



Strathmore
UNIVERSITY

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MASTER OF SCIENCE IN MATHEMATICAL FINANCE, MASTER OF SCIENCE IN
STATISTICAL SCIENCES AND MASTER OF SCIENCE IN BIO-MATHEMATICS

END OF SEMESTER EXAMS : STA 8204

COURSE NAME: DESIGN OF EXPERIMENTS

DATE: 17th April 2019

TIME: 2 HOUR 30 MINUTES

INSTRUCTIONS.

Answer any **THREE** Questions

QUESTION 1.

- a) Explain three principles of experimental designs? **[5 Marks]**
- b) Distinguish between split plot design and row column design? **[5 Marks]**
- c) Explain the conditions necessary to use block designs in an experiment? **[5 Marks]**

QUESTION 2.

In a wine testing experiment, four wines are tasted and evaluated by eight judges. In this experiment a plot is one tasting by one judge and the judges are the blocks. So there are 8 blocks and 32 plots. You are further informed that plots within each judge are identified by order of tasting. We now want to randomize and we are provided with a stream of random digits for each successive block as follows:

5 4 6 2 8 6 2 0 8 0 2 2 4 2 7 4 1 5 9 8 5 7 4 7 4 7 2 6
2 1 3 4 4 3 2 1 4 1 2 x 3 2 4 3 1 1 4 3 x 2 2 4 x x 1 3

9 3 3 1 5 6 4 1 6 3
 4 2 x 1 3 4 3 1 x 2

The upper row indicates the random digit while the lower one indicates the sequence of experiments.

a) Explain why randomization is important in any experiment? **[3 Marks]**

b) Use the information above to construct a randomized plan for each judge separately for all the judges. **[12 Marks]**

QUESTION 3

a) Explain briefly how you would design a hypothetical factorial experiment with two factors each with two levels? Use a table to illustrate. **[5 Marks]**

b) Explain how you would tease out the main effect from a factorial experimental design? **[5 Marks]**

c) Explain any two instances when the factorial design is preferred over completely randomized design? **[5 Marks]**

QUESTION 4

a) What is a row-column experimental design? **[5 Marks]**

b) Explain any two ways in which you can construct a Latin square design? **[5 Marks]**

c) Explain two models that are used to analyze the effect of treatment in an experiment? **[5 Marks]**

QUESTION 5

a) Differentiate between experimental unit and observational unit in an experiment? **[5 Marks]**

b) Suppose there are three treatment regimens in a HIV treatment experiment coded A, B and C with replications indicated as $r_A = 5$ and $r_B = r_C = 4$. The individual treatment is represented as:

1 2 3 4 5 6 7 8 9 10 11 12 13
 A A A A A B B B B C C C C

Where the upper row indicates the individual and the lower row the regimen administered.

If the random permutation is as shown below,

1 2 3 4 5 6 7 8 9 10 11 12 13
 6 2 8 11 13 1 12 5 7 4 9 3 10

i) Which experimental design is appropriate for this experiment and why? **[4 Marks]**

ii) Show the final experimental design in a table? **[6 Marks]**