

STAT 516 – Spring 2009 – Homework 5

Due: Wednesday, March 25th

1) (3 points) For each of the three descriptions below, say whether or not each of factorial, with replication, and balanced apply or not, and how you can tell.

a) An ANOVA is performed to see how effective different methods of studying are, and how much extra time spent helps. Students studied by either primarily going over old exams, reading notes, or reading the text; and they studied for either two, five, or ten hours. The forty-five students were assigned at random so that there were five in each of the combinations of studying strategies and time.

b) An ANOVA is performed to see how effective different methods of studying are, and how much extra time spent helps. Students studied by either primarily going over old exams, reading notes, or reading the text; and they studied for either two, five, or ten hours. The sixteen students were assigned at random so that four spent two hours using the text, four spent two hours using the notes, four spent two hours using the old exams, two spent five hours using text, and two spent ten hours using the text.

c) An ANOVA is performed to see how effective different methods of studying are, and how much extra time spent helps. Students were assigned to study by either primarily going over old exams, reading notes, or reading the text; and they studied for either two, five, or ten hours. The nine students were assigned at random so that there was one in each of the combinations of studying strategies and time.

2) (3 points) A soft-drink company is testing out its marketing strategy for a new sales campaign. They choose 27 demographically similar cities and randomly assign them to have one of three levels of advertising, and one of three levels of discount pricing.

Promotional Discount	Advertising		
	None	Moderate	Heavy
None	1.09	2.12	3.02
	1.58	1.86	2.59
Moderate	2.35	3.29	4.92
	1.11	6.44	6.92
Heavy	2.69	4.25	8.52
	2.07	4.37	9.72
	3.17	10.23	21.22
	5.66	12.91	18.29
	4.59	18.84	26.77

For each of the cases below, determine which test is appropriate:

- the main p-value from the ANOVA table
- one of the Type III tests (say which main effect or interaction)
- a contrast (say which factor and say what the coefficients would be just like you would for a one-way ANOVA)
- Holm procedure on all of the pairs of levels of a factor (say which factor it would be performed on)
- cannot be tested for this data-set

a) It is desired to see which (if any) of the discount levels are significantly more effective than the others on average.

b) It is desired to see if the effect of changing the discount level is the same regardless of the level of advertising campaign expenditures.

c) It is desired to see if the effect of changing the level of advertising is the same regardless of the amount of discount being offered.

d) It is desired to see if discounts and/or advertising have any affect at all on sales.

3) (4 points) The data on the web is extracted from a study that appeared in *European Bulletin of Cognitive Psychology*. Eight adopted children were selected from each of four groups. The four groups were based on two factors: adoptive parents had either very high or very low social economic status, and the biological parents had either very high or very low social economic status.

- a) Write down the model equation for this two-way ANOVA being careful to identify the parameters.
- b) Check the assumptions for the two-way ANOVA... including using Levene's test for the variances. Also, comment on why it is unreasonable to expect data of this sort to have the independence you would usually find in an experiment.
- c) State what hypotheses are being tested by the p-value in the ANOVA table and the p-value in the Type III tests, in terms of the parameters you wrote down in part A. Also describe what each of your conclusions mean in a brief sentence or two.
- d) Construct a display to illustrate the main effects and interactions (like figures 9.2 and 9.3 on page 439).