Psychology 315 Dr. McFatter

ANOVA Homework Potpourri

On all problems do multiple comparisons where appropriate.

1. Below are two hypothetical separate sets of data which are somewhat exaggerated to help clarify the procedures underlying analysis of variance. In each case, the experimenter is interested in the number of errors made by rats in a maze as a function of the kind of reward. Group 1 receives 100% water reward; group 2 receives a solution of 50% water and 50% sugar as the reward; and group 3 receives 100% sugar reward.

Group	Experiment 1		
	1	2	3
	1	8	6
	3	7	5
	2	5	3
	1	4	3
	3	6	3
Sum	10	30	20
Mean	2	6	4

Group	Experiment 2		
	1	2	3
	4	10	10
	0	0	0
	5	9	8
	0	1	1
	1	10	1
Sum	10	30	20
Mean	2	6	4

a. By inspection, in which experiment would you guess that the difference among groups is more likely to be statistically significant? Why?

b. Carry out the ANOVAs for each experiment. Are the results statistically significant (use alpha = .05)?

c. Briefly explain why the results of the two analyses differ despite the fact that the group means are the same for both experiments.

d. For which experiment should multiple comparisons be run? Carry out the statistical analysis for all possible pairs of group means and state your conclusions.

2. For each of the two experiments that follow compute a one-way ANOVA. If an experiment yields statistically significant results compute all possible multiple comparisons.

Group	Experiment 1		
	1	2	3
	17	15	9
	12	11	21
	3	4	3
	10	26	7
	1	18	20
	14	23	
	5		

Group	Experiment 2		
	1	2	3
	1	4	26
	10	17	21
	3	11	15
	12	20	9
	3	14	23
	5	18	
	7		

3. Given only the following data in a ANOVA table, determine $MS_{Between}$, MS_{Within}, and F.

Source	*df*	SS	MS	F
Between	4	81.25		
Within				
Total	49	378.60		

4. A *t*-test of the significance of the difference between two means was done on the following data (M_1 = mean for group 1, S_1 = std dev for group 1, etc.):

Group 1	*Group 2*
$n_1 = 10$	$n_2 = 10$
$M_1 = 19.2$	$M_2 = 11.3$
$S_1 = 7.93$	$S_2 = 5.79$

The value of *t* was 2.55, which was significant at the .05 level. Perform a one-way ANOVA with a=2 on the above data and show that the F-ratio equals the square of the *t*-value, and is also significant at the .05 level. Thus, verify for this case that the one-way ANOVA for 2 groups is equivalent to an independent samples *t*-test.

5. Guthrie (1967) studied the effectiveness of three different modes of training on deciphering cryptograms. Group I was trained by first being presented rules for deciphering cryptograms, then working examples. Group II worked examples first, then was told the rules. Group III worked only examples. A control group studied Russian vocabulary during the training period. A group of 72 subjects was randomly split into four groups of 18 each and assigned to the four training conditions. After training, the Ss were given a 10-item test comprising 10 new cryptograms like those studied during training. The means and standard deviations of the number of cryptograms solved on the criterion test in each group are as follows:

Group I (rule-example)	*Group II (example-rule)*	*Group III (example)*	*Group IV Control*
$n_1 = 18$	$n_2 = 18$	$n_3 = 18$	$n_4 = 18$
$M_1 = 8.06$	$M_2 = 6.94$	$M_3 = 7.11$	$M_4 = 4.73$
$S_1 = 2.37$	$S_2 = 2.31$	$S_3 = 2.42$	$S_4 = 2.27$

In Guthrie's data determine whether training mode has a significant effect on performance in solving cryptograms. Use alpha = .05. Use multiple comparisons if appropriate, and state your conclusions very clearly.

6. An industrial psychologist wishes to determine the effects of satisfaction with pay and satisfaction with job security on overall job satisfaction. He obtains measures of each variable for a total group of 20 employees, and the results are shown below. (Cell entries represent overall job satisfaction, where 7=very satisfied, and 1=very dissatisfied.) Analyze the data using ANOVA. What should the psychologist conclude?

		Satisfaction with Pay: High		Satisfaction with Pay: Low	
Satisfaction with Job Security	High	7	4	3	2
		7	6	1	2
		6		2	
	Low	1	2	2	1
		2	2	1	1
		5		3	

7. Suppose that a 2x2 factorial design is conducted to determine the effects caffeine and sex on scores on a 20-item English test. The cell means and the various mean squares are given below. Compute the appropriate F-ratios, test them for statistical significance, and comment briefly on the results.

Means		Caffeine Condition: Caffeine	Caffeine Condition: Placebo
Sex	Males	17.3	12.0
	Females	12.3	16.4

Mean square for Caffeine = 2.40
Mean square within groups = 2.00
Mean square for Sex = 1.60
Degrees of freedom within = 24
Mean square for interaction = 13.84