

**CMA DECEMBER, 2020 EXAMINATION
 FOUNDATION LEVEL
 SUBJECT: 003. QUANTITATIVE TECHNIQUES**

Time: Three hours

Full Marks: 100

- ❖ Answer any **TEN** questions, FIVE questions from each part.
- ❖ Answer must be brief, relevant, neat and clean.
- ❖ Use **fresh sheet** for answering each question.

PART-A: BUSINESS MATHEMATICS

Q. No. 1

- (a) (i) What is a power set? What is the probability of choosing a single member from a power set of A, having 10 members?
 (ii) When does $n(A \cup B \cup C) = n(A) + n(B) + n(C)$ occur? Display in Venn diagram.
- (b) Out of 880 students in a school, 224 played cricket, 240 played hockey and 336 played basketball; of the total 64 played both basketball and hockey, 80 played cricket and basketball and 40 played cricket and hockey, 24 played all the 3 games. How many did not play any game and how many played only one game?

[Marks: (2+3)+5 = 10]

Q. No. 2

- (a) A company has approximated the marginal revenue function for one of its products by $MR = 20x - 2x^2$. The marginal cost function is approximated by $MC = 81 - 16x + x^2$. Determine the profit – maximizing output.
- (b) If Taka 1000 is deposited in an account each month for 12 years and the account earns 9% compounded monthly, how much will be in the account after the last deposit is made?

[Marks: (5 + 5) = 10]

Q. No. 3

- (a) (i) Find x if $\log_{\frac{1}{2}}[\log_x(\log_4 32)] = 2$
 (ii) Show that $x = \frac{2\sqrt{24}}{\sqrt{2} + \sqrt{3}} = 12\sqrt{2} - 8\sqrt{3}$ and $\frac{x + \sqrt{8}}{x - \sqrt{8}} + \frac{x + \sqrt{12}}{x - \sqrt{12}} = 2$
- (b) How many arrangements can be made with the letters of the word VACCINATION and in how many of them vowels occur together?

[Marks: (2+3)+5 = 10]

Q. No. 4

- (a) For the total cost function $C(x) = 3600 + 100x + 2x^2$ and the total revenue function $R(x) = 500x - 2x^2$, find the number of units that maximizes profit and find the maximum profit.
- (b) Find the inverse matrix of A, where

$$A = \begin{pmatrix} 1 & 2 & 4 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{pmatrix}$$

[Marks: (4+6) = 10]

Q. No. 5

- (a) The 2018 monthly charge in Taka for x kilowatt hours (kWh) of electricity used by a residential customer of Excelsior Electric Membership Corporation during the months of November through June is given by the function

$$C(x) = \begin{cases} 10 + 0.094x & \text{if } 0 \leq x \leq 100 \\ 19.40 + 0.075(x - 100) & \text{if } 100 < x \leq 500 \\ 49.40 + 0.05(x - 500) & \text{if } x > 500 \end{cases}$$

- (i) What is the monthly charge if 1100 kWh of electricity are consumed in a month?
(ii) What is the monthly charge if 450 kWh are consumed in a month?
- (b) Prove that, $\text{Cot}(A+B) = \frac{\text{Cot}A \cdot \text{Cot}B - 1}{\text{Cot}B + \text{Cot}A}$

[Marks: (6+4) = 10]

Q. No. 6

- (a) Find the equation to the straight line which passes through the point of intersection of the straight lines $2x + 3y + 4 = 0$ and $3x + 4y - 5 = 0$ and is perpendicular to the straight line $6x - 7y + 8 = 0$.
- (b) Mr. Mahmood borrowed Tk. 20,000 from a money-lender but he could not repay any amount in a period of 4 years. Accordingly, the money-lender demands now TK: 26,500 from him. At what rate percent per annum compound interest did the latter lend his money?

