PSYCHOLOGY 515 -- EXPERIMENTAL DESIGN
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Homework No. 5

1. An experiment on the effects of sleep deprivation on hand steadiness was carried out by randomly assigning 8 subjects each to four groups of sleep deprivation time (total of 32 subjects). The dependent variable was the number of times during a 2-minute interval that a stylus makes contact with the side of a 2 inch hole. The data are given below:

Hours of Sleep Deprivation

12 hr	18 hr	24 hr	30 hr
4	4	5	3
6	5	6	5
3	4	5	6
3	3	4	5
1	2	3	6
3	3	5	7
2	4	3	9
2	3	4	9

a) Give the complete ANOVA summary table including sources, *SS, df,* and *MS.* Are the results statistically significant?

b) What are the least squares estimates of the main effect parameters?

c) What proportion of the total variation in subjects' scores is estimated to be due to differences between the number of hours of sleep deprivation?

2. The following data are from a hypothetical investigation of the role of drive level and magnitude of reward on the learning of a discrimination problem by monkeys. The animals are given five trials a day for four days on a set of 20 "oddity" problems. In this task, three objects (two the same, one different are presented to the monkeys, and the subject's task is to learn to select the nonduplicated (odd) object. A food reward is placed in a well underneath the correct object. A trial consists of the presentation of the three objects and a monkey's selection of one of them. The response measure is the number of correct selections in the 20 training trials. One of the independent variables (factor A) is the magnitude of the food reward, either 1, 3, or 5 grapes, while the other variable (factor B) is the drive level of the animals, either 1 hour of food deprivation or 24 hours of food deprivation. Four monkeys are randomly assigned to each treatment combination. Thus, the design is a 3 x 2 factorial with 4 subjects in each cell.

		Level of Reward		
		1 grape	3 grapes	5 grapes
Deprivation	1 hr	1	13	9
		4	5	16
		0	7	18
		7	15	13
	24 hrs	15	6	14
		6	18	7
		10	9	6
		13	15	13

Please do a two-way ANOVA on this data using JMP and *interpret the results*. Include a plot of the cell means as part of your interpretation. [The data are identical to that of an example in Keppel & Wickens (p. 221), but one of the independent variables is different.]

3. Consider a 2 × 2 factorial design. There are 100 subjects in each cell of the design. Factor A is high vs. low self-esteem subjects, and Factor B is stressful vs. relaxed testing situation. Each subject's performance on a difficult intellectual task is assessed. (High score = good performance.) Test anxiety scores (High score = high anxiety) were obtained on each subject several weeks before the main experimental session. Over and above the usual mean differences in performance, the experimenter is interested in how the relationship between anxiety and performance is affected by the conditions. In order to examine this, the following correlations between test anxiety scores and performance were obtained for the subjects in each cell of the design:

		Test Situation	
		Stressful	*Relaxed*
Self-esteem	*Low*	-.60	-.31
	High	-.33	-.10

a) Test the statistical significance of the main effects and interaction in this table of correlations.

b) Briefly interpret the results.