THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/B.Ed Degree Programme, Continuing Education Programme
APPLIED MATHEMATICS - LEVEL 04
PSU2182/PSZ4130/PSE4182–DESIGN AND ANALYSIS OF EXPERIMENTS
OPEN BOOK TEST 2008/2009

DURATION: ONE AND HALF-HOURS

DATE: 20 – 03-2009	4.00pm – 5.30pm

ANSWER ALL QUESTIONS.

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

1) A researcher is interested in studying the effect of Nitrogen on the growth rate of a medicinal plant. Thirty similar experimental plots are selected for this study. Each plot is around $1m \times 1m$ in size and has four plants that are of similar age and size. Since plants in the same plot are close to each other, same fertilizer needs to be applied for all the plants in a plot. Suppose the researcher is interested in studying the growth of the plant when no fertilizer is applied (referred as the control) and when $5mg$ and $10mg$ of a Nitrogen rich fertilizer are applied every week for a month. The girth of each plant is measured at the end of one month as an indicator of the growth.

   i) In relation to this study, explain the following terms.
      a) treatment

      b) Response variable

      c) random variation

   ii) How many factors are involved in the study?

   iii) If the researcher plans to have an equal number of replicates for all the treatments, how many replicates are possible for a treatment?

2) A researcher is interested in studying the effect of diet on the weight gain of rats. He is particularly interested in three diets: a fibre rich diet (A), a high fat diet (B) and a high sugar diet (C). The researcher is able to collect information on 60 rats who can be fed with different diets of experimenter's choice. Let y denote the weight gain measured on a randomly selected rat.

i) Write down a model for the weight gain measured on a randomly chosen rat. Cleary describe the notation you use.

ii) The researcher reported that he used a completely randomized design. Clearly explain how the treatments were assigned to the rats.

iii) Suppose 40 of the rats were less than 6 months old and the rest were over 10 months. Would you still advise the researcher to use the same design. If yes, give reasons. If not, briefly explain how you would then design the study.

3) A researcher is interested in assigning 4 treatments to experimental units using a 4x4 Latin Square design with no replicates.

i) How many experimental units does he need?

ii) Let T_1, T_2, T_3 and T_4 denote the treatments. Suppose the researcher seeks your advice on how to assign the treatments to the experimental units. Clearly explain how you advice indicating which treatment to be applied to which plot.

iii) A student reported that the treatment structure used in this experiment is a 4-way treatment structure. Do you agree with the report made by the student? Give reasons for your answer.

iv) Let y denote the response. In the usual notation, explain how you estimate the difference in the effects of the treatments T_1 and T_2.