University of Ruhuna

Bachelor of Science General Degree
Level II (Semester II) Examination - November 2016

Subject: Mathematics
Course Unit: AMT224β/IMT224β (Applied Statistics I)

Time :Two (02) Hours

Answer 04 Questions only.

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1. a) Briefly explain the following.

(i) Qualitative and Quantitative data.

(ii) There are 180 workers in the ABC company.

Male Workers		Female Workers	
Full time	Part time	Full time	Part time
90	18	9	63

Explain how you would select 40 workers by using stratified random sampling technique.

b) Following table show the daily average salaries of 125 clerks in different companies.

Daily salaries(Rs.)	Number of clerks
300 - <325	5
325 - <350	17
350 - <375	25
375 - <400	31
400 - <425	27
425 - <450	10
450 - <475	5
475 - <500	5

Find the mean, median and standard deviation salary of clerks.

c) An examination was conducted for the students in class A and B. However due to the damage of records some information were lost.

Class	Mean	Standard deviation	Class size
A	$\star$	5	12
B	50	$\star$	8

Here $\star$ denotes the lost values. It was known that the mean of the marks was 56 and the standard deviation of the marks was 8 when the two classes were combined. Find the lost vales of class A and B considering as **populations**.

Continued.

2. a) Write down the five number summary for the following population levels observed in a river and find the outliers, if any.
10.2, 14.1, 14.4, 14.4, 14.4, 14.5, 14.5, 14.6, 14.7, 14.7, 14.7, 14.9, 15.1, 15.9, 16.4

b) A teacher wants to find out the correlation coefficient between English marks (X_i) and Mathematics marks (Y_i) of an assignment. Sample of 25 students were taken and following sums were obtained.

$\sum_{i=1}^{25} X_i = 125$ $\sum_{i=1}^{25} X_i^2 = 650$ $\sum_{i=1}^{25} X_i Y_i = 510$ $\sum_{i=1}^{25} Y_i = 100$ $\sum_{i=1}^{25} Y_i^2 = 450$

However, she later discovered that marks of two students were obtained incorrectly. They were taken as (6,14) and (8,6) while the correct marks were (8,12) and (6,8) respectively. Find the correct correlation coefficient.

c) Paintings completed by a group of 10 students are assessed by two independent judges. The marks awarded are shown below. Find the correlation between first judge and second judge.

First judge	Second judge
30	50
35	45
35	45
40	45
50	60
55	55
60	75
65	70
70	65
80	80

Find the Spearman's rank correlation coefficient between first judge and second judge.

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3. a) Obtain the least squares estimates for β_0 and β_1 of the regression model $y_i = \beta_0 + \beta_1 x_i + \epsilon_i$ for i=1,2,...,n in the usual notation.

b) A market trader sells ball-point pens on his stall. He sells pens for a different fixed price in each of eight weeks. He noted the number of pens he sells in each of these eight weeks. The results are shown in the following table.

Price of a pen(Rs.)	10	15	20	25	30	35	40	45
Number of pens	68	60	55	48	38	32	30	26

(i) Identify the independent variable(x) and the dependent variable(y).

(ii) Calculate the least square regression line y on x.

(iii) Find the coefficient of determination. Discuss the suitability of the model.

(iv) Estimate the least number of pens he sell if the price of a pen is Rs.27.

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4. a) A manufacturer of metal piston finds that 12% of his pistons are rejected because they are either oversize or undersize. What is the probability that a batch of 10 pistons will contain

(i) no more than two rejected?

(ii) at least two rejected?

b) A certain type of missiles can attack to a target with success probability p=0.2. Suppose we fire n missiles. If the probability of attacking the target at least by one missiles is at least 90% then find n.

c) Suppose that a sample of $n = 1000$ tires of the same type are obtained at random from an ongoing production process in which 14% of all such tires produced are defective. Find the probability that in a such sample 150 or fewer tires will be defective using a suitable approximation.

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5. a) A botanist is studying the distribution of daisies in a field. The field is divided in to number of equal size squares. The mean number of daisies per square is 3. The daisies are distributed randomly throughout the field. Find the probability that, in a randomly chosen square will contain

(i) less than three daisies.

(ii) more than two daisies.

b) An electricity power failures occur according to a poisson distribution with an average of 3 failures in every twenty weeks. Calculate the probability that there will not be more than one failure during a particular week.

c) The daily number of arrivals to a rural emergency room is a Poisson random variable with a mean of 100 people per day. Use the normal approximation to the Poisson distribution to obtain the approximate probability that 112 or more people arrive in a day.

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6. a) In school term test, a candidate fails if he obtains less than 40 marks out of the 100 marks and he has to obtain at least 76 marks in order to pass examination with a distinction. The top 10% of the students have received passes with distinction and the bottom 30% of the students have failed the examination. Assuming that the distribution of marks is normal, find the mean and the standard deviation of the marks.

b) It is given that a battery of brand **A** laptop lasts on average 3 years with standard deviation of 0.5 years and a battery of brand **B** laptop lasts on average 3.2 years with standard deviation of 0.6 years. Find the probability that

(i) A battery of brand **A** laptop has higher lifetime than a battery of brand **B** laptop.

(ii) A battery of brand **A** laptop lasts more than 4 years and a battery of brand **B** laptop lasts more than 4 years.
