Exam 2 PS 217, Spring 2001

1. We are about to conduct a study regarding the impact of duration of exposure on the ability of people to recognize faces. To finesse the issue of the actual durations used, I'll call them Short, Medium, and Long. Consistent with our design, each participant will be exposed to each of the three durations. The DV for this analysis is the percent Hits (saying Old to an Old item). Suppose that the results of the experiment come out as seen below. Complete the analysis and interpret the results as completely as you can. If the results turned out as seen below, what would they mean to you? [15 pts]

ANOVA Table for Duration

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Subject	23	3345.319	145.449				
Category for Duration	2	457.528	228.764	46.603	<.0001	93.205	1.000
Category for Duration * Subject	46	225.806	4.909				

Means Table for Duration
Effect: Category for Duration

	Count	Mean	Std. Dev.	Std. Err.
Short	24	43.833	7.257	1.481
Medium	24	47.792	7.342	1.499
Long	24	49.917	6.978	1.424

H_0: $\mu_{Short} = \mu_{Medium} = \mu_{Long}$

H_1: Not H_0

Because the P-Value is less than .05, we would reject H0 and conclude that the presentation time had an impact on memory (as measured by Hit rate). To determine which presentation times differed, we'd need to conduct a Tukey's post hoc test.

$$HSD = q\sqrt{\frac{MS_{Error}}{n}} = 3.42\sqrt{\frac{4.91}{24}} = 1.55$$

Thus, if means differed by 1.55 or more, they would be significantly different. In this study, all the means differ, so we would conclude that Long presentation times led to significantly higher Hit rates than Medium or Short presentation times and that Medium presentation times led to significantly higher Hit rates than Short presentation times.

2. A psychologist studying human memory would like to examine the process of forgetting. One group of participants is required to memorize a list of words in the evening just before going to bed. Their recall is tested 10 hours later in the morning. Participants in the second group memorize the same list of words in the morning and then their memories are tested 10 hours later after being awake all day. The psychologist hypothesizes that there will be less forgetting during sleep than during a busy day. The recall scores and some summary information for the two samples of college students are seen below. Interpret the results of this study as completely as you can. [15 pts]

	Asleep Scores	Awake Scores
	15	15
	13	13
	14	14
	14	12
	16	14
	15	13
	16	11
	15	12
	16	13
	15	13
	17	12
	14	14
T	180	156
SS	14	14
Mean	15	13

H_0: $\mu_{Asleep} = \mu_{Awake}$

H_1: $\mu_{Asleep} \neq \mu_{Awake}$

$F_{Crit}(1,22) = 4.30$

Source	SS	df	MS	F
Treatment	**24**	**1**	**24**	**18.9**
Error	**28**	**22**	**1.27**	
Total	**52**	**23**		

Because $F_{Obt} \geq F_{Crit}$, we would reject H_0 and conclude that people who learned the list before sleeping performed significantly better than people who learned the list in the morning. (Note that no post hoc test is needed, because there are only two groups.)

3. Describe clearly the circumstances under which a repeated measures analysis will not yield a larger F-ratio than an independent groups analysis. Accompany your description with source tables to illustrate your point. [10 pts]

The reason that a repeated measures ANOVA would not yield a larger F-ratio than an independent groups ANOVA is that the individual differences are insubstantial. As you can see in the two source tables below, the two analyses would produce identical F-ratios when SS_{Subj} = 36. Thus, if the SS_{Subj} were greater than 36, the F-ratio would get larger. (For example, if SS_{Subj} = 90, then SS_{Error} = 54, so MS_{Error} = 2 and the F-ratio would become 15.) If the SS_{Subj} were smaller than 36, then the F-ratio would get smaller. (For example, if SS_{Subj} = 9, then SS_{Error} = 135 and MS_{Error} = 5, which would produce an F-ratio of 6.)

Independent Groups Analysis

Source	SS	df	MS	F
Treatment	90	3	30	7.5
Error	144	36	4	
Total	234	39		

Repeated Measures Analysis

Source	SS	df	MS	F
Treatment	90	3	30	7.5
Error	144	36		
Subject	36	9		
Error	108	27	4	
Total	234	39		

4. If you conducted a single-factor independent groups experiment with 7 levels and n = 25, what would your df be? [5 pts]

SOURCE	**df**
Treatment	**6**
Error	**168**
Total	**174**

5. Searching for the dangers of caffeine, a researcher adds two types of caffeine (those found in coffee and chocolate) to the water supply of groups of laboratory-bred rats. This species ordinarily survives about 13 months. The water supply of a control group of rats did not have any caffeine added. The DV is the number of days that each rat lives. Analyze the results of this experiment as completely as you can. What would you do next? [10 pts]

Coffee Caffeine	**Chocolate Caffeine**	**No Caffeine**
398	401	412
372	389	386
413	413	394
419	396	409
408	406	415
393	378	401
387	382	384
414	417	398

ANOVA Table for Days Lived

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Caffeine	2	33.250	16.625	.084	.9194	.169	.061
Residual	21	4136.375	196.970				

Means Table for Days Lived
Effect: Caffeine

	Count	Mean	Std. Dev.	Std. Err.
Chocolate	8	397.750	14.140	4.999
Coffee	8	400.500	16.009	5.660
None	8	399.875	11.606	4.103

As you can see, with a P-Value much greater than .05, you would conclude that there are no differences among these three groups in terms of longevity. Either H_0 is correct or you've made a Type II error. Assuming that it's the latter, what would you do next? Design a more powerful study, of course. To design a more powerful study, you could use a larger n (n = 30, 40, etc.). You could be sure to add greater quantities of caffeine in the groups who received caffeine. You could do everything possible to equate the environments in which the rats live (to minimize the random differences). You might also make sure that the rats are all from the same strain (to minimize individual differences).