Grad Stats Final Exam Fall, 2000

Question I

This problem is a reward to the one SLHS student who stuck with us. A speech researcher is trying to find ways to help people whose speech has been impaired by injuries to either their vocal apparatus or to the brain areas responsible for speech. She suspects that one reason people with such injuries have trouble being understood is that they don't talk loudly enough, either because their injuries make it difficult to do so or because they are embarrassed by their acquired speech problems. Before designing an intervention, she conducts a study to examine the relationship between loudness and speech intelligibility among a group of patients with speech problems. The following variables are available for each patient:

LOUD	loudness (in dB) of the patient's typical speech
INTEL	intelligibility as rated on a 10-point scale by judges unaware of the purposes of the study
AGE	age (in years) of the patient

For each substantive question below, specify MODEL A/MODEL C comparisons that could be used to answer the question.

1. Are patients who speak louder easier to understand? (In this question and subsequent ones, treat INTEL as the dependent variable.)

2. Age is known to affect loudness. When controlling for age, are patients who speak louder easier to understand?

3. Is it more true for younger patients than older patients that patients who speak louder are easier to understand?

4. Ignoring age for the moment and assuming there is a relationship been intelligibility and loudness, can there be too much of a good thing? That is, do effects of loudness on intelligibility decrease with increasing loudness?

5. Assuming that loudness is decreasingly effective, is the optimal level intelligibility attained when loudness is 80 dB?

6. Does the degree to which the effectiveness of loudness decreases at higher levels depend on the age of the patient?

Question II

Although African-Americans (AA) as a group are economically disadvantaged compared to Caucasian-Americans as a group, there are many salient counterexamples of AA affluence in the media (e.g., Oprah, Colin Powell). What effect do such images have on the perception of AA's plight as a whole? The enlightened racism perspective argues that successful AA individuals may actually undermine the perception that AA as a whole are discriminated against. Thus, thinking about Colin Powell may at least temporarily decrease how much discrimination you think exists toward AAs.

Bodenhausen, Schwarz, Bless and Wanke (1995) investigated this issue by making an affluent AA temporarily salient to participants and then assessing participants' attitudes. Specifically, participants completed a survey on which the last question referred to Oprah, Michael Jordan or Julia Roberts (control condition) thus making either an AA or control target temporarily available to participants. In an unrelated task participants later rated how much they believed AA continued to be discriminated against in the U.S. on a scale from 0 = *not very much* to 9 = *very much*. The average response, standard deviation and n for each condition are provided below.

	Oprah	**Michael Jordan**	**Control**
Mean:	6.8	5.4	3.0
St. Dev.:	1.6	1.8	1.4
n:	15	13	12

1. Develop two contrast codes to analyze this data keeping in mind that one code should address the enlightened racism hypothesis. Give a brief interpretation of the substantive question asked by each code.

2. Calculate the parameter estimate for each contrast-coded predictor you gave in question 1.

3. Provide a full source table for the one-way ANOVA of this data.

4. Write a one-paragraph results section that summarizes the results you have found. Make sure to address what the results imply about the viability of the enlightened racism hypothesis in the discussion.

Question III

Data are collected on a sample of 200 elderly people to examine the determinants of depression in old age. Four variables are measured:

DEP	Scores on a depression inventory, ranging from 1 to 50, where higher numbers indicate greater levels of depression. This is the outcome variable in all analyses.
AGE	Respondent's Age

FRIENDS	The number of "very close" friends reported by the respondent (from 0 to 4).
EVENTS	The number of traumatic life events reported by the respondent in the last 3 years.

In the following analyses, two other variables are computed from the above variables:

AGE2 = AGE*AGE
FEINT = FRIENDS*EVENTS

The following models are estimated using the above variables:

```
Proc reg:
 model dep=friends;
 model dep=age;
 model dep=events;
 model dep=friends age events/pcorr2 ss2 tol clb;
 model dep=age age2/pcorr2 ss2 tol clb;
 model dep=friends events feint/pcorr2 ss2 tol clb;
 model dep=friends age events age2 feint/pcorr2 ss2 tol clb;
```

Following these models, a one-way analysis of variance is conducted, to examine mean differences in DEP as a function of the five levels of FRIENDS. To do this, four contrast codes (using orthogonal polynomials) are used to code the five levels of FRIENDS (originally scored as 0 to 4). These codes are defined by the lambda's in the following table:

	FRIENDS				
	0	1	2	3	4
Contrast Coded Variable					
FLIN (linear code)	-2	-1	0	1	2
FQUAD (Quadratic code)	2	-1	-2	-2	2
FCUB (Cubic code)	-1	2	0	-2	1
FQUAR (Quartic code)	1	-4	6	-4	1

This analysis of variance is conducted by regressing DEP on FLIN, FQUAD, FCUB, and FQUAR. The following are the mean values of DEP (and cell n's) at each level of FRIENDS::

