

STA 6934 – Fall 2001 – Quiz 4

Print Name:

SSN:

1) An epidemiologist studies the concentration of lead in children's blood in $k = 5$ sections of her city. She sets up an Analysis of Variance, wishing to test whether mean lead levels vary among the city's five sections. Samples of $n_i = 6$ children are obtained from each of the five sections and lead concentrations are assayed from samples of blood. The between and within section sums of squares for lead levels are $SST = 1200$ and $SSE = 4000$, respectively.

Give the test statistic, rejection region, and conclusion for testing:

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 \quad \text{vs} \quad H_A : \text{Not all } \mu_i \text{ are } =$$

where μ_i is the true (population) mean lead concentration among children in section i . Conduct the test at the $\alpha = 0.05$ significance level.

i) Test Statistic(**8 Points**):

ii) Rejection Region(**6 Points**): (also sketch it)

iii) Conclusion(**4 Points**):

iv) Based on your test, is your P -value **larger** or **smaller** than .05?(**5 Points**)

2) A pharmacist working the late shift gets bored and wants to determine whether there are differences among four brands of temporary blond hair color. He samples 5 friends, and has them use each of the four hair colors (in random order, and with a 6 week washout period between each color). One day after application, he measures the 'blondness' of each subject.

a) Is this an example of a **parallel groups** or **crossover** design?(**4 Points**)

b) Give the analysis of variance (sources and degrees of freedom).(10 Points)

c) Assuming each friend does the study simultaneously, how long would it take to conduct the experiment?(**4 Points**)

3) An HMO accountant has determined that the mean monthly expenditures on prescription medications varies among three groups of patients (those aged 25-44 (group 1), 45-64 (2), and 65+ (3)), based on the F -test for the Completely Randomized Design. She wishes to make comparisons among all three groups, simultaneously, at the $\alpha = 0.05$ significance level. She obtains the following information from an extensive search of the records:

$$n_1 = n_2 = n_3 = 50 \quad MSE = 625.0 \quad t_{.0083,147} \approx 2.40 \quad \bar{y}_1 = 150 \quad \bar{y}_2 = 135 \quad \bar{y}_3 = 165$$

a) Use Bonferroni's method to compare the true means among all pairs of groups by setting up simultaneous 95% confidence intervals for $\mu_i - \mu_j$ and interpreting them. **(16 Points)**

b) Give the treatment sum of squares (SST). **(7 Points)**

4) Crossover designs are preferred over parallel groups designs (when it is possible to implement) because: **(4 Points)**

- a) The same response is being measured.
- b) The same treatments are being applied.
- c) To remove variation among subjects.
- d) To increase the error sum of squares.

5) When a Completely Randomized Design has been conducted, for the treatment sum of squares in the ANOVA to be 0, which of the following conditions would have to occur? **(4 Points)**

- a) Every observation within a given treatment would have to be the same.
- b) All observations in the entire sample would have to be the same.
- c) The treatment means would all have to be the same.
- d) The treatment standard deviations would all have to be the same.
- e) None of the above.