00282

THE OPEN UNIVERSITY OF SRI LANKA

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

Bachelor of Industrial Studies/ Diploma in Industrial Studies Programm

APPLIED MATHEMATICS - LEVEL 03

PCU1142/PCE3142/PSU 1182/ PSE 3182/PSZ3182/ PSZ 4182 – Bio Statistics

FINAL EXAMINATION 2010/2011

DURATION: TWO HOURS.

DATE: 22.12.2011	TIME: 9.30am – 11.30am

ANSWER **FOUR** QUESTIONS ONLY.

Statistical Tables are provided. Non programmable calculators are permitted.

1. A researcher is interested in comparing the effectiveness of two drugs (say D_1 and D_2) on controlling the blood sugar level. Two hundred and ten persons with inflated blood sugar levels have agreed to take any one of the drugs assigned to them while continuing with their regular pattern of exercise. Of these 210 persons, 80 are females Among the 80 females, 20 exercise daily, 40 exercise every other day and the rest exercise only occasionally. Among the 130 males, 30 exercise daily, 50 exercise every other day and the rest exercise only occasionally. The researcher suspects of possible differences in the effectiveness of the drugs depending on the gender and the pattern of exercise.

   Suppose you are asked to advise the researcher to design this study.

   i) Clearly explain how you advise the researcher. If you use the random number table, clearly describe how you read the values.

   ii) Explain the following terms in relation to this study.
      a) Replicate
      b) Main effect
      c) Interaction

2. A company sells gas cookers of a particular brand through its four sales outlets located in the four cities Colombo, Kandy, Galle and Matara. Records indicate that the average monthly sales in the outlets in Colombo, Kandy, Galle and Matara in the year 2010 are around 600, 400, 400 and 200 respectively. The storage cost per gas cooker per day is around Rs. 40/= in each outlet but the length of storage could differ from one outlet to the other. Each outlet keeps records on date received and date sold for each gas cooker. Suppose the cost of collecting records form each outlet is nearly the same and the company plans to collect information on 400 gas cookers.

   The company wishes to estimate the total storage cost of gas cookers sold in the year 2010.

   i) Suppose you are asked to advise the company to design the study. Clearly describe how you advise the company.

   ii) Explain the following terms in relation to this study.
      a) Population
      b) Sampling unit

3. The following are the dried weights (in grams) of 40 medicinal plants randomly selected from a large population of plants in a farm.

4.2	4.2	4.3	4.3	4.3	4.4	4.4	4.4	4.4	4.8
4.8	4.9	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.1
5.1	5.3	5.3	5.3	5.4	5.5	5.5	5.5	5.7	5.7
5.7	5.7	5.7	5.8	5.8	5.8	5.8	5.9	5.9	5.9

   Suppose it is reasonable to assume that the dried weights follow a normal distribution with an unknown mean μ and an unknown variance σ^2.

   A researcher claims that the expected dried weight of a randomly chosen plant exceeds 5.0 grams.

   i) State the null and the alternative hypotheses you would test to examine the validity of the researcher's claim.

   ii) Using a 5% significance level, test the validity of the researcher's claim. Clearly state your findings.

   iii) Explain the following terms in relation to this study.
      a) Type I error
      b) Critical region

4. A researcher is interested in comparing the effects of two fertilizers (say F_1 and F_2) on the yields from a bean variety. He has selected 60 nearly similar experimental plots and measured the yield per plot (in kilograms) after one month of applying the fertilizer. The following summary table is constructed based on the information collected.

Description	Fertilizer	
	F_1	F_2
Sample mean	10.1	8.7
Sample standard deviation	3.4	2.1
Sample size	30	30

i) Test, at 5% significance level, whether the data provide evidence to support the claim that fertilizer F_1 gives a better yield compared to F_2. Describe any notation you use in the analysis and clearly state your findings in relation to this study.

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

a) Null hypothesis

b) Critical Value

5. The weights (in kg) of 120 females in the age group of 30 to 40 years are summarised in the accompanying table.

Weight	Number of females
40 – 44	5
45 - 49	15
50 – 54	81
55 - 59	19

i) What is the cumulative frequency at 54 kg. In relation to this study, what does it measure?

ii) Construct a suitable graph that can be used to find the quartiles of the data.

iii) Clearly state the findings from the graph constructed in Part (ii).

iv) Estimate the percentage of females who are over 52 kilograms belonging to the age group of 30 to 40 years.

6. In a study on identifying the factors that may have an impact on the yield from tomatoes, information was collected on the variables described below.

V_1 : Variety of tomatoes recorded as
(1:cherry tomatoes; 2: plum tomatoes 3:pears tomatoes; 4: other type)
V_2 : Exposure to sunlight recorded as
(1:morning only; 2: evening only 3: through out the day)
V_3 : Type of fertilizer recorded as
(1:organic only; 2: compost only 3:mixture of compost and organic)

V_4 : Yield received in (kg per perch)

i) Classify the data collected on each variable as qualitative or quantitative.
ii) Classify the data collected on each variable as nominal, ordinal, interval or ratio.
iii) Classify the study as observational or experimental. Give reasons for your answer.
iv) A student argued that if the variable V_3 has an impact on the yield, a frequency polygon constructed from the data collected on the variable V_4 will be multi-modal. Do you agree with the argument made by the student? Give reasons for your answer.