STA 6207 – Fall 2001 – Exam 3

Print Name: SSN:

1) An advertising executive wishes to study the effects of three factors on consumers' liking of her client's product (Y, on a scale of 0–100). The three factors are: the length of the ad (factor A, with levels of 15 and 30 seconds), the volume that the ad is presented at (B with levels 25db and 50db), and whether or not the celebrity speaking in the ad is seen (C, with levels No and Yes). A sample of 40 consumers are selected and randomly assigned to one of the 8 conditions, such that 5 receive each treatment combination. The averages for each condition are given below.

Trt	$\overline{y}$
(1)	62.0
a	68.0
b	58.0
ab	66.0
c	72.0
ac	78.0
bc	64.0
abc	70.0

a) Give the linear contrast l_A, the effect estimate A, and the sum of squares SSA for the effects of factor A (this is the effect of 30 second versus 15 seconds).

b) Repeat part a) for the 3–factor interaction ABC.

c) Plot the means on the following grids. (Seperate plots for each level of factor C). Does there appear to be a 3–factor interaction?

2) A split plot experiment is conducted to compare 3 cake mixes and 3 cooking temperatures on the hardness of the cake. On each day, cake mixes are randomly ordered, then a batch is made of a cake mix, and parts of each batch are cooked at the three temperatures in random order. This is then repeated for the other cake mixes. The experiment is run for 3 days (replicates).

a) Give the statistical model, assuming these are the only 3 cake mixes and the only 3 potential cooking temperatures.

b) Give the Analysis of Variance (Sources of variation and degrees of freedom). Distinguish between the whole plot and subplot portions of the table.

3) An experiment was conducted to compare the sexual side effects of 4 brands of anti-depressants: Wellbutrin, Prozac, Zoloft, and Paxil. Patients marked their change in libido since beginning treatment on a visual analogue scale ranging from -2 to +2. Means, standard deviations, and sample sizes are given below. These are the only antidepressants that we are concerned with.

Trt	r_i	$\overline{y}_i$	S_i
Wellbutrin	34	1.00	0.70
Prozac	52	-0.50	0.60
Zoloft	36	-1.00	0.80
Paxil	25	-0.50	0.70

a) Give the Analysis of Variance, and test whether the true mean changes in sexual libido differ among the 4 brands (use $\alpha = 0.05$ significance level).

b) Wellbutrin is of a different class than the remaining brands which are SSRI's. Give a contrast that compares Wellbutrin with the mean of the three SSRI's. Give the estimate of the contrast, and a 95% confidence interval for it.

4) A fashion designer has designed 3 new styles of men's suits for the upcoming season. She knows that perceptions of a suit's quality depend on the model. She has 5 male models under contract, and photographs each model in each suit. An editor for a men's fashion magazine is asked to rate each suit on a scale of 0–100 (these 15 photographs are embedded in a much larger set of photos). She randomizes the order of all photos. She analyzes her results as a Randomized Complete Block experiment, where the suits act as treatments and the models act as blocks (both fixed from her standpoint). She obtains the following scores (where the total sum of squares is 1800 and the overall mean is 70).

| | Suit Style | | |
Model	1	2	3
1	75	80	85
2	65	80	85
3	40	50	60
4	80	75	95
5	70	75	95

a) Set up the Analysis of Variance, and test whether the true mean scores differ among the suits at $\alpha = 0.05$ significance level.

b) Test whether there is an interaction (of the following form) between suit and model, based on Tukey's test for non–additivity at $\alpha = 0.05$.

$$H_0 : Y_{ij} = \mu + \tau_i + \beta_j + e_{ij} \qquad H_0 : Y_{ij} = \mu + \tau_i + \beta_j + \lambda\tau_i\beta_j + e_{ij}$$