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Serial No.....

Society of Certified Management Accountants of Sri Lanka

Technician Stage March 2007 Examination

Examination Date : 31st March 2007
Examination Time: 9.30a.m.-11.30a.m.

Number of Pages : 06
Number of Questions: 07

Instructions to the Candidates

1. Time allowed is **two (2)** hours.
2. Answer **any five(5)** questions
3. Answers should be entirely in the **English language**.

Subject	Subject Code
Business Mathematics	(BMT)

Question No. 1 (20 Marks)

- (i) Solve the equation for x
- (a) $\log_2 (2x^2 + 7) - \log_2 (x + 3) = \log_2 3$ (5 Marks)
- (b) $3^{2x} - 4(3^x) + 3 = 0$ (5 Marks)
- (ii) The third term of an arithmetic progression is 60 and its ninth term is 36.
- (a) Find the first term and the common difference of the progression. (5 Marks)
- (b) Find the sum of the first 35 terms of the progression. (5 Marks)
- (Total 20 Marks)

Question No. 2 (20 Marks)

- (i) The equation of a parabola is given by $y = -\frac{1}{2}x^2 - x + 4$
- (a) Find the coordinates of the vertex of the parabola. (3 Marks)
- (b) Find the x and y intercepts of the parabola. (3 Marks)
- (c) Sketch the graph of the parabola. (4 Marks)
- (ii) (a) Find A^{-1} of the following matrix A
- $$A = \begin{pmatrix} 2 & -3 \\ 5 & -8 \end{pmatrix}$$
 (5 Marks)
- (b) Use A^{-1} to solve the following system of equations:
- $2x - 3y = 5x - 8y = 1$ (5 Marks)
- (Total 20 Marks)

Question No. 3 (20 Marks)

- (i) Suppose you borrow Rs. 100,000/- at an annual interest rate known to be compounded semi-annually and 3 years later you pay back a total of Rs. 119,405/-, what nominal interest rate did you pay? **(10 Marks)**
- (ii) Suppose you invest Rs. 20,000/- at 12% annual interest rate compounded continuously,
- (a) How much will the investment be worth in 4 years? **(5 Marks)**
- (b) How long will it take for the investment to become double? **(5 Marks)**
- (Total 20 Marks)**

Question No. 4 (20 Marks)

- (i) A vase contains eight marbles of which 5 are red and 3 are white. You draw 2 marbles from the vase without replacement. Using a tree diagram or otherwise, find the following probabilities.
- (a) Both marbles drawn are white. **(2 Marks)**
- (b) Just one of the marbles drawn is white. **(3 Marks)**
- (c) The second marble drawn is white. **(3 Marks)**
- (ii) If A and B are two events of the same sample space such that $P(A) = 0.28$, $P(B) = 0.36$ and $P(A \cup B) = 0.48$, find the following probabilities.
- (a) $P(A \cap B)$ **(2 Marks)**
- (b) $P(A / B)$ **(2 Marks)**
- (c) $P(A' \cap B')$ **(4 Marks)**
- (d) $P(B' / A')$ **(4 Marks)**
- Where A' and B' are complements of the events A and B respectively.
- (Total 20 Marks)**

Question No. 5 (20 Marks)

- (i) The measurements of a population are given by 4, 3, 0, 1, 5, 7, 3 and 9
- (a) Find the mean of the population **(2 Marks)**
- (b) Find the variance of the population **(5 Marks)**
- (c) Compute the standard deviation of the population **(1 Mark)**
- (d) How many measurements will fall within one standard deviation of the mean? **(2 Marks)**
- (ii) The lifetime of a battery is exponentially distributed with a mean life of 500 hours.
- (a) Sketch the probability distribution. **(4 Marks)**
- (b) Find the probability that a battery will last less than 400 hours **(6 Marks)**
- (Total 20 Marks)**

Question No. 6 (20 Marks)

- (i) A random variable X is normally distributed with an unknown mean μ and a known standard deviation $\sigma = 10$. A sample size $n = 36$ is taken, which yields a sample mean $\bar{X} = 46$

You are required to:

- (a) Test the null hypothesis $H_0 : \mu > 42$ using a significance level of $\alpha = 0.02$ **(8 Marks)**
(b) State your conclusion **(2 Marks)**

- (ii) The following are the test marks for mathematics (x) and statistics (y) obtained by six students.

x	8	7	16	14	15	6
y	18	16	9	15	12	20

- (a) Plot a scatter diagram for the test marks. **(2 Marks)**
(b) Find the equation of the regression line. **(6 Marks)**
(c) Plot the regression line on the scatter diagram. **(2 Marks)**
(Total 20 Marks)

Question No. 7 (20 Marks)

- (i) Sigma company's sales are running at 100 per year. The cost to place an order with Sigma's distributor is Rs.4. Product cost is Rs.80 per item and the annual carrying cost rate is Rs. 0.10. Determine the optimal number of orders per year of Sigma. **(4 Marks)**

- (ii) The constraints of a linear programming problem are given below,

$$1 \leq x + y \leq 6, \quad x + 5y \leq 15, \quad x \geq 0 \text{ and } y \geq 0$$

- (a) Graph the feasible region **(6 Marks)**
(b) Find the maximum value of the objective function $\rho = x + 2y$, subject to these constraints **(2 Marks)**

- (iii) The data for a project are given below.

Activity	A	B	C	D	E	F	G	H	I
Immediate Predecessor	-	-	A	B	A	D, E	D,E	G	C,F,H
Activity Time	3	4	6	4	5	3	1	1	2

- (a) Construct the project network. **(6 Marks)**
(b) Find the critical path or paths. **(2 Marks)**
(Total 20 Marks)

End of Question Paper

List of Formulae

1. Sum to n terms of an arithmetic progression:

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

Where, a = first term
 d = common difference
 n = number of terms
 S_n = sum to n terms

2. Compound Interest Formula:

$$A = P(1 + r)^{mn}$$

Where, P = principle invested
 $r = \frac{i}{100m}$, nominal interest rate
 A = amount accumulated at the end of n years
 m = number of compounding periods
 n = number of years
 i = annual interest rate

3. Continuous Compounding Formula:

$$A = Pe^{rt}$$

Where, $r = i/100$, nominal interest rate
 i = annual interest rate
 P = principle invested
 A = amount accumulated at the end of t years

4. Probability:

$$(i) \quad p(A \cup B) = p(A) + p(B) - p(A \cap B)$$

$$(ii) \quad p(A/B) = \frac{p(A \cap B)}{p(B)}, \text{ Where}$$

A and B are two events of the same sample space.

5. Variance of a population:

$$\sigma^2 = \frac{\sum (x - \mu)^2}{n}$$

Where, σ^2 = variance
 μ = population mean
 n = size of the population
 x = a sample value

6. Exponential Distribution:

$$f(x) = \frac{1}{\mu} e^{-x/\mu}$$

Where, μ = mean
 x = exponential random variable and $P(X \geq x) = e^{-x/\mu}$

7. Z-Statistic for a large sample:

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

Where, \bar{x} = sample mean,
 n = sample size,
 μ = population mean
 σ = population standard deviation.

8. Equation of the Regression Line:

$$Y = \alpha + \beta x$$

Where, $\beta = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2}$, $\alpha = \bar{y} - \beta \bar{x}$

9. Economic Order Quantity:

$$Q = \sqrt{\frac{2DC_o}{C_h}}$$

Where, Q = Economic Order Quantity
 D = Annual Demand
 C_o = Ordering Cost
 C_h = Carrying Cost