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THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. /B.Ed. Degree Programme, Continuing Education Programme

APPLIED MATHEMATICS-LEVEL 05

PCU3141/PCE5141/PCU1142/PCE3142/FSU1182/PSE3182 – Bio Statistics

FINAL EXAMINATION 2016/2017

Duration: Two Hours.

Date: 08.01.2018	**Time: 1.30p.m- 3.30p.m**

Instructions:

- **This question paper consists of 06 questions. Answer only four questions.**
- **Statistical Tables are provided. When reading values, you may use the closest degrees of freedom given in the table.**
- **In all tests, use the significance level as 0.05.**
- **If the random number table is to be used, you are required to clearly indicate how to read the values and present three values that you read as an example.**
- **Non-programmable calculators are permitted.**

1. A researcher is interested in comparing the effects of two diets on the weight gain of rats. For this experiment, he has 80 rats available, belonging to two age groups juvenile and adults in equal numbers.. Rats are to be kept in cages with five rats in each. Rats in the same cage have to be of the same age and have to be fed with the same diet. The researcher plans to measure the weight gains after keeping the rats on the stipulated diet for five months. The researcher suspects that the weight gain could depend on the age in addition to the diet.

   Suppose the researcher seeks your advice to design this study.

   i) Clearly describe how you advice the researcher.

   ii) Explain the following terms in relation to this study:

      a) Main effect

      b) Interaction

      c) Random error

2. The following table summarises the number of days taken by a sample of watermelon plants to mature for harvesting after sowing.

Number of days	Number of plants
50 – 54	7
55 - 59	22
60 - 64	64
65 - 69	47
70- 74	5
75 – 79	4
80 - 84	13
85 – 89	32
90- 94	6

i) What is the sample size used in this study?

ii) Construct a suitable graph that can be used to examine whether the data belongs to a homogeneous population or to a mixture of subpopulations with differences in expected number of days to mature for harvesting.

iii) Clearly state all the findings from the graph constructed in part (i).

iv) Calculate the relative frequency corresponding to the third class interval and clearly explain what it measures in relation to this study.

3. A manufacturer claims that the mean drying time of a newly introduced paint is less than 3 hours. The sample mean and the standard deviation of 25 drying times were 2.9 and 1.2 respectively.

i) Briefly describe the following terms in relation to this study:

   a) Type I error

   b) Significance level

ii) Suppose you are not willing to accept the manufacturer's claim until it is proven by an appropriate statistical test. Clearly describing the notation, write down the null and the alternative hypotheses that you examine.

iii) Using a suitable statistical test, examine the validity of the claim at 5% significance level and clearly state the findings.

4. A researcher claims that a certain catalyst has no effect on the reaction rate of a chemical reaction. In order to test the validity of this claim, reaction rates were measured on 30 samples with catalyst added and on another 30 samples with no catalyst added. The following summary statistics were computed from the reaction rates (minutes) measured.

Description	Sample mean	Standard deviation
No catalyst added	10.2	2.1
With catalyst added	9.8	2.4

i) Clearly state the null and the alternative hypotheses that you examine to address the research objectives.

ii) Using a suitable statistical test, examine the validity of the claim at 5% significance level. Clearly state the findings.

iii) Clearly state the assumptions you make in applying the suggested test procedure.

5. In a study to estimate the percentage of defectives resulting from a production line, a quality controller inspected 100 items on each of 200 days. The number of defectives found in each of 100 items inspected is summarized in the following table.

Number of defectives	Number of days
0	3
1	10
2	37
3	54
4	64
5	32

i) Calculate the sample mean and explain what it measures in relation to this study.

ii) Calculate the range of the data.

iii) Calculate the standard deviation of the data.

iv) Calculate the first quartile of the data.

v) Calculate the inter-quartile range of the data.

6. The management of a hospital wants to assess the satisfaction of persons regarding the facilities available. The data are to be collected on two days from persons attending the eye clinic, diabetic clinic and the wellness clinic. From past experience, on each day, the hospital expects around 300, 600 and 300 persons for the eye clinic, diabetic clinic and the wellness clinic respectively. Resources are available to sample 200 persons for data collection on each day. Around 40% of persons attending each clinic are females and the researcher suspects gender differences in the opinion on facilities.

   i) Suggest a suitable sampling design. You need to clearly explain how you sample the persons.

   ii) In relation to this study, explain the following terms:

      a) Population

      b) Sampling unit

   iii) State whether each of the following statements is true or false.

      a) Bias can be reduced by increasing the sample size.

      b) Non-sampling error cannot occur in a census.