



**HTE 232-2 Quantitative Techniques**

**Instructions to candidates:**

- No. of pages : Three (03)  
No. of questions : Three (03) Essay Questions  
Time allocation : One (1) hour and thirty (30) minutes  
Marks allocation : 80 marks  
**Answer All Questions**



**Part B: Essay Questions**

- 1)
- a) Experiment: Tossing an un-balanced coin for 2 times.
- i. What is the sample space,  $S$ ? **(3 marks)**
- ii. Let,  $X$  be a random variable such that number of tails in two tosses. Assume that  $P(\text{Tail}) = 0.4$  and  $P(\text{Head}) = 0.6$ . Construct the discrete probability distribution and discrete cumulative probability distribution. **(7 marks)**
- b)  $A$ ,  $B$  and  $C$  are events with respect to the random experiment such that  $P(A^c) = 0.2$ ,  $P(B) = 0.6$  and  $P(C) = 0.2$ .  $B$  and  $C$  are mutually exclusive events.  $A$  and  $C$  are independent events. Calculate:
- i.  $P(A) =$
- ii.  $P(A \cap C) =$
- iii.  $P(A \cup C) =$
- iv.  $P(B \cap C) =$
- v.  $P(B \cup C) =$  **(5 marks)**
- c) Define the following terms and describe how they may be used in analyzing tourism statistics:
- i. Pearson's correlation **(2.5 marks)**
- ii. Regression. **(2.5 marks)**
- (Total- 20 marks)**

2)

- a) A guest house has two rooms which it hires day by day. It is observed that the demand for a room on a day follows a Poisson distribution with mean 2.5. Calculate the probability on a particular day that;
- Both rooms are vacant. (5 marks)
  - At least one room is vacant. (5 marks)
- b) The weight of the XYZ chocolate bars is normally distributed with a mean of 130g and standard deviation of 8g. Find the probability that,
- the weight of a randomly selected chocolate bar exceeds 135g. (5 marks)
  - the weight of a randomly selected chocolate bar lies between 125g and 140g. (5 marks)
- c) People who get angry easily tend to be more likely to have heart disease. That is the conclusion of a study that followed a random sample of 12,986 people from three locations over about four years. All subjects were free of heart disease at the beginning of the study. The subjects took the Spielberger Trait Anger Scale, which measures how prone a person is to sudden anger. The 8474 people in the sample who had normal blood pressure were classified according to whether they had "coronary heart disease" (CHD) or not and whether they had low anger, moderate anger, or high anger according to the Anger Scale. The classification summary is given.

	Low Anger	Moderate Anger	High Anger
CHD	53	110	27
No CHD	3057	4621	606

**Task:** Perform a Chi-square test of independence at the 10% level to assess if Anger classification and Heart Disease Status are related. (Chi-squared table value is 6.7 with df 2)

(10 marks)

(Total - 30 marks)

- 3) A multiple regression analysis is used to study the Sri Lankan tourist behaviour. A sample of 1000 respondents is considered. The objective of this study is to predict the number of miles travelled on vacation. The number of miles travelled on vacation, family size, family income and age are recorded. The description of variables is given in Table 01. Answer the following questions, in each case justifying your answer by appropriate analyses.

Table 01: List of variables

Variable	Definition
Y	number of miles travelled on vacation
X1	family size
X2	family income
X3	Age

Using the computer software, the following incomplete Minitab output has generated for the best-fitting multiple regression.

