty.data';
  input birthrate deathrate infmort lifexM lifexF gnp group country $;
  /* Make all 6 dummy vars for country group (use 5 if intercept) */
  if group=1 then g1=1; else g1=0;
  if group=2 then g2=1; else g2=0;
  if group=3 then g3=1; else g3=0;
  if group=4 then g4=1; else g4=0;
  if group=5 then g5=1; else g5=0;
  if group=6 then g6=1; else g6=0;
  label g1 = 'Eastern Europe' g2 = 'S. America & Mexico'
        g3 = 'Industrialized' g4 = 'Middle East'
        g5 = 'Asia'          g6 = 'Africa';
  format group gfmt.;
  gnp g1 = gnp*g1 ; gnp g2 = gnp*g2 ; gnp g3 = gnp*g3 ;
  gnp g4 = gnp*g4 ; gnp g5 = gnp*g5 ; gnp g6 = gnp*g6 ;

proc reg;
  model birthrate deathrate infmort lifexM lifexF
        = gnp g1 g2 g4 g5 g6
        gnp g1 gnp g2 gnp g4 gnp g5 gnp g6;
  Uni: test gnp g1=gnp g2=gnp g4=gnp g5=gnp g6=0;
  Multi: mtest gnp g1=gnp g2=gnp g4=gnp g5=gnp g6=0;
  Multi2: mtest gnp=0;

```

Poverty Data

1

The REG Procedure
 Model: MODEL1
 Dependent Variable: birthrate

Number of Observations Read	97
Number of Observations Used	91
Number of Observations with Missing Values	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	14725	1338.62584	48.84	<.0001
Error	79	2165.05335	27.40574		
Corrected Total	90	16890			

Root MSE	5.23505	R-Square	0.8718
Dependent Mean	29.46044	Adj R-Sq	0.8540
Coeff Var	17.76976		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	11.89224	3.53114	3.37	0.0012
gnp		1	0.00005134	0.00017752	0.29	0.7732
g1	Eastern Europe	1	10.38403	6.26358	1.66	0.1013
g2	S. America & Mexico	1	26.45069	4.94109	5.35	<.0001
g4	Middle East	1	29.27666	4.39491	6.66	<.0001
g5	Asia	1	20.50665	3.87314	5.29	<.0001
g6	Africa	1	34.36885	3.75709	9.15	<.0001
gnpg1		1	-0.00374	0.00253	-1.48	0.1432
gnpg2		1	-0.00553	0.00187	-2.96	0.0040
gnpg4		1	-0.00100	0.00032658	-3.08	0.0029
gnpg5		1	-0.00148	0.00037039	-4.01	0.0001
gnpg6		1	-0.00209	0.00094896	-2.20	0.0308

Poverty Data

2

The REG Procedure
 Model: MODEL1
 Dependent Variable: deathrate

Number of Observations Read 97
 Number of Observations Used 91
 Number of Observations with Missing Values 6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	949.91044	86.35549	6.66	<.0001
Error	79	1024.51396	12.96853		
Corrected Total	90	1974.42440			

Root MSE 3.60118 R-Square 0.4811
 Dependent Mean 10.73407 Adj R-Sq 0.4089
 Coeff Var 33.54912

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	9.02042	2.42907	3.71	0.0004
gnp		1	0.00002198	0.00012211	0.18	0.8576
g1	Eastern Europe	1	-2.88689	4.30871	-0.67	0.5048
g2	S. America & Mexico	1	-0.14937	3.39897	-0.04	0.9651
g4	Middle East	1	-0.17200	3.02326	-0.06	0.9548
g5	Asia	1	1.28562	2.66433	0.48	0.6308
g6	Africa	1	7.59031	2.58450	2.94	0.0043
gnpg1		1	0.00225	0.00174	1.29	0.1994
gnpg2		1	0.00030425	0.00128	0.24	0.8133
gnpg4		1	-0.00033156	0.00022465	-1.48	0.1439
gnpg5		1	-0.00047483	0.00025479	-1.86	0.0661
gnpg6		1	-0.00235	0.00065279	-3.61	0.0005

Poverty Data

3

The REG Procedure
 Model: MODEL1
 Dependent Variable: infmort

Number of Observations Read	97
Number of Observations Used	91
Number of Observations with Missing Values	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	133266	12115	16.04	<.0001
Error	79	59686	755.51325		
Corrected Total	90	192951			

Root MSE	27.48660	R-Square	0.6907
Dependent Mean	55.28132	Adj R-Sq	0.6476
Coeff Var	49.72132		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	11.31149	18.54024	0.61	0.5435
gnp		1	-0.00018463	0.00093205	-0.20	0.8435
g1	Eastern Europe	1	18.11586	32.88692	0.55	0.5833
g2	S. America & Mexico	1	75.79083	25.94315	2.92	0.0045
