PSYC 943: Fundamentals of Multivariate Modeling
Homework #1 (Total 10 Points)
Due: Friday, September 6, 2013 at 12pm.

Homework Problems:

1. Find and "like" the Facebook course page for PSYC 943 Fall 2013. Use https://www.facebook.com/psyc943fall2013. If you do not have a Facebook account, then post a comment using you name and email address to our lecture page at jonathantemplin.com. (1 point)

2. Sign up for an HCC account to get access to Tusker (used for SAS and Mplus). See link on course webpage. (1 point)

The following questions refer to analyses conducted on a study of the effectiveness of several methods for teaching mathematics. In the study, a sample of students were randomly assigned to a teaching method condition. The study had three variables: the teaching method (METHOD), a student's score on a pre-test centered at a score of 20 (MATHPRE20), and a student's score on a post-test (MATHPOST).

An ANCOVA model

3. What was the sample size? (1 point)

4. How many teaching methods were being compared? (1 point)

5. Assuming an ANCOVA analysis was conducted, were the regression coefficients (the slopes) for MATHPRE equal across teaching method? In your answer, list how you came to this conclusion, including any hypothesis test statistic and p-value you used in your assessment. (1 point)

6. Using the most parsimonious model (Analysis #1 or Analysis #2), what were the adjusted means of MATHPOST for each teaching method when a student had a pretest score of 20? (1 point)

7. Describe the relationship between MATHPRE and MATHPOST in the context of the most parsimonious model (e.g., is the relationship positive, what is the strength of the relationship). (1 point)

8. Using APA style, write a sample results section describing the analyses conducted and the results found. (3 points)

Submission Instructions:

All homework and final answers must be your own and not be copied or paraphrased from anyone else's answers. Homework must be submitted via email (jtemplin@unl.edu) in the form of Microsoft Word document with the name: 943_FirstLast_HW#.docx. Late homework will have a penalty of 10% per calendar day.

ANALYSIS #1

The GLM Procedure

Dependent Variable: MATHPOST

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	609.030366	203.010122	8.46	0.0001
Error	52	1247.094634	23.982589		
Corrected Total	55	1856.125000			

R-Square	Coeff Var	Root MSE	MATHPOST Mean
0.328119	27.01905	4.897202	18.12500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
METHOD	2	115.6381579	57.8190789	2.41	0.0997
MATHPRE20	1	493.3922076	493.3922076	20.57	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
METHOD	2	228.7091212	114.3545606	4.77	0.0125
MATHPRE20	1	493.3922076	493.3922076	20.57	<.0001

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	29.89549734	B	2.42995768	12.30	<.0001

Parameter	Estimate		Standard Error	t Value	Pr > |t|
METHOD 1	-4.05848748	B	1.63206836	-2.49	0.0161
METHOD 2	-5.01500355	B	1.72577987	-2.91	0.0054
METHOD 3	0.00000000	B	.	.	.
MATHPRE20	0.77323836		0.17047680	4.54	<.0001

The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Least Squares Means at MATHPRE20=0

METHOD	MATHPOST LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	25.8370099	2.2221443	<.0001	1
2	24.8804938	1.9821434	<.0001	2
3	29.8954973	2.4299577	<.0001	3

Least Squares Means for effect METHOD
Pr > |t| for H0: LSMean(i)=LSMean(j)
Dependent Variable: MATHPOST

i/j	1	2	3
1		0.5481	0.0161
2	0.5481		0.0054
3	0.0161	0.0054	

ANALYSIS #2

The GLM Procedure

Dependent Variable: MATHPOST

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	625.070867	125.014173	5.08	0.0008
Error	50	1231.054133	24.621083		
Corrected Total	55	1856.125000			

R-Square	Coeff Var	Root MSE	MATHPOST Mean
0.336761	27.37635	4.961964	18.12500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
METHOD	2	115.6381579	57.8190789	2.35	0.1060
MATHPRE20	1	493.3922076	493.3922076	20.04	<.0001
MATHPRE20*METHOD	2	16.0405020	8.0202510	0.33	0.7235

Source	DF	Type III SS	Mean Square	F Value	Pr > F
METHOD	2	41.3346813	20.6673407	0.84	0.4380
MATHPRE20	1	421.6803338	421.6803338	17.13	0.0001
MATHPRE20*METHOD	2	16.0405020	8.0202510	0.33	0.7235

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	30.19923918	B	5.47141051	5.52	<.0001
METHOD 1	-1.83137730	B	6.78646537	-0.27	0.7884
METHOD 2	-6.33713230	B	5.99601306	-1.06	0.2956
METHOD 3	0.00000000	B	.	.	.
MATHPRE20	0.79790775	B	0.43280665	1.84	0.0712
MATHPRE20*METHOD 1	0.19678016	B	0.54932888	0.36	0.7217
MATHPRE20*METHOD 2	-0.13098450	B	0.48863296	-0.27	0.7898
MATHPRE20*METHOD 3	0.00000000	B	.	.	.

The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Least Squares Means at MATHPRE20=0

METHOD	MATHPOST LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	28.3678619	4.0149445	<.0001	1
2	23.8621069	2.4527209	<.0001	2
3	30.1992392	5.4714105	<.0001	3

Least Squares Means for effect METHOD
Pr > |t| for H0: LSMean(i)=LSMean(j)
Dependent Variable: MATHPOST

i/j	1	2	3
1		0.3428	0.7884
2	0.3428		0.2956
3	0.7884	0.2956	