Question 1

The startle reflex (SR) is an automatic blink response that occurs following a startling stimulus (most typically a loud noise). The magnitude of SR is generally larger during negative mood states and reduced during positive mood states. An eating disorder researcher wants to evaluate if this typical finding is also true of women with binge eating disorder (BED) and women with anorexia nervosa (AN). She enrolls 15 subjects with BED, 15 with AN, and 15 normal controls (all females). Each subject undergoes an experimental session in which she views three 5-minute video clips: one clip designed to induce feelings of sadness (a family discussion following the death of a loved one), one affectively neutral documentary clip (about pothole repair), and one clip designed to induce feelings of happiness (puppies playing in a field). Prior to viewing the first video clip, a measure of current mood state (MOOD) is completed. During each video clip, multiple loud noises are administered to the subject, and the SR to each noise is recorded and averaged for each clip (i.e., each subject has three startle scores: one for the sad clip (SAD), one for the neutral clip (NEUTRAL), and one for the happy clip (HAPPY)).

Give the "source" and "df" columns of the full source table for the full analysis of variance of these data, defining variables explicitly. Read the paragraph below before designing your source table to make sure that it includes the hypotheses the researcher wants to test.

The researcher is especially interested in testing the following hypotheses. Circle and label (with the letter corresponding to the hypothesis tested) the row in your source table that tests each of these hypotheses.

A. Startle values will be higher overall for those subjects in the BED and AN groups than for the normal controls.
B. Startle values will be higher across groups in the sad condition than in the happy condition.
C. The difference between startle values for the sad and happy conditions will be greater in the BED and AN groups than among the normal controls.

Specify Models C and A for tests of the following questions. Be sure to fully define all variables and any transformed dependent variables that you would need to create for each test. Note, the tests and variables (or transformations) for this question are not necessarily the same as those you used to generate the full source table above.

D. Do the startle values associated with the happy and sad video clips differ reliably from those that are associated with the neutral video clip?
E. Is the difference between startle values in the happy condition and the sad condition different for subjects in the BED and AN groups than for the normal controls?
F. Are startle values different between subjects in the BED and AN groups?
G. Does the linear effect of increasingly positive affect across video clips depend on the subject's clinical status (i.e., whether she is in the BED, AN, or normal control group)?
H. Assuming there are differences in the startle values (across all three film clips) between the 2 clinical groups (BED & AN) and the normal controls, does this difference depend on mood at the beginning of the experimental session?

Question 2
(Adapted from Keppel & Zedeck, 1989)

A researcher was interested in the effects of two drugs (d1 and d2) on learning in nonhuman primates. Twelve chimpanzees were assigned one of three conditions, a control condition where they received no drug (drug='c'), a condition where they received drug 1 (drug='d1'), or a condition where they received drug 2 (drug='d2'). Drug 1 was thought to decrease brain activity; Drug 2 was thought to increase it.

Subsequently each chimpanzee was tested daily for three days. On these tests, they were presented with three objects, two of which were identical and one was different. They were rewarded with a grape if they selected the unique object. On each day, the chimpanzees were given 30 tests and the number of correct choices over each day's 30 tests were recorded. Each chimpanzee's scores were recorded as s1, s2, and s3 (scores from days 1, 2, and 3, respectively).

The following SAS code was used to input the data, to define dc and d1d2 (contrast codes that code the drug condition to which a chimpanzee was assigned), to create within subject composite scores (ave, W1, and W2) from the dependent variables, and to conduct the analysis.

```
data keppel;
input subj drug $ s1 s2 s3;
dc=2*(drug='c')-1*(drug='d1')-1*(drug='d2');
d1d2=0*(drug='c')-1*(drug='d1')+1*(drug='d2');
ave=(s1+s2+s3)/3;
w1=(s3-s1);
w2=2*s2-s1-s3;
cards;
1 c 5 7 9
2 c 9 9 13
3 c 15 14 15
4 c 12 15 16
5 d1 5 3 1
6 d1 9 8 4
7 d1 10 9 8
8 d1 10 8 7
9 d2 10 8 12
10 d2 12 8 13
11 d2 9 13 13
12 d2 9 14 15
;
proc means;by drug;var s1 s2 s3 ave w1 w2;
proc reg;
 model ave=dc d1d2/ss2 pcorr2;
 model w1=dc d1d2/ss2 pcorr2;
 model w2=dc d1d2/ss2 pcorr2;
run;
```

Based on these data and the SAS output on the following pages, answer the following questions.

A. On average across the three days, is there any evidence to support the hypothesis that chimps given drug 2 outperform chimps given drug 1? (Provide PRE, F*, pa-pc, N-pa, and a one sentence conclusion.)

