



MACHAKOS UNIVERSITY

University Examinations for 2016/2017 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ADMINISTRATION

FIRST YEAR FIRST SEMESTER EXAMINATION FOR MASTER OF BUSINESS
ADMINISTRATION

BMS 840: QUANTITATIVE TECHNIQUES

DATE: 4/8/2017

TIME: 10.00-1.00

PM

INSTRUCTIONS

Answer Question ONE and any other TWO Questions

QUESTION ONE(30 MARKS)

- (a) A firm's total revenue is given by the function

$$R = Q^3 - 7.5Q^2 - 18Q + 700$$

- (i) Determine the average revenue when the output Q is 20 units (2 marks)
- (ii) Work out the levels of the output Q at which the total revenue R is maximized. (5 marks)
- (b) The marketing manager of a manufacturing company has established that the current market share for Brand Q is 20%. After six months of an aggressive marketing campaign for the product, market analysis revealed that the chances of Brand Q customers purchasing it again is 0.8 and 0.3 for customers of competing Brands switching to Brand Q. Determine the market share of Brand Q after the six months of aggressive campaign. (6 marks)
- (c) (i) Explain the meaning of the term "hypothesis" and describe the steps followed to test the validity of hypothesis. (4 marks)

(ii) In testing a statistical hypothesis one is likely to commit two types of errors.

State the errors and clearly explain when they are committed (2 marks)

(d) The table below shows the scores awarded to two candidates by a panel of ten people

Candidate A	8	5	8	9	4	8	7	5	6	5
Candidate B	6	6	7	7	5	7	8	4	7	6

Compute the Spearman's rank correlation coefficient for the data (5 marks)

(e) In a production line out of 1000 items produced in a day 20 items were found to be defective. If five items are drawn at random from the daily production work out the probability that the firm will get more than one item will be defective. (5 marks)

QUESTION TWO (20 MARKS)

(a) A supplier of three items has established that, the quantities required by one of the client are related by the 3 systems of linear equations given below.

$$5q_1 + 3q_2 + 6q_3 = 4,900$$

$$8q_1 + 4q_2 + 4q_3 = 5,000$$

$$4q_1 + q_3 = 2,300$$

Work out the values of q_1, q_2 , and q_3 that satisfies the three equations (10 marks)

(b) The production manager of a production firm gave the average cost function of the firm as $AC = \frac{1}{3}Q^2 + Q - 1$ while the revenue director stated the average revenue function of the firm as

$$AR = 1 - \frac{1}{2}Q + \frac{2}{3}Q^2$$

(i) Determine the profit function of the firm (4 marks)

(ii) Work out the levels of Q for which the profit at maximum and minimum (6 marks)

QUESTION THREE (20 MARKS)

(a) An economy is based on three sectors: Electricity, Water and Agriculture. The production of a dollar's worth of Electricity requires an input of 0.15 dollars from the electricity sector and 0.2 dollars from the water sector. The production of a dollar worth of water requires an input of 0.25 dollars from electricity sector and 0.4 dollars from the water

sector while the production of a dollar worth of agriculture requires input of 0.3 dollars from the electricity sector, 0.1 dollars from water sector and 0.4 dollars from the agriculture sector.

- (i) If the Electricity and Agriculture sector each produced a total of 30 and 40 dollars' worth of electricity and agriculture respectively in 2014, determine how many dollars were available for external consumption for each sector after satisfying the internal demand. (3 marks)
 - (ii) Find the output required from each sector to meet an external demand of 200 billion dollars of electricity, 100 billion dollars of water and 300 billion dollars of agriculture. (12 marks)
- (b) Given that $\frac{dC}{dx} = 4x + 21 + x^2$, where C is the total Cost (in millions) incurred in producing x items.
- (i) Work out the marginal cost of producing 20 items (2 marks)
 - (ii) Determine the total cost function for producing x items (3 marks)

QUESTION FOUR (20 MARKS)

- (a) The probabilities of the royal customers of three competing products Colgate (A), Close-up (B) and Aqua fresh (C) remaining in their brands are 0.2, 0.3 and 0.6 respectively. Market research has established that every year Brand A customers transit from A to brand B or C with probabilities 0.3 and 0.5 respectively, those in brand B transit to A or C with probabilities 0.6 and 0.1 respectively while brand C customers move from C to A and B with probabilities 0.3 and 0.1 respectively.
 - (i) Draw a transition diagram for this information (4 marks)
 - (ii) Formulate the transition probability matrix (P) and initial state matrix (S_0) (3 marks)
 - (iii) Market research puts the current market share of the three brands A, B and C at 10%, 25% and 60% respectively. Work the market share of each brand on the third year (8 marks)
- (b) A firm's production function in terms of number of workers (L) is given by

$$Q = 2L^2(3 - 0.1L)$$

Determine the size of the workforce (L) that maximizes output and hence a graph of this production function (5 marks)

QUESTION FIVE (20 MARKS)

Simon plans to spend 450,000 to acquire a second hand car and he knows that the older the car the less its price. In order to make an informed decision he visited a car bazaar and got the following figures.

Car Age in years (x)	4	12	6	16	8	10	5	18	21	14
Cost of the car ('000) (y)	1200	400	840	240	650	700	1050	250	200	420

- (a) With aid of diagram explain the meaning of the statements “*X and Y are positively correlated, X and Z are negatively correlated while Y and Z are No correlated*”(6 marks)
- (b) Workout the Karl Pearson’s correlation coefficient between age and cost of the car. (8 marks)
- (c) (i) Estimate the simple linear regression line of cost of the car on the age of the car. (5 marks)
- (ii) Using the fitted regression line, determine the age of the car Simon should buy with his money. (1 mark)