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University Examinations 2022/2023

SECOND YEAR, SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR
THE DEGREE OF BACHELOR OF PURCHASING AND SUPPLIES MANAGEMET

SMB 3275: QUANTITATIVE METHODS II

DATE: AUGUST 2023

TIME: 2 HOURS

INSTRUCTIONS: *Answer question one and any other two questions*

QUESTION ONE (30 MARKS)

- a) The total revenue received from the sale of x units of a product is given by
 $R(x) = 12x + 2x^2 + 6$. Find the marginal revenue at $x=50$ (4 marks)
- b) Distinguish between Null and alternative hypothesis (4 marks)
- c) A random sample of 12 items is taken and is found to have a mean weight of 50 grams and a standard deviation of 9 grams. What is the mean weight of population with 95% confidence? (4 marks)
- d) Define the following terms:
- i. Mutually exclusive events (1 mark)
 - ii. Independent events (1 mark)
 - iii. Dependent events (1 mark)
- e) Two manufacturers A and B are competing with each other in a very restricted market. The state-transition matrix for the market summarises the probabilities that customers will move from one manufacturer to the other in any one month



$$\text{From } \begin{matrix} A \\ B \end{matrix} \begin{bmatrix} A & B \\ 0.7 & 0.3 \\ 0.1 & 0.9 \end{bmatrix}$$

Interpret the state transition matrix in terms of

- i. Retention and loss (4 marks)
- ii. Retention and gain (4 marks)
- f) Evaluate the definite integral $\int_0^1 x(x - 4)dx$ (3 marks)
- g) The marginal cost function of manufacturing x units of a product is $mc=5+16x-3x^2$.
The total cost of producing 5 items is sh.500. Find the total cost function (4 marks)

QUESTION TWO (20 MARKS)

Two products A and B currently share the market with shares of 55% and 45% each respectively. Each week some brand switching takes place of those who bought A the previous week, 60% buy it again while 40% switch to B of those who bought B the previous week, 80% buy it again while 20% switch to A

- i. Construct the initial probability transition matrix (T) of the switching probabilities (1 mark)
- ii. Construct the initial market share matrix (ms) (1 mark)
- iii. Find week two market share (3 marks)
- iv. Find week three market share (3 marks)
- v. Predict the market share at equilibrium (12 marks)

QUESTION THREE (20 MARKS)

- a) i. Draw a scatter graph from the following data

Age of husband	30	28	35	25	40	33	42
Age of wife	25	27	33	20	30	20	38

- ii. Indicate whether the correlation is positive or negative (2 marks)



iii. State two merits of this method (2 marks)

b) Calculate the regression equations of x on y and y on x from the following data using the method of least squares (13 marks)

x	1	2	3	4	5
y	2	5	3	8	7

QUESTION FOUR (20 MARKS)

- a) The cost function of a firm is given by $C = 2x^2 + x - 5$. Find
- i. The average cost; when $x = 4$ (5 marks)
 - ii. The marginal cost, when $x = 4$ (3 marks)
- b) The cost function for x units of a product produced and sold by a company is $C(x) = 250 + 0.005x^2$ and the total revenue is given as $R = 4x$. Find how many items should be produced to maximize the profit. What is the maximum profit? (12 marks)

QUESTION FIVE (20 MARKS)

- a) In a sample of 800 candidates, 560 were male. Estimate the population proportion at 95% confidence level (6 marks)
- b) A box contains 5 blue pens and 12 black pens. The pens are wrapped in the same material and same size
- i. If one pen is picked out at random, determine the probability of this pen being blue (1 mark)
 - ii. Find the probability of getting a blue at first selection, retaining it and getting a black pen at the second selection (3 marks)
- c) Given that $Z = 6x^4 - 7y^6 - 5x^2y^2$.

Find

- i. $\frac{\partial z}{\partial x}$ (1marks)
- ii. $\frac{\partial z}{\partial y}$ (1marks)



iii. $\frac{\partial^2 z}{\partial x^2}$ (1mark)

iv. $\frac{\partial^2 z}{\partial y^2}$ (1mark)

d) Find the derivative of:

i. $y = (3x^2 - 4x)^5$ (2 mark)

ii. $y = e^{2x}$ (2mark)

