University of Ruhuna

Bachelor of Science General Degree
Level II (Semester II) Examination - January 2018

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

Time :Two (02) Hours

Answer 04 Questions only.
A calculator will be provided.

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1. a) Briefly explain the following.

   (i) Qualitative and Quantitative data.

   (ii) If there are 50 names on the list, explain how we obtain a sample of 10 names using systematic random sampling technique (Use 2 as the primary unit).

   b) The frequency distribution of weight in grams of a sample of mangoes, of a given variety is given below.

Weights in grams	Number of mangoes
410 - 419	14
420 - 429	20
430 - 439	42
440 - 449	54
450 - 459	45
460 - 469	18
470 - 479	7

Find the mean and standard deviation weight of mangoes by using direct method.

c) Find the missing frequency from the following distribution of sales of shops, given that the median sales of shops is Rs. 2400.

Sale in Rs.	0-<1000	1000-<2000	2000-<3000	3000-<4000	4000-<5000
No. of shops	5	25	x	18	7

Here x denote the missing frequency.

d) The frequency distribution of 100 families given below. The number of families corresponding to the expenditure groups $20-40$ and $60-80$ are missing from the table. However, the median is known to be 50. Find the missing frequencies f_1 and f_2.

Expenditure in Rs.	0-<20	20-<40	40-<60	60-<80	80-<100
No. of families	14	f_1	26	f_2	15

Continued.

2. a) Marks of the 15 students for the Applied Statistics course unit are as follows:
78, 76 ,56 ,89 ,92 ,98 ,74 ,22 ,13 ,68 ,59 ,88 ,81 ,79 , 84
Find the five number summary and outliers if any.

b) Calculate the Karl Pearson's coefficient of correlation between X and Y if
$n = 10$, $\sum_{i=1}^{n} x_i = 140$, $\sum_{i=1}^{n} y_i = 150$,
$\sum_{i=1}^{n} (x_i - 10)^2 = 180$, $\sum_{i=1}^{n} (y_i - 15)^2 = 215$, $\sum_{i=1}^{n} (x_i - 10)(y_i - 15) = 60$.

c) A psychologist assumes that the correlation between two teaching methods is weak. The psychologist wants to compare the two teaching methods A and B. He selected a random sample of 22 students. He grouped them into 11 pairs so that the student in a pair have approximately equal scores on an intelligence test. In each pair, one student was taught by method A and the other by method B and examine after the course. The marks obtained by the students tabulated below:

pair	1	2	3	4	5	6	7	8	9	10	11
Method A	24	29	19	14	30	19	27	30	20	28	11
Method B	37	35	16	26	23	27	19	20	16	11	21

Comment on the psychologist assumption, use Spearman's rank correlation coefficient between teaching method A and B .

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

b) A panel of judges A and B graded seven debators and independently awarded the following marks.

Debator	1	2	3	4	5	6	7
Marks by judge A	40	34	28	30	44	38	31
Marks by judge B	32	39	26	30	38	34	28

(i) Find the simple linear regression equation of marks by judge B on marks by judge A.

(ii) Calculate the coefficient of determination and comment on the suitability of the regression line.

(iii) A eighth debator was awarded 36 marks by judge A while judge B was not present. If judge B was also present, how many marks do you expect him to award to the eighth debator assuming that the same degree of relationship exists in their judgment?

Continued.

4. a) If 6 out of 18 new buildings in a city violate the building code. A building inspector randomly select 4 of the new buildings for inspection. What is the probability that the inspector will catch

(i) none of the buildings violate the building code?

(ii) at least two of the buildings violate the building code?

b) Between the hours 2 pm and 4 pm the average number of phone calls per minute received into the switch board of a company is 2.35. Find the probability that during a particular minute,

(i) there will be no phone calls.

(ii) there will be at most 2 phone calls.

c) In a certain examination the percentages of passes and the percentage of distinctions were 46 and 9 respectively. Assume that the marks of the students were normally distributed. Find the mean and the standard deviation of candidates if minimum pass and distinction marks are considered as 40 and 75 respectively.

d) Based upon past experience, 40% of all customers at Millers Automotive Service Station pay for their purchases with a credit card. If a random sample of 200 customers is selected, what is the probability that at least 75 pay with a credit card?

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5. a) The management of photograph record company has discovered that the number of defects on records appears to follow a Poisson distribution with mean equal to 0.4.

(i) What is the probability that a record selected at random will have three defects?

(ii) If management sets a policy that all photograph records sold to customers must not have any defects, what percent of its records production will not be made available for sales because of defects?

b) In a multiple choice examination, there are 5 questions. Each question has four alternative answers following it and the students must select the one correct answer. Four marks are given for the correct answer and one mark deducted for every wrong answer. A student must secure at least 50% of maximum possible marks to pass the examination. Suppose that a student decide to answer to the question on a random basis. What is the probability that he will pass the examination?

c) A radio active substance emits alpha particles. The number of particles reaching a screen over a time period follows a Poisson distribution. Suppose that two such substances emits alpha particles independently. The first substance emit with an average of one particle per second and the second substance emits with an average of two particles per second. Find the probability that, the total number of particles reach the screen in one seconds is, at least two.

d) The life time of battery type A is normally distributed with mean 20 days and standard deviation 4 days and the life time of battery type B is normally distributed with mean 22 days and standard deviation 3 days. Find the probability that the battery type A has life time than the battery type B.

Continued.

6. a) The average test marks in a particular class is 79 and the standard deviation is 5. If the marks are distributed normally, find

   (i) the probability that a student get marks over 70?

   (ii) the probability that a student get marks between 75 and 82?

   (iii) the expected number of student who did not receive marks between 75 and 82 out of 200 students?

   b) Based on past experience, 7% of all luncheon vouchers are in error. If a random sample of 400 vouchers is selected, what is the approximate probability that between 20 and 25 vouchers are in error?

   c) A foot bridge of negligible weight is capable of carrying out a maximum weight of 400kg at once. If 9 persons go by it at the same time, find the probability that the foot bridge is out of dangerous. You may assume that the weight of a person has a normal distribution with the mean of 50kg and the standard deviation of 6kg.

   d) Suppose that a local appliances shop has found from experience that the demand for tube lights is roughly distributed as poisson with a mean of 6 tube lights per week. If the shop keep 10 tube lights during a particular week, what is the probability that the demand will exceed the supply during that week?