	FRIENDS				
	0	1	2	3	4
Mean DEP	39.52	35.81	34.05	31.24	30.06
N	13	52	54	55	16

Based on these analyses, answer the following questions:

5. Ignoring all other variables, are older respondents more depressed than younger respondents? (Give PRE, F*, n-pa, and pa-pc)

6. Are older respondents more depressed than younger respondents once FRIENDS and EVENTS are controlled? (Give PRE, F*, n-pa, and pa-pc)

7. Do FRIENDS and EVENTS as a set predict depression once AGE is held constant? (Give PRE, F*, n-pa, and pa-pc).

8. What would be the value of r-squared if AGE were regressed on EVENTS and FRIENDS?

9. Ignoring FRIENDS and EVENTS, is there evidence that AGE has a nonlinear relationship with depression? (Give PRE, F*, n-pa, and pa-pc).

10. Provide interpretations of all three parameter estimates in the model where DEP is regressed on AGE and AGE2.

11. Ignoring AGE, is there evidence that the impact of more negative EVENTS on DEP is smaller as individuals report having more FRIENDS? (Give PRE, F*, n-pa, and pa-pc).

12. Given the model where DEP is regressed on FRIENDS, EVENTS, and their interaction, what is the simple slope for EVENTS for respondents reporting the mean level of FRIENDS (i.e., FRIENDS = 2.045)?

13. Is there evidence that the impact of more negative EVENTS on DEP is smaller as individuals report having more FRIENDS even when we control for the nonlinear effects of AGE? (Give PRE, F*, n-pa, and pa-pc).

14. In the model where DEP is regressed on AGE, AGE2, FRIENDS, EVENTS, and FEINT, provide interpretations of the slopes for AGE and EVENTS.

15. Your advisor says "Forget the fancy Judd and McClelland model comparison stuff. Just give me the overall F from a one-way analysis of variance that treats FRIENDS as the independent variable and DEP as the dependent variable." What statistic (and cautions) do you give your advisor?

16. In the first model where DEP is regressed on FRIENDS, FRIENDS has an SSR of1186.6, a PRE of .34, and $\underline{t}$ of 10.11. In the ANOVA model where DEP is regressed on the four orthogonal polynomials used to code FRIENDS, FLIN (the linear contrast) has an SSR of 929.8, a PRE of .29, and a $\underline{t}$ of 8.96.. Explain in a couple of sentences the reasons why the linear effect of FRIENDS in the first equation seems to have a larger impact than it does in the ANOVA model. (Note that the MSE in the first equation is larger than it is in the ANOVA model.)

17. Test whether the mean level of DEP for respondents reporting 0 friends is significantly different from the mean level of DEP for respondents reporting 1 close friend. (Give SSR, SSE(A), PRE, F*, n-pa, and pa-pc).

The REG Procedure
Model: MODEL1
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1186.56773	1186.56773	102.29	<.0001
Error	198	2296.85227	11.60026		
Corrected Total	199	3483.42000			

Root MSE	3.40592	R-Square	0.3406
Dependent Mean	33.77000	Adj R-Sq	0.3373
Coeff Var	10.08563		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	38.49152	0.52530	73.28	<.0001
friends	1	-2.30881	0.22828	-10.11	<.0001

The REG Procedure
Model: MODEL2
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	96.51837	96.51837	5.64	0.0185
Error	198	3386.90163	17.10556		
Corrected Total	199	3483.42000			

Root MSE	4.13589	R-Square	0.0277
Dependent Mean	33.77000	Adj R-Sq	0.0228
Coeff Var	12.24722		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	25.59498	3.45394	7.41	<.0001
age	1	0.11623	0.04893	2.38	0.0185

The REG Procedure
Model: MODEL3
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	514.26604	514.26604	34.29	<.0001
Error	198	2969.15396	14.99573		
Corrected Total	199	3483.42000			

Root MSE	3.87243	R-Square	0.1476
Dependent Mean	33.77000	Adj R-Sq	0.1433
Coeff Var	11.46708		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	28.50724	0.93947	30.34	<.0001
events	1	1.90335	0.32502	5.86	<.0001

The REG Procedure
Model: MODEL4
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1398.44450	466.14817	43.82	<.0001
Error	196	2084.97550	10.63763		
Corrected Total	199	3483.42000			

Root MSE	3.26154	R-Square	0.4015
Dependent Mean	33.77000	Adj R-Sq	0.3923
Coeff Var	9.65809		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Type II SS
Intercept	1	31.44505	2.98149	10.55	<.0001	1183.26633
friends	1	-2.01191	0.22925	-8.78	<.0001	819.31214
age	1	0.04382	0.03915	1.12	0.2645	13.32233
events	1	1.21424	0.28399	4.28	<.0001	194.46410

