

THE OPEN UNIVERSITY OF SRI LANKA

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

B.Sc (Nursing)
Bachelor of Industrial Studies/ Diploma in Industrial Studies Programme

APPLIED MATHEMATICS - LEVEL 03

PCU1142/PSU 1182/ PSE 3182/PSZ3182/ PSZ 4182/- Bio Statistics

NSU1142
FINAL EXAMINATION 2010/2011



DURATION: TWO HOURS.

DATE: 21.12.2010

TIME: 1.00pm – 3.00pm

ANSWER FOUR QUESTIONS ONLY.

Statistical Tables are provided. Non programmable calculators are permitted.

1. A medical practitioner is interested in comparing the effects of two cough syrups say CS1 and CS2. Two dose levels of each cough syrup is to be tested, which are 1 tea spoon in the night only and 1 tea spoon in the night and one in the morning. Seventy five persons suffering from cough have volunteered to participate in the study. Out of those, 25 are smokers and the rest are non smokers. Of smokers, 15 have had cough for almost six months while the rest have had cough for about three months. Among the non smokers, 20 have had cough for almost six months while the rest have had cough for about three months. The medical practitioner suspects differences in the effects of two drugs depending on the dose level, whether the person smokes or not and on how long the patient has had the cough.
 - i) Clearly describe how you advise the medical practitioner to design this study. If you use the random number table, clearly state how you read the values.
 - ii) Explain the following terms in relation to this study
 - a) replicate
 - b) random variation
 - c) interaction

2. The instructor of a course claims that the expected time taken by a randomly selected student to answer the final examination paper is at most two hours. The times (in minutes) taken by 30 randomly selected students are given below.

107 107 107 108 108 108 109 109 109 110
 110 110 110 111 112 114 114 116 116 116
 117 117 117 117 118 118 118 119 121 121

- i) Write down the null hypothesis and the alternative hypothesis you would test in order to examine the validity of the instructor's claim. Clearly describe the notation you use.
 - ii) Using a 5% significance level, examine the validity of the instructor's claim. Clearly state the findings.
 - iii) Explain the following terms in relation to this study.
 - a) critical value
 - b) significance level
3. A production process of nails is said to be in satisfactory condition if the percentage of defectives produced is at most 3%. The management samples nails to find out whether the production process is in satisfactory condition, whether there is a difference in the performance of the two production crews and how the performance has changed over time. The following table presents the data collected from the two production crews over a period of two years.

Description		Jan 2006	May 2006	Aug. 2006	Jan 2007	June 2007	Oct 2007	Jan 2008	Sep 2008
Crew 1	No. of nails sampled	107	184	102	109	111	97	81	98
	No. of defectives	2	3	2	3	2	1	1	2
Crew 2	No. of nails sampled	201	210	190	109	220	164	208	185
	No. of defectives	4	4	3	3	5	4	6	4

- i). Construct a suitable graphical summary to meet the objectives of the management.
- ii) Clearly state the findings from the graphical summary constructed in part (i).
- iii) Briefly explain the following terms in relation to this study.
 - a) parameter
 - b) estimate

4. A researcher is interested in estimating the total dried weight of 420 coconuts when scraped and dried. The following are the dried weights (in grams) of 40 coconuts sampled from this collection.

58.1	58.1	58.3	58.3	58.3	58.4	58.6	58.6	58.7	58.9
58.9	59.1	59.1	59.2	59.3	59.4	59.4	59.4	59.4	59.5
59.7	59.7	59.7	59.8	59.8	59.8	60.1	60.1	60.2	60.3
60.3	60.3	60.4	60.5	60.6	60.6	60.6	60.8	60.8	60.8

- i) Find the first quartile of the data. In relation to this study, what does it measure?
- ii) Estimate the total dried weight of the 420 coconuts.
- iii) Briefly explain the following terms in relation to this study.
- population
 - sampling unit
5. A company has three machines that produce nails. The machines are quite similar except for their ages. The management suspects associations between the age and the percentage of defectives produced. The output of each machine comes out as packets of 10 nails and is stored separately. On each day, each machine produces around 5000 nails. The company has resources to sample around 500 nails from the output of each day.
- Suppose the company seeks your assistance to design the study. Briefly explain how you advise them.
 - State whether the study is observational or experimental. Give reasons for your answer.
 - State whether the following statements are true or false. Give reasons for your answer in each case.
 - If all the units in the population were sampled, there can not be non-sampling errors.
 - Random variation can be reduced by increasing the sample size.

6. The following table summaries the ages at which a sample of persons are first diagnosed with diabetes.

Age range	Number of Persons
15-19	3
20-24	10
25-29	27
30-34	42
35-39	28

- i) Find the sample standard deviation. In relation to this study, what does it measure?
- ii) What is the cumulative frequency responding to the third class interval. In relation to this study, what does it measure?
- iii) A researcher is interested in finding out whether the age at which a person is first diagnosed with diabetes is symmetrically distributed or not. Construct a suitable graphical summary to meet the objectives of the researcher.
- iv) Clearly state the findings from the graphical summary constructed in part (iii).

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