The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Agricultural and Plantation Engineering

097

Study Programme: Bachelor of Industrial Studies Honours (Agriculture)
Name of the Examination: Final Examination
Course Code and Title : AGZ5367 Experimental Design
Academic Year : 2022/2023
Date: 21.02.2024
Time: 09.30 to 12.30 hrs
Duration: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This is an **Open Book Test**
3. Answers should be in clear handwriting.
4. Do not use red colour pen.
5. This question paper consists of **six (06)** question in **four (04)** pages.
6. Answer **only five (04)** questions.
7. All questions carry equal marks.

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1. a). Define the following terms in relation to experimental designs (***20 marks***)

i. Experimental error

ii. Experimental unit

iii. Replication

iv. Randomization

b). Briefly explain the importance of following principals in experimental designs (***5 marks***)

i. Replication

ii. Randomization

2. a). A researcher conducts an experiment in the laboratory to study the pollen germination process of five coconut cultivars. He uses four climate-controlled growth chambers which are set to simulate similar temperature and relative humidity. In each growth chamber, five similar sized and shaped glass beakers filled with the same amount of 1% sucrose solution were kept. Then pollen (1g) of five cultivars is randomly allocated to each beaker within each growth chamber. After 24 hours, he recorded the percentage of germinated pollen in each beaker in each growth chamber.

i. What is the experimental design used in this experiment? (***4 marks***)

ii. What is the experimental unit in this experiment? (***4 marks***)

iii. Write the null and alternative hypotheses for this experiment (***4 marks***)

iv. Write the statistical model for ANOVA for this experiment (with all terms defined) (***4 marks***)

v. Give the ANOVA table for this experiment (sources of variation and degrees of freedom only) (***5 marks***)

b). What is the number of replicates could have been if the researcher wants to maintain an error degree of freedom of 20? (***4 marks***)

3. Suppose an agronomist wants to compare the effect of four different phytohormones (T1, T2, T3 and T4) on growth of tomato seedlings in greenhouses. He plans to conduct this experiment using four different greenhouses located close to each other. However, he noted that there is a difference in the light levels between the four green houses.

i. What is the most appropriate experimental design for the above experiment? (***4 marks***)

ii. Give the treatment layout according to the experimental design mentioned above. (***4 marks***)

iii. Given below are the treatment means reported for the above experiment (kg/plant).

T1 mean = 26.0, T2 mean = 25.2, T3 mean = 28.0 and T4 mean = 20. Considering a MSE value of 6.0,

a). Use LSD method to compare all pairs of treatment means and interpret the results using letter notation (***6 marks***).

b). If the agronomist is interested to compare the means of the treatments T2, T3 and T4 with the mean of T1, which mean comparison method will be the most suitable? (***5 marks***)

c). Compare means using the proposed procedure in (b) and interpret the results using letter notations. (***6 marks***)

4. a). Define the term "interaction" in a factorial experiment (***5 marks***)

b). List one advantages of factorial experiments (***5 marks***)

c). Consider a factorial experiment with two levels of fertilizer (low vs high) and two varieties (Var1 and Var2). Display the following two situations using the appropriate graphs. (***10 marks***).

i. An interaction between planting variety and fertilizer

ii. No interaction between planting variety and fertilizer

d). Give the table ANOVA for the above experiment described in *c* (sources of variation and degrees of freedom only) assuming the treatments are arraigned in a completely randomised design with 5 replicates. (***5 marks***)

5. A researcher conducts a study on a faculty of the Open University of Sri Lanka to examine the relationship between a student's class standing and the number of times a student visits the faculty medical officer during an academic year. Given below the responses of a random sample of 270 students employed in the study. **Do the data indicate that the number of visits a student makes to the medical officer is independent of his or her class standing? (*25 marks*)**

	0 visits	**1 – 5 visits**	**More than 5 visits**	**Row sums**
First year	20	16	24	**60**
Second year	30	10	10	**50**
Third year	50	30	10	**90**
Final year	19	11	50	**80**
Column sums	**119**	**67**	**94**	**Total observations = 280**

6. Consider a field experiment with four (04) treatments. These treatments must be arranged in a field where you find a gradient in soil moisture in along the field and a gradient in shade across the field.

a. Which experimental design is suitable for this field experiment? (***4 marks***)

b. How many replicates would you propose for this experiment? (***4 marks***)

c. Write the statistical model for ANOVA for above experiment (***4 marks***)

d. Construct the ANOVA table for the above experiment (sources of variation and degreed of freedom only) (***8 marks***)

c. Give one disadvantage of the experimental design you mentioned in (a) and propose a method to overcome it (***5 marks***)