[Marks: (5+5) = 10]

Q. No. 7

- (a) Find the differential coefficient with respect to x :

(i) $\frac{1 + \cos x}{\sin x}$

(ii) $3\sqrt{x} \sin x$

- (b) Evaluate:

(i) $\int x \sin x \, dx$

(ii) $\int \frac{\cos x}{1 + \sin^2 x} \, dx$

[Marks: (5+5) = 10]

PART-B: BUSINESS STATISTICS

Q. No. 1

- (a) What are the various measures of central tendency? Why are they called measures of central tendency?
 (b) Compute Mean, Median and Mode from the following data:

| Monthly Income(Tk.) | No. of Households |
|---------------------|-------------------|
| 300-500 | 25 |
| 500-700 | 55 |
| 700-900 | 30 |
| 900-1100 | 20 |
| 1100-1300 | 14 |
| 1300-1500 | 6 |

[Marks: (4+6) = 10]

Q. No. 2

- (a) What is questionnaire? Draft a questionnaire containing 12 questions to study the effect of drug addiction among young society of Bangladesh.
 (b) You are given below the following information about advertisement and sales:

| | Adv. Exp. (x) (Tk. Crore) | Sales (y) (Tk. Crore) |
|------|------------------------------|--------------------------|
| Mean | 20 | 120 |
| S.D. | 5 | 25 |

Correlation coefficient 0.8

- (i) Calculate the two regression equations.
 (ii) Find the likely sales when advertisement expenditure is Tk. 25 crore.
 (iii) What should be the advertisement budget if the company wants to attain sales target of Tk. 150 crore?

[Marks: 4+(3x2) = 10]

Q. No. 3

- (a) Explain briefly what is meant by Bar Charts, Pie Charts and Histograms, and describe briefly how they are useful in business analysis. Illustrate also any one of these methods of graphical representation.
 (b) Draw Ogives from the following frequency distribution and hence compute the median of the distribution:

| Profit(Lakhs) | 50-99 | 100-149 | 150-199 | 200-249 | 250-299 | 300-349 |
|-----------------|-------|---------|---------|---------|---------|---------|
| No of Companies | 7 | 12 | 18 | 27 | 20 | 19 |

[Marks: (5+5) = 10]

Q. No. 4

- (a) Explain what do you understand by the mathematical expectation. How is it useful for a businessman? Give an example to illustrate its usefulness.
 (b) The personnel department of a company has records. Which shows the following analysis of its 200 engineers:

| Age (yrs) | Bachelor degree only | Master degree | Total |
|-----------|----------------------|---------------|-------|
| Under 30 | 90 | 10 | 100 |
| 30 to 40 | 20 | 30 | 50 |
| Over 40 | 40 | 10 | 50 |
| Total | 150 | 50 | 200 |

If one engineer is selected at random from the company, find:

- (a) The probability he has only a Bachelor's degree.
 (b) The probability he has a Master degree given that he is over 40.
 (c) The probability he is under 30 given that he has only a Bachelor degree.

[Marks: (4+6) = 10]

Q.No.5

- (a) Define Correlation. Explain with examples of the following concepts:
- (i) Positive correlation
 - (ii) Negative correlation
 - (iii) Zero correlation
- (b) From the following table find correlation coefficient between Income and Expenditure of a wage earner:

| Month | Jan. | Feb. | March | April | May | June | July |
|-------------|------|------|-------|-------|-----|------|------|
| Income | 46 | 54 | 56 | 56 | 58 | 60 | 62 |
| Expenditure | 36 | 40 | 44 | 54 | 42 | 58 | 54 |

Comment on the result.

[Marks: (3+6+1) =10]

Q. No. 6

- (a) Describe the absolute measures of dispersion. Discuss their relative advantages and disadvantages.
- (b) A factory produces two types of electric lamps A and B. In an experiment relating to their life, the following results were obtained:

| Length of Life (in hours) | 500-700 | 700-900 | 900-1100 | 1100-1300 | 1300-1500 |
|---------------------------|---------|---------|----------|-----------|-----------|
| No. of Lamps A | 5 | 11 | 26 | 10 | 8 |
| No. of Lamps B | 4 | 30 | 12 | 8 | 6 |

Compare the variability of the life of the two varieties using Coefficient of Variation.

[Marks: (4+6) = 10]

Q. No. 7

- (i) Probability Sampling and Non-probability Sampling
- (ii) Null Hypothesis and Alternative Hypothesis
- (iii) Type-I error and Type-II error
- (iv) Primary data and Secondary data.
- (v) Statistics and Parameters.

[Marks: (5 x 2) = 10]

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