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Test Papers

MOI UNIVERSITY

OFFICE OF THE CHIEF ACADEMIC OFFICER

UNIVERSITY EXAMINATIONS

2004/2005 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

COURSE CODE: MBA 850

COURSE TITLE: QUANTITATIVE TECHNIQUES

DATE: 9TH SEPTEMBER 2005 **TIME:** 9.00A.M. - 12.00 NOON

INSTRUCTION TO CANDIDATES

- SEE INSIDE.

INSTRUCTIONS:

Answer question one and any other three questions.

QUESTION 1 (21 MARKS)

a) Explain the following terms used in quantitative methods:

(i)	Independent events	1 mark
(ii)	Random experiment	1 mark
(iii)	Marginal cost	1 mark
(iv)	Marginal revenue	1 mark
(v)	Set	1 mark
(vi)	Domain	1 mark
(vii)	Interval estimate	1 mark
(viii)	Poisson distribution	1 mark
(ix)	Producer's surplus	1 mark
(x)	Discrete random variable	1 mark

b) In an organization, the monthly salary (y) of a salesman is determined by the number of items (x) sold per month by the function:

$$y = f(x) = 4x + 55$$

It is noticed that the number of items sold by the salesman depends upon the price charged for the item defined by the following function:

$$X = g(p) = 175 - p$$

Where p is the price in K£

Required:

- (i) Compute the salesman's monthly salary by making use of composite function
3 marks
- (ii) If the selling price of the item is K£ 45, determine the monthly salary of the salesman
2 marks

c) Toyota Kenya Company has established its annual inventory cost function (C) defined by:

$$C = \frac{6912}{q} + 12q + 265,000$$

Where C is stated in K£ and q denotes the batch size of motor vehicles ordered to replenish the supply.

Required:

- i) Determine the batch order size which will minimize annual inventory cost
3 marks

ii) Compute the expected minimum annual inventory cost

1 mark

d) Consider a 2X2 matrix given below

$$A = \begin{pmatrix} -6 & 4 \\ 5 & -2 \end{pmatrix}$$

establish the inverse of (I-A)

2 marks

QUESTION 2 (13 MARKS)

a) Explain briefly how calculus is used to solve problems in business studies

3 marks

b) Wambua and Awiti Company limited manufactures large –scale items. The company has employed a cost accountant Mr. Were who developed two functions to describe the operations at the firm. He found the marginal cost to be $$(92-2q)$ thousands and the marginal revenue to be $$(112 - 2q)$ thousands
Where q is the number of units of output per annum
The fixed costs are \$ 800,000 per annum

Required:

i) Establish the function for total cost

2 marks

ii) Establish the function for total revenue

2 marks

iii) Establish the break even situation for the company

3 marks

iv) Establish the number of units of output that would maximize the total revenue; hence the maximum total revenue.

3 marks

QUESTION 3 (13 MARKS)

a) Demonstrate how Cramer's rule is used to solve a system of linear equations of order three.

2 marks

b) A real situation has been modeled with the help of the following set of simultaneous equations

$$\begin{aligned} x_1 + x_2 + x_3 &= 500 \\ 3x_1 + 2x_2 + 4x_3 &= 1,500 \\ 10x_1 + 8x_2 + 6x_3 &= 3,800 \end{aligned}$$

By first finding the inverse of the coefficient matrix or otherwise, solve the equations

6 marks

- c) Ochieng and Maina marketing consultants surveyed Kenyan Market to study the consumer's switching pattern for 4 bathing soaps. A sample of 2,000 respondents has been chosen, which provided the following information regarding the use of Lux, Geisha, Imperial and Lifebuoy. Out of the consumer's sample: 800 were using Lux, 350 Geisha, 600 Imperial and the rest Lifebuoy. Due to vigorous advertising campaigns, the following switching pattern has been observed. Out of the users of Lux, 50 switched to Geisha, 60 switched to imperial, 30 to life buoy while the rest remained brand loyal. Out of the users of Geisha 250 remained brand-loyal, 40 switched to Lux 35 switched to Imperial and the remaining switched to life buoy. Out of the users of Imperial 45 switched to Lux, 30 switched to Geisha, 25 to life buoy and the rest remained brand loyal. Similarly out of the users of life buoy, 160 remained brand loyal, 15 switched to Lux, 20 switched to Imperial while the rest switched to Geisha.