g4	Middle East	1	60.00465	23.07547	2.60	0.0111
g5	Asia	1	70.15360	20.33590	3.45	0.0009
g6	Africa	1	97.98901	19.72656	4.97	<.0001
gnpg1		1	-0.00566	0.01327	-0.43	0.6711
gnpg2		1	-0.02121	0.00980	-2.16	0.0335
gnpg4		1	-0.00303	0.00171	-1.77	0.0809
gnpg5		1	-0.00619	0.00194	-3.18	0.0021
gnpg6		1	-0.01097	0.00498	-2.20	0.0306

Poverty Data

4

The REG Procedure
 Model: MODEL1
 Dependent Variable: lifexM

Number of Observations Read	97
Number of Observations Used	91
Number of Observations with Missing Values	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	6507.44074	591.58552	23.26	<.0001
Error	79	2009.07750	25.43136		
Corrected Total	90	8516.51824			

Root MSE	5.04295	R-Square	0.7641
Dependent Mean	61.38132	Adj R-Sq	0.7312
Coeff Var	8.21578		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	67.48314	3.40157	19.84	<.0001
gnp		1	0.00021474	0.00017100	1.26	0.2129
g1	Eastern Europe	1	-0.29694	6.03374	-0.05	0.9609
g2	S. America & Mexico	1	-10.61182	4.75978	-2.23	0.0286
g4	Middle East	1	-6.73032	4.23364	-1.59	0.1159
g5	Asia	1	-9.32863	3.73102	-2.50	0.0145
g6	Africa	1	-19.78277	3.61922	-5.47	<.0001
gnpg1		1	-0.00012705	0.00244	-0.05	0.9585
gnpg2		1	0.00328	0.00180	1.82	0.0724
gnpg4		1	0.00035847	0.00031459	1.14	0.2579
gnpg5		1	0.00092582	0.00035680	2.59	0.0113
gnpg6		1	0.00323	0.00091414	3.53	0.0007

Poverty Data

5

The REG Procedure
 Model: MODEL1
 Dependent Variable: lifexF

Number of Observations Read 97
 Number of Observations Used 91
 Number of Observations with Missing Values 6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	8884.57563	807.68869	28.16	<.0001
Error	79	2265.97426	28.68322		
Corrected Total	90	11151			

Root MSE 5.35567 R-Square 0.7968
 Dependent Mean 66.03033 Adj R-Sq 0.7685
 Coeff Var 8.11093

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	74.18754	3.61250	20.54	<.0001
gnp		1	0.00021338	0.00018161	1.17	0.2436
g1	Eastern Europe	1	0.12701	6.40790	0.02	0.9842
g2	S. America & Mexico	1	-11.86793	5.05494	-2.35	0.0214
g4	Middle East	1	-11.40461	4.49618	-2.54	0.0132
g5	Asia	1	-14.39899	3.96238	-3.63	0.0005
g6	Africa	1	-23.20915	3.84365	-6.04	<.0001
gnpg1		1	0.00011277	0.00259	0.04	0.9653
gnpg2		1	0.00350	0.00191	1.83	0.0705
gnpg4		1	0.00048563	0.00033410	1.45	0.1500
gnpg5		1	0.00126	0.00037892	3.33	0.0013
gnpg6		1	0.00349	0.00097083	3.60	0.0006

Poverty Data

6

The REG Procedure
Model: MODEL1

Test Uni results

Dependent Variable	Source	DF	Mean Square	F Value	Pr > F
birthrate	Numerator	5	175.91761	6.42	<.0001
	Denominator	79	27.40574		
deathrate	Numerator	5	46.98840	3.62	0.0053
	Denominator	79	12.96853		
infmort	Numerator	5	2785.36123	3.69	0.0047
	Denominator	79	755.51325		
lifexM	Numerator	5	104.37990	4.10	0.0023
	Denominator	79	25.43136		
lifexF	Numerator	5	142.50096	4.97	0.0005
	Denominator	79	28.68322		

Poverty Data

8

The REG Procedure
Model: MODEL1

Multivariate Test: Multi

Multivariate Statistics and F Approximations

S=5 M=-0.5 N=36.5

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.46835859	2.54	25	280.11	0.0001
Pillai's Trace	0.65497683	2.38	25	395	0.0003
Hotelling-Lawley Trace	0.89029787	2.63	25	174.91	0.0001
Roy's Greatest Root	0.51252652	8.10	5	79	<.0001

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

Multivariate Test: Multi2

Multivariate Statistics and Exact F Statistics

S=1 M=1.5 N=36.5

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.89016823	1.85	5	75	0.1132
Pillai's Trace	0.10983177	1.85	5	75	0.1132
Hotelling-Lawley Trace	0.12338317	1.85	5	75	0.1132
Roy's Greatest Root	0.12338317	1.85	5	75	0.1132

