Universidade Federal de Alfenas
Programa de Pós-graduação em Estatística Aplicada e Biometria
English Proficiency Exam

Identification number: ________________________ Date: 04/18/2013

In this exam we present fragments of a scientific paper and ask questions regarding their interpretation. The paper is:
DUNNETT, C. W. New Tables for Multiple Comparisons with a Control. *Biometrics*, v.20, n.3. p. 482-491, 1964.

Read the fragments carefully and answer the questions. Don't forget, you must answer only in Portuguese! Answers in English will not be considered.

Fragment 1:

> Some time ago, a multiple comparison procedure for comparing several treatments simultaneously with a control or standard treatment was introduced by the present author (Dunnett [1955]). The procedure was designed to be used either to test the significance of the differences between each of the treatments and the control with a stated value $1 - P$ for the *joint* significance level, or to set confidence limits on the true values of the treatment differences from the control with a stated value P for the *joint* confidence coefficient. Thus the procedure has the property of controlling the experimentwise, rather than the per-comparison, error rate associated with the comparisons, in common with the multiple comparison procedures of Tukey [unpublished] and Scheffé [1953].

Question 1: What was introduced by Dunnett in 1995?____________________

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Question 2: In the sentence "...value $1 - P$ for the *joint* significance level", what does "joint significance level" stand for?____________________

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Fragment 2:

The main purpose of the present paper is to give the exact tables for making two-sided comparisons. The necessary computations were done on a General Precision LGP-30 electronic computer, by a method described in section 3 below. The tables are given here as Tables II and III; these replace Tables 2a and 2b, respectively, of the previous paper. In addition to providing the exact values, a method is given for adjusting the tabulated values to cover the situation where the variance of the control mean is smaller than the variance of the treatment means, as occurs for example when a greater number of observations is allocated to the control than to any of the test treatments. Furthermore, the number of treatments which may be simultaneously compared with a control has been extended to twenty.

Question 3: What is the main purpose of the present paper?____________________

Question 4: What is the example given by the author to illustrate the situation where the variance of the control mean is smaller than the variance of the treatment means?__________

Fragment 3:

The main comparisons of interest to the experimenter are between each of the three treatments and the control. The one differing most from the control is treatment C. To test the significance of this treatment difference, we calculate a Student t-statistic in the usual way. On the assumption that the four treatment groups have homogeneous variances, and following the 'fixed effects' model of the analysis of variance which dictates the use of the residual mean square to estimate the error variance, we obtain for the t-statistic

$$t = \frac{\bar{X}_t - \bar{X}_c}{s\sqrt{(1/n_t) + (1/n_c)}} = \frac{2.240 - 2.493}{\sqrt{.1086}\sqrt{2/20}} = -2.43. \qquad (1)$$

Question 5: On the example, which test treatment differs most from the control?__________

Question 6: Just copy here the usual t-statistic used by the author.____________________

Question 7: What does the "fixed effects" model of analysis of variance dictate?__________

Fragment 4:

> Following the method of Cochran and Cox (see Anderson and Bancroft [1952], p. 52), the number of degrees of freedom to be associated with this statistic is the weighted average of the degrees of freedom associated with the two variances, using s_t^2/n_t and s_c^2/n_c as weights. The result in this instance is 40 d.f., and entering Table II with $p = 3$ and d.f. = 40, we find that 2.44 is the .05 critical value. This value should, however, be adjusted for the unequal variances as described in the next part of this section, by calculating $1 - n_t s_c^2 / n_c s_t^2 = .655$, which when multiplied by the superscript number on the value taken from Table II gives the percentage increase required in the critical value ($.655 \times 2.2 = 1.4\%$ is the percentage increase, so the correct critical value is $1.014 \times 2.44 = 2.47$).

Question 8: What states the method of Cochran and Cox?____________________

Question 9: According to the fragment, how do we find 2.44 on Table II?____________________

Question 10: This value should be adjusted for unequal variances? How?____________________