Parameter Estimates

Variable	DF	Squared Partial Corr Type II	Tolerance	95% Confidence Limits	
Intercept	1	.	.	25.56513	37.32497
friends	1	0.28210	0.90932	-2.46402	-1.55980
age	1	0.00635	0.97118	-0.03340	0.12104
events	1	0.08531	0.92914	0.65417	1.77431

The REG Procedure
Model: MODEL5
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	161.71605	80.85803	4.80	0.0093
Error	197	3321.70395	16.86144		
Corrected Total	199	3483.42000			

Root MSE	4.10627	R-Square	0.0464
Dependent Mean	33.77000	Adj R-Sq	0.0367
Coeff Var	12.15952		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Type II SS
Intercept	1	-34.85141	30.93052	-1.13	0.2612	21.40725
age	1	1.83798	0.87694	2.10	0.0374	74.06936
age2	1	-0.01217	0.00619	-1.97	0.0507	65.19769

Parameter Estimates

Variable	DF	Squared Partial Corr Type II	Tolerance	95% Confidence Limits	
Intercept	1	.	.	-95.84885	26.14603
age	1	0.02181	0.00307	0.10859	3.56737
age2	1	0.01925	0.00307	-0.02438	0.00003524

The REG Procedure

Model: MODEL6
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1452.78146	484.26049	46.74	<.0001
Error	196	2030.63854	10.36040		
Corrected Total	199	3483.42000			

Root MSE	3.21876	R-Square	0.4171
Dependent Mean	33.77000	Adj R-Sq	0.4081
Coeff Var	9.53141		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Type II SS
Intercept	1	30.77422	1.80487	17.05	<.0001	3012.01972
friends	1	-0.20520	0.75596	-0.27	0.7863	0.76338
events	1	2.60990	0.60965	4.28	<.0001	189.87602
feint	1	-0.70129	0.27442	-2.56	0.0114	67.65928

Parameter Estimates

Variable	DF	Squared Partial Corr Type II	Tolerance	95% Confidence Limits	
Intercept	1	.	.	27.21476	34.33369
friends	1	0.00037579	0.08145	-1.69606	1.28565
events	1	0.08551	0.19637	1.40759	3.81221
feint	1	0.03224	0.07885	-1.24248	-0.16009

The REG Procedure
Model: MODEL7
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1530.29678	306.05936	30.40	<.0001
Error	194	1953.12322	10.06765		
Corrected Total	199	3483.42000			

Root MSE	3.17296	R-Square	0.4393
Dependent Mean	33.77000	Adj R-Sq	0.4249
Coeff Var	9.39578		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Type II SS
Intercept	1	-33.13137	24.32440	-1.36	0.1748	18.67766
friends	1	-0.13853	0.74617	-0.19	0.8529	0.34699
age	1	1.76559	0.68423	2.58	0.0106	67.03621
events	1	2.67086	0.60166	4.44	<.0001	198.39076
age2	1	-0.01217	0.00483	-2.52	0.0126	63.91443
feint	1	-0.69369	0.27054	-2.56	0.0111	66.18784

Parameter Estimates

Variable	DF	Squared Partial Corr Type II	Tolerance	95% Confidence Limits	
Intercept	1	.	.	-81.10560	14.84285
friends	1	0.00017763	0.08123	-1.61018	1.33312
age	1	0.03318	0.00301	0.41612	3.11507
events	1	0.09221	0.19592	1.48422	3.85750
age2	1	0.03169	0.00301	-0.02169	-0.00264
feint	1	0.03278	0.07884	-1.22727	-0.16010

The REG Procedure
Model: MODEL1
Dependent Variable: dep

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1226.38816	306.59704	26.49	<.0001
Error	195	2257.03184	11.57452		
Corrected Total	199	3483.42000			

Root MSE	3.40213	R-Square	0.3521
Dependent Mean	33.77000	Adj R-Sq	0.3388
Coeff Var	10.07443		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Type II SS
Intercept	1	34.13838	0.29851	114.36	<.0001	151385
flin	1	-2.35233	0.26245	-8.96	<.0001	929.82494
fquad	1	0.29029	0.19706	1.47	0.1423	25.11698
fcub	1	-0.03333	0.18292	-0.18	0.8556	0.38430
fquar	1	0.08151	0.05543	1.47	0.1430	25.03474

Parameter Estimates

Variable	DF	Squared Partial Corr Type II	Tolerance	95% Confidence Limits	
Intercept	1	.	.	33.54966	34.72709
flin	1	0.29177	0.75490	-2.86993	-1.83472
fquad	1	0.01101	0.92461	-0.09836	0.67894
fcub	1	0.00017024	0.75704	-0.39408	0.32742
fquar	1	0.01097	0.93171	-0.02780	0.19083