B. Ignoring drug condition, is there evidence that the chimps learned the task across the three days, i.e., did their performance improve? (Provide PRE, F*, pa-pc, N-pa, and a one sentence conclusion.)

C. Is there any evidence that the chimps receiving drug 1 differed from those receiving drug 2 in the degree to which their performance improved across the three days? (Provide PRE, F*, pa-pc, N-pa, and a one sentence conclusion.)

D. In the W1 regression equation, provide an interpretation for the slope for the D1D2 predictor variable (i.e., 3.375).

E. Is there any evidence that the chimps receiving drug 2 differed from those in the control condition in the degree to which their performance improved across the three days? (Provide PRE, F*, pa-pc, N-pa, and a one sentence conclusion.)

F. In the W2 regression equation, provide an interpretation for the intercept (i.e., -.75).

---------- DRUG=c ----------

Variable	N	Mean	Std Dev	Minimum	Maximum
S1	4	10.2500000	4.2720019	5.0000000	15.0000000
S2	4	11.2500000	3.8622101	7.0000000	15.0000000
S3	4	13.2500000	3.0956959	9.0000000	16.0000000
AVE	4	11.5833333	3.6349640	7.0000000	14.6666667
W1	4	3.0000000	2.0000000	0	4.0000000
W2	4	-1.0000000	2.5819889	-4.0000000	2.0000000

---------- DRUG=d1 ----------

Variable	N	Mean	Std Dev	Minimum	Maximum
S1	4	8.5000000	2.3804761	5.0000000	10.0000000
S2	4	7.0000000	2.7080128	3.0000000	9.0000000
S3	4	5.0000000	3.1622777	1.0000000	8.0000000
AVE	4	6.8333333	2.6874192	3.0000000	9.0000000
W1	4	-3.5000000	1.2909944	-5.0000000	-2.0000000
W2	4	0.5000000	1.7320508	-1.0000000	3.0000000

---------- DRUG=d2 ----------

Variable	N	Mean	Std Dev	Minimum	Maximum
S1	4	10.0000000	1.4142136	9.0000000	12.0000000
S2	4	10.7500000	3.2015621	8.0000000	14.0000000
S3	4	13.2500000	1.2583057	12.0000000	15.0000000
AVE	4	11.3333333	1.1221672	10.0000000	12.6666667
W1	4	3.2500000	2.2173558	1.0000000	6.0000000
W2	4	-1.7500000	6.7515430	-9.0000000	4.0000000

Model: MODEL1
Dependent Variable: AVE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	57.16667	28.58333	3.953	0.0586
Error	9	65.08333	7.23148		
C Total	11	122.25000			

Root MSE	2.68914	R-square	0.4676
Dep Mean	9.91667	Adj R-sq	0.3493
C.V.	27.11739		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	9.916667	0.77628826	12.774	0.0001
DC	1	0.833333	0.54891869	1.518	0.1633
D1D2	1	2.250000	0.95075506	2.367	0.0421

Variable	DF	Type II SS	Squared Partial Corr Type II
INTERCEP	1	1180.083333	.
DC	1	16.666667	0.20387360
D1D2	1	40.500000	0.38358327

Model: MODEL2
Dependent Variable: W1

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	117.16667	58.58333	16.606	0.0010
Error	9	31.75000	3.52778		
C Total	11	148.91667			

Root MSE	1.87824	R-square	0.7868
Dep Mean	0.91667	Adj R-sq	0.7394
C.V.	204.89868		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.916667	0.54220059	1.691	0.1252
DC	1	1.041667	0.38339372	2.717	0.0237
D1D2	1	3.375000	0.66405739	5.082	0.0007

Variable	DF	Type II SS	Squared Partial Corr Type II
INTERCEP	1	10.083333	.
DC	1	26.041667	0.45061283
D1D2	1	91.125000	0.74160732

Model: MODEL3
Dependent Variable: W2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	10.50000	5.25000	0.285	0.7585
Error	9	165.75000	18.41667		
C Total	11	176.25000			

Root MSE	4.29146	R-square	0.0596
Dep Mean	-0.75000	Adj R-sq	-0.1494
C.V.	-572.19525		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.750000	1.23883906	-0.605	0.5599
DC	1	-0.125000	0.87599150	-0.143	0.8897
D1D2	1	-1.125000	1.51726179	-0.741	0.4773

Variable	DF	Type II SS	Squared Partial Corr Type II
INTERCEP	1	6.750000	.
DC	1	0.375000	0.00225734
D1D2	1	10.125000	0.05756930