Table 02: Coefficients Table

Predictor	Coefficient	Standard Deviation	P
Constant	26.40	6.700	0.000
X1	-0.250	4.800	0.000
X2	5.02	4.690	0.043
X3	-0.269	0.587	0.000

Table 03: Analysis of Variance Table

Source	df	SS	MS	F
Regression		8925698		
Residual		132589		
Total				

- What is/are the continuous variable/s? (3 marks)
- What is the fitted regression model? (5 marks)
- Test whether the multiple regression model is statistically significant, and explain what does it means. (5 marks)
- Which, (if any), of the independent variables are statistically significant? Explain your reasoning. What implications do these findings have? (6 marks)
- How much proportion of variation can be explained by the fitted regression model? (3 marks)
- What are the model assumptions and mention appropriate tests to check the validity of assumptions? (8 marks)

(Total- 30 marks)

**Part C: Essay Questions**

1. The manager of a large restaurant in Colombo believes that visitors to the restaurant spend 85 minutes on average in the restaurant on any weekend. To test this belief, the manager conducted a study using a random sample of 16 visitors. Their average spend times at the restaurant were recorded in below table.

66.3	78.8	76.9	80.2	94.2	84.5	97.4	88.9
105.2	86.2	65.3	75.5	66.7	95.5	89.6	101.2

Assuming that the spending time in the restaurant is approximately normally distributed with a population standard deviation is 20 minutes.

- a) Construct the 95% confidence interval for the on average spending time in the restaurant on any weekend. (7 Marks)
- b) Using an appropriate test statistics, test the manager's belief at 5% level of the significance. (8 Marks)
- c) The manager of the restaurant wants to increase the spending time in the restaurant. He has introduced some entertainment events during the weekends. After introducing these entertainment events, again he has selected a random sample of 20 visitors and recorded their spending time. To check whether the introduced entertainment events has increased the average spending time, what would be the suitable test statistics? How do you get the decision? (5 Marks)
- (Total- 20 marks)**
2. A Sri Lankan holiday company has a brochure listing the prices of holidays to certain destinations in continental Sri Lanka. For each of eight destinations (coded as A to H), one holiday is chosen at random from the list, and the length and price are shown in the table. All holidays include accommodation and air travel, and are in hotels of comparable standard.

Destination	A	B	C	D	E	F	G	H
x = length of holiday (days)	8	9	14	8	9	15	13	8
y = price (Rs.) per person	895	1495	1895	1095	945	1575	1495	1095

You are given that:

$\Sigma x = 84$	$\Sigma y = 10490$	$\Sigma x^2 = 944$	$\Sigma y^2 = 14633800$	$\Sigma xy = 116230$
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- a) Draw a scatter diagram showing the relationship between price (y) and length of holiday (x) and comment on what it shows. (3 Marks)

- b) Calculate the Pearson Product-moment correlation coefficient ( $r$ ) and Comment on both the sign and the magnitude of the coefficient. Is ' $r$ ' significant at  $\alpha = 0.05$  and  $p$ -value = 0.012? **(4 Marks)**
- c) Calculate the equation of the regression line of  $y$  on  $x$  and plot the line on your scatter diagram. **(4 Marks)**
- d) Use your equation to estimate the price of a similar holiday lasting 21 days. State, whether this is likely to be a good prediction giving reasons. **(3 Marks)**
- e) Test whether the fitted regression model is statistically significant by constructing ANOVA table with appropriate hypothesis, and explain what does it mean. (SST = 878787 and SSE = 281574) **(5 Marks)**
- f) How much proportion of variation can be explained by the fitted regression model? **(3 Marks)**
- g) What are the model assumptions and mention appropriate tests to check the validity of assumptions? **(4 Marks)**
- (Total- 26 Marks)**

#### Useful Formula

$$1. r = 1 - 6 \sum \frac{d_i^2}{n(n^2-1)}$$

$$2. r = \frac{(\sum_{i=1}^n X_i Y_i - n\bar{X}\bar{Y})}{\sqrt{(\sum_{i=1}^n X_i^2 - n\bar{X}^2)(\sum_{i=1}^n Y_i^2 - n\bar{Y}^2)}}$$

$$3. \beta_1 = \frac{(\sum_{i=1}^n X_i Y_i - n\bar{X}\bar{Y})}{(\sum_{i=1}^n X_i^2 - n\bar{X}^2)}$$

$$4. \beta_0 = \bar{Y} - \beta_1 \bar{X}$$