```

/* 442s12FinalMantids.sas */
options linesize=79 pagesize=500 noovp formdlim='_' nodate;
title 'Mantids Data';

proc format;
  value sexfmt 0 = 'Male' 1 = 'Female';
  value dfmt 1 = '1=8cm' 2 = '2=13cm' 3 = '3=18cm';

data bugs; /* Univariate Data Read */
  infile 'mantids.data' firstobs=2; /* Skip the first line */
  input id Sex Order Predator Distance Calls;
  format sex sexfmt. distance dfmt.;

proc mixed;
  class Sex Predator Distance;
  model calls = Sex|Predator|Distance;
  repeated / type=un subject=id;
  lsmeans sex distance Predator*Distance;

```

Mantids Data

1

The Mixed Procedure

Model Information

Data Set	WORK.BUGS
Dependent Variable	Calls
Covariance Structure	Unstructured
Subject Effect	id
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
Sex	2	Female Male
Predator	4	1 2 3 4
Distance	3	1=8cm 2=13cm 3=18cm

Dimensions

Covariance Parameters	6
Columns in X	60
Columns in Z	0
Subjects	57
Max Obs Per Subject	3

Number of Observations

Number of Observations Read	171
Number of Observations Used	171
Number of Observations Not Used	0

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	1276.89660248	
1	1	1238.85078928	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Subject	Estimate
UN(1,1)	id	203.06
UN(2,1)	id	141.72
UN(2,2)	id	249.57
UN(3,1)	id	101.00
UN(3,2)	id	114.05
UN(3,3)	id	305.72

Fit Statistics

-2 Res Log Likelihood	1238.9
AIC (smaller is better)	1250.9
AICC (smaller is better)	1251.5
BIC (smaller is better)	1263.1

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	38.05	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Sex	1	49	14.82	0.0003
Predator	3	49	2.22	0.0972
Sex*Predator	3	49	0.17	0.9180
Distance	2	49	23.25	<.0001
Sex*Distance	2	49	0.37	0.6956
Predator*Distance	6	49	4.38	0.0013
Sex*Predato*Distance	6	49	0.68	0.6637

Least Squares Means

Effect	Sex	Predator	Distance	Estimate	Standard Error	DF
Sex	Female			61.2690	2.4960	49
Sex	Male			74.6881	2.4327	49
Distance			1=8cm	74.8436	1.9419	49
Distance			2=13cm	70.5139	2.1528	49
Distance			3=18cm	58.5783	2.3827	49
Predator*Distance		1	1=8cm	75.5357	3.5112	49
Predator*Distance		1	2=13cm	69.5000	3.8927	49
Predator*Distance		1	3=18cm	56.2000	4.3083	49
Predator*Distance		2	1=8cm	75.9554	3.6875	49
Predator*Distance		2	2=13cm	68.0000	4.0881	49
Predator*Distance		2	3=18cm	41.4464	4.5246	49
Predator*Distance		3	1=8cm	69.3167	4.3144	49
Predator*Distance		3	2=13cm	70.4333	4.7831	49
Predator*Distance		3	3=18cm	66.6000	5.2938	49
Predator*Distance		4	1=8cm	78.5667	3.9741	49
Predator*Distance		4	2=13cm	74.1222	4.4058	49
Predator*Distance		4	3=18cm	70.0667	4.8763	49

Least Squares Means

Effect	Sex	Predator	Distance	t Value	Pr > t
Sex	Female			24.55	<.0001
Sex	Male			30.70	<.0001
Distance			1=8cm	38.54	<.0001
Distance			2=13cm	32.75	<.0001
Distance			3=18cm	24.58	<.0001
Predator*Distance		1	1=8cm	21.51	<.0001
Predator*Distance		1	2=13cm	17.85	<.0001
Predator*Distance		1	3=18cm	13.04	<.0001
Predator*Distance		2	1=8cm	20.60	<.0001
Predator*Distance		2	2=13cm	16.63	<.0001
Predator*Distance		2	3=18cm	9.16	<.0001
Predator*Distance		3	1=8cm	16.07	<.0001
Predator*Distance		3	2=13cm	14.73	<.0001
Predator*Distance		3	3=18cm	12.58	<.0001
Predator*Distance		4	1=8cm	19.77	<.0001
Predator*Distance		4	2=13cm	16.82	<.0001
Predator*Distance		4	3=18cm	14.37	<.0001