

University of Ruhuna
B.Sc.(General) Degree
Level II (Semester II) Examination - June 2022

Subject: Applied Mathematics/ Industrial Mathematics
Course Unit: AMT224 β /IMT224 β -Applied Statistics I

Time: Two (2) Hours

Answer All Questions

1. a) The following data represent the costs (in Rupees) of a sample of 20 postal mailings by a company:

30 62 45 78 35 76 51 42 98 65
93 76 58 72 71 85 88 52 95 68

- (i) Construct a Stem and leaf plot.
(ii) Find the five number summary.
(iii) Determine whether there are any outliers.

[60 marks]

- b) For a group of 100 candidates the mean (μ) and standard deviation (σ) of their marks were found to be 60 and 15 respectively. Later on it was found that the scores 45 and 72 were wrongly entered as 40 and 27. Find the corrected mean and standard deviation.

[40 marks]

2. a) The mean of the following distribution is 62.8 and the sum of all the frequencies is 50.

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

- (i) Find the missing frequencies f_1 and f_2 .
(ii) Verify that the mean is 62.8 by using the step deviation method.
(iii) Find median and mode of the above set of data.
(iv) Find first quartile (Q_1), third quartile (Q_3) and inter quartile range (IQR) of the above data set.

[60 marks]

- b) Six students have scored $7y$, $4y$, $5y$, $3y$, $2y$ and $9y$ marks for an examination. If the mean deviation of the marks of these students about the mean is 14, then find the marks of each student.

[40 marks]

3. a) Obtain the least square estimates for β_0 and β_1 of the simple linear regression model, $y_i = \beta_0 + \beta_1 x_i + \epsilon_i$ for $i = 1, 2, \dots, n$ in the usual notation. [20 marks]
- b) To discuss the suitability of the model, the coefficient of determination can be used. Write down the equation of coefficient of determination and comment on it. [10 marks]
- c) An instructor of a University would like to examine the relationship (if any) between the number of optional homework problems which were completed during the semester and their final marks. 12 students were randomly selected for the study and ask them to keep track of the number of these problems completed during the course of the semester. At the end of the class, each student's mark is recorded.

Number of optional problems	51	58	62	65	68	76	77	78	78	84	85	91
Final mark	62	68	66	66	67	72	73	72	78	73	76	75

- (i) Identify the response variable and the predictor variable.
- (ii) Construct the least square regression line between these two variables.
- (iii) Using the derived regression equation, predict student's final mark if 75 optional homework assignment are done.
- (iv) Can you use derived equation to find number of optional homework assignments that need to be completed if a student expects on mark 85?

[70 marks]

4. a) A student is given a multiple choice question paper with 50 questions. There are five alternative answers to each question with only one correct answer. He guesses randomly for each question. Let X be the number of correct answers.
- (i) What is the distribution of X ?
- (ii) What is the expected number of correct answers?
- (iii) Find the probability of exceeding 15 correct answers. [35 marks]
- b) A secretary was assigned to make a report with 10 pages. On average she makes 2 mistakes per page.
- (i) Find the expected number of pages in the report with no mistakes.
- (ii) Find the probability that the number of mistakes in the report is more than 13. [30 marks]
- c) The annual salaries of employees in a company are approximately normally distributed with mean Rs. 25,000 and standard deviation Rs. 10,000.
- (i) What percentage of employees earn less than Rs. 20,000?
- (ii) What percentage of employees earn between Rs.23,000 and Rs.33,000?
- (iii) What is the least salary of the top 20%?

[35 marks]