Required:

- i) Construct the consumer's transition matrix from the given information. **3 marks**
- ii) If the consumer's switching pattern persist, calculate the future share for the four bathing soaps. **2 marks**

QUESTION 4 (13 MARKS)

- a) The transmission system of a model of a specific car has a warranty for 40,000 miles. It is known that the life of such a transmission has a normal distribution with a mean of 72,000 miles and a standard deviation of 12,000 miles.

Required:

- i) What percentage of the transmissions will fail before the end of the warranty period? **2 marks**
- ii) What percentage of the transmissions will be good for more than 100,000 miles? **2 marks**
- iii) What percentage of the transmissions will be good between 60,000 and 84,000 miles? **3 marks**
- b) Experience has shown that 30% of all persons afflicted by a certain illness recover. Africa Pharms Limited has developed a new vaccine and 10 people with the illness were selected at random and injected with the vaccine; 9 recovered shortly thereafter.

Required:

- i) suppose that the vaccine was absolutely worthless, what is the probability that at least 9 out of 10 injected by the vaccine will recover? **3 marks**

- ii) if 200 people with illness were selected at random and injected with the vaccine, what are the expected number, variance and standard deviation of people who recover? (Assume each additional person will also have the same probability of success)

3 marks

QUESTION 5 (13 MARKS)

- a) Define in brief the following terms used in hypothesis testing

- | | | |
|------|-----------------------|--------|
| i) | Type I error | 1 mark |
| ii) | Type II error | 1 mark |
| iii) | Level of significance | 1 mark |
| iv) | Null hypothesis | 1 mark |
| v) | Normal distribution | 1 mark |

- b) A manufacturer of gunpowder has developed a new powder, which was tested 18 shells. The resulting muzzle velocity, in feet per second were as follows:

3005	2925	2935	2965
1995	3005	2937	1905

Using the above results

- i) Determine the point estimates of population mean μ and standard deviation δ .
- ii) Construct a 95% confidence interval to estimate the true average velocity μ for shells of this type. Assume that muzzle velocities are approximately normally distributed.
- iii) The manufacturer claims that the new gunpowder produces an average velocity of no less than 3,000 feet per second. Do the sample data provide sufficient evidence to contradict the manufacturer's claim at the 0.025 level of significance?

3 marks

3 marks

3 marks

QUESTION 6 (13 MARKS)

- a) The weekly amount spent for maintenance and repairs of electrical components in a manufacturing company was observed over a long period of time to be approximately normally distributed with a mean of \$ 400 and a standard deviation of \$ 20.
- i) If \$450 is budgeted for next week, what is the probability that the actual costs will exceed the budgeted amount?
- ii) How much should the company budget for weekly repairs and maintenance in order that the budgeted amount be exceeded with a probability of only 0.1?

2 marks

3 marks

- b) Eleven employees were put under the care of the company nurse because of highcholesterol readings. The nurse lectured them on the dangers of this condition and put them on a new diet. Shown bellow is the cholesterol readings of the 11 employees both before the new diet and one month after use of the diet began.

Employee	Before	After
1	255	197
2	230	225
3	290	215
4	242	215
5	300	240
6	250	235
7	215	190
8	240	230
9	225	200
10	219	203
11	236	223

- i) Construct a 98% confidence interval to estimate the population mean difference of cholesterol readings for people who are involved in this program.
- ii) Test the hypothesis $H_0: D = 0$ against $H_1: D \neq 0$ at $\alpha = 1\%$ level of significance. Assume differences in cholesterol readings are normally distributed in the population.

QUESTION 7 (13 MARKS)

- a) A market research team working with the ministry of Trade and Industry has asked 2,000 consumers if they had purchased three different brands of toothpastes from the supermarket. The following data was gathered:
- 350 had purchased Aqua-fresh (A)
 - 430 had purchased Colgate (C)
 - 300 had purchased Dabur (D)
 - 110 had purchased Both A and C
 - 160 had purchased both A and D
 - 130 had purchased both C and D
 - 50 had purchased all the three brands

Required

- i) Construct a venn diagram that summarizes the results of the survey **5 marks**
- ii) How many consumers purchase only A, only C and only D? **3 marks**
- iii) How many consumers purchased A and C only? **1 mark**
- iv) How many consumers purchased A and D only?

1 mark

v) How many consumers purchased C and D only?

1 mark

vi) How many consumers had not purchased only at the three brands

2 marks