THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/B.Ed Degree Programme, Continuing Education Programme
APPLIED MATHEMATICS - LEVEL 04
PSU2182 – DESIGN AND ANALYSIS OF EXPERIMENTS
OPEN BOOK TEST 2007/2008

DURATION: ONE AND HALF-HOURS

DATE: 18 – 03 – 2008	TIME: 4.00pm -5.30pm

ANSWER ALL QUESTIONS.

Statistical Tables are provided. Non-programmable calculators are permitted.

1. A researcher is interested in comparing the effects of five fertilizers on the growth of tomato plants. To reduce the effects of the fertilizers applied to adjacent plants, he plans to use 1m by 1m plots and plant only a single tomato plant in each plot. Effects of the fertilizers will be measured when the plants are over two months old. The increase in height in each plant as a percentage of the height prior to applying the fertilizer will be used as an indicator of growth. The experimental plots for this study are chosen from four different sites. The soils in different sites differ in fertility. From each site, the researcher plans to use 10 experimental plots and each of the five fertilizers will be applied to two randomly chosen plots.

    (i)   Describe the following terms in relation to this study
          a) Blocking
          b) Response variable

    (ii) Is the design described in this study, a balanced design? Give reasons for your answer.

    (iii) Describe a model for the response measured on a randomly chosen plant. You need to clearly describe the notation you use.

2. A researcher is interested in finding out the variety of beans and the type of fertilizer that need to be applied to receive the highest yield. He is interested in comparing three varieties of beans (say A, B and C) and two fertilizers one rich in potassium and another that has low potassium content (say F_1 and F_2). He is planning to apply 20 grams of the selected fertilizer per experimental plot. Eighty experimental plots are available for the study of which 30 plots are situated near a stream and have high soil moisture content compared to the rest of the 50 plots.

(i) Briefly explain how you would advise the researcher to design his experiment.

(ii) In relation to this study explain the following terms
(a) treatment.
(b) experimental error
(c) factor level

3. A researcher is interested in comparing the effects of two drugs (say A and B) on alleviating the symptoms of a chronic disease. For each drug, he is interested in the effects when 20 mg of the drug is given twice a day and when 40 mg of the drug is given only in the morning. Sixteen patients are available for this experiment. Testing the effects of any single drug requires a week.

(i) Clearly describe how you would design this study.

(ii) Now suppose only four patients are available for the study and each patient is available for four weeks. Do you still use the same design? If not, clearly explain the changes you make.

(iii) Compare the advantages and disadvantages of the studies described in parts (i) and (ii).

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