

THE OPEN UNIVERSITY OF SRI LANKA

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

Bachelor of Industrial Studies/ Diploma in Industrial Studies Program

APPLIED MATHEMATICS - LEVEL 03

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

FINAL EXAMINATION 2012/2013



DURATION: TWO HOURS.

DATE: 30.05.2013

TIME: 9.30am – 11.30am

ANSWER **FOUR** QUESTIONS ONLY.

**Statistical Tables are provided. Non programmable calculators are permitted.**

1. A researcher is interested in finding out the effect of a fertilizer on the growth of tomato plants. He is interested in two varieties of tomatoes (say  $V_1$  and  $V_2$ ) and three amounts of the fertilizer ( $F_1$ ,  $F_2$  and  $F_3$ ). For this study, he has 30 experimental plots. Each plot has five plants of the same variety. Plants in a plot are close to each other and hence it is not practical to apply different fertilisers to plants in the same plot. Of the 30 plots, 10 have two-week old plants of variety  $V_1$  and the rest of the plots have two-week old plants of variety  $V_2$ . The researcher suspects that the two varieties have different responses to the two fertilizers. The researcher is planning to use the increase in height in a month from the application of the fertilizer as a measure of the growth.
  - i) Clearly describe how you advise the researcher to design this study. If you use the random number table clearly explain how you read the values.
  - ii) In relation to this study, explain the following terms.
    - a) main effect
    - b) interaction

2. The following summary statistics were computed based on the times (in minutes) taken by persons to type a two-page document. The data had been collected to find out whether there is a difference in the mean typing speeds of left-handed and right-handed persons.

Description	Value for	
	Left-handed	Right-handed
Sample size	25	40
Sample mean	28.5	24.2
Standard deviation	6.5	5.2

Past records indicate that the typing speeds of left-handed and right-handed persons follow normal distributions with unknown means and unknown but equal random variations.

- i) Write down the null and the alternative hypotheses you would test to address the objectives of the researcher.
  - ii) Write down the test statistic you would use to test the hypothesis stated in part (i).
  - iii) Test the validity of the null hypothesis using a 5% significance level and clearly state your findings.
3. A quality controller wants to find out whether the expected weight of sugar packets each labelled 1kg is the same as the labelled weight. A sample of 30 randomly chosen packets had mean 960 grams and a standard deviation of 4.2 grams. Assume that the weights of packets follow a normal distribution with unknown mean and variance.
- i) Write down the null and the alternative hypothesis you would test to address the objectives of the quality controller.
  - ii) Test the null hypothesis using a 5% significance level and clearly state the findings.
  - iii) Explain the following terms in relation to this study.
    - a) Null hypothesis
    - b) Type I error
    - c) Critical value

4. The following are the dried weights (in mg) of a particular three-month old 30 medicinal plants collected in a study.

2.1    2.2    2.2    2.2    2.3    2.3    2.4    2.4    2.5    2.6  
 2.6    2.8    2.8    2.9    2.9    2.9    3.0    3.0    3.1    3.1  
 3.2    3.3    3.3    3.3    3.4    3.6    3.6    3.6    3.6    3.7

- i) Compute the sample mean.
  - ii) Compute the sample median.
  - iii) Out of the estimates computed in parts (i) and (ii), which one would you recommend as more appropriate to estimate the expected dried weight of the medicinal plant at the age of three months? Give reasons for your choice.
  - iv) Based on the measures computed in parts (i) and (ii), what can you say about the shape of the distribution of the dried weights? Give reasons for your answer.
  - v) Suggest a suitable graphical summary that can be used to examine the shape of the distribution of dried weights. **You need not construct the graphical summary.**
5. Fasting blood sugar levels (mg/dL) of 180 adults are summarised in the following table.

Fasting blood sugar level (mg/dL)	Number of persons
60 – 79	34
80 – 99	51
100 – 119	70
120 – 139	25

- i) Construct a suitable graphical summary that can be used to read the percentiles of the data.
- ii) Using the graphical summary estimate
  - a) 10<sup>th</sup> percentile
  - b) Sample median
  - c) First quartile
- iii) Using the graphical summary or otherwise, give an estimate of the random variation in the fasting blood sugar levels.

6. The manuscript of a book has 289 pages. The first 94 pages had been typed by one person and the rest of the pages by another person. The two persons may differ in the accuracy of their typing. The author is interested in estimating the number of typing errors in the manuscript. A student has agreed to spend 6 days for counting the number of typing errors. On each day, the student has only agreed to check 10 pages.
- i) The author seeks your advice for data collection. Clearly explain how you advise him.
  - ii) Explain the following terms in relation to this study.
    - a) Sampling unit
    - b) Random variation
    - c) Population

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