

3806/202
OPERATIONS RESEARCH
July 2011
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
HIGHER DIPLOMA IN BUSINESS MANAGEMENT
MODULE II

OPERATIONS RESEARCH

3 hours

INSTRUCTIONS TO CANDIDATES

This paper consists of SIX questions.
Answer any FIVE questions.
All questions carry equal marks.
Show all your workings.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) Timo Furnitures Ltd makes orders to supply tables and chairs which require material and labour time. To make a table and a chair requires 3 units and 4 units of direct material respectively of which there are 96 units available in a week. To make a table or a chair each requires 6 hours and there are 168 labour hours available in a week. Where as the market demand for tables is unlimited, only 18 chairs can be sold weekly. The price per table and chair are Sh500 and Sh600 respectively. The unit variable cost for table and chair are Sh380 and Sh400 respectively.
- (i) Formulate
- I. the linear programming model
- II. the dual linear programming model.
- (ii) Set-up the initial tableau. (12 marks)
- (b) Explain each of the following terms as used in Markov analysis.
- (i) closed state
- (ii) transition matrix
- (iii) stochastic process
- (iv) steady state (8 marks)
2. (a) The demand function of a firm is $P = 12 - 3\frac{1}{2}Q$ and the average total cost function is $3 - \frac{1}{2}Q$ where Q = quantity and P = price in shilling.
- Determine the:
- (i) Quantity that maximizes profits;
- (ii) Maximum profits;
- (iii) Price that maximizes profits. (10 marks)
- (b) Explain five areas in which simulation may be applied in a business. (10 marks)
3. (a) An economy consists of three sectors A, B and C. The following table shows input and output of each sector:

INPUT ('000' TONS)

OUTPUT '000' TONS	A	B	C	FINAL DEMAND	TOTAL OUTPUT
A	30	20	20	50	120
B	50	40	30	70	190
C	20	20	40	90	170

The final demand changed to 90, 130 and 70 thousand tons for A, B and C respectively.

Calculate the new total output for each sector. (12 marks)

(b) Explain four benefits that an organization may derive from quality customer service. (8 marks)

4. (a) Three supermarkets; Tallys, Nallys and Timlys daily demands for milk are 700 litres, 900 litres and 1,800 litres respectively. The milk is procured from four towns: Kikuyu, Kiambu, Thika and Narok. Kikuyu can supply 500 litres, Kiambu 800 litres, Thika 700 litres and Narok 1,400 litres.

The company's transportation costs per trip are given in the table below in thousands of shillings.

SUPERMARKET \ TOWN	TALLYS	NALLYS	TIMLYS
Kikuyu	2	7	4
Kiambu	3	3	1
Thika	5	4	7
Narok	1	6	2

- (i) Using the North-West corner rule, advise the management on the most economical distribution route to use. (12 marks)
- (ii) Determine the expected minimum cost of transportation. (12 marks)
- (b) A dentist in a clinic can serve an average of 4 patients per hour. 3 patients arrive at the clinic every hour. Determine the:
- (i) Proportion of time the dentist is idle;
 - (ii) Probability that a patient receives immediate attention upon arrival;
 - (iii) Average number of patients in the queuing system;
 - (iv) Average time a patient spends in the queuing system. (8 marks)

5. (a) Mary, a wholesaler, buys tomatoes at Sh.200 per box and sells them for Sh.500 per box. The tomatoes are highly perishable and any unsold quantity must be thrown away at the end of the day. Her sales for the past 100 days are given below:

Daily sales (boxes)	10	11	12	13
Number of days	15	20	40	25

Advise Mary on the optimum number of boxes she should stock at the beginning of each day.

(12 marks)

- (b) Explain the following terms as used in network analysis:

- (i) optimistic time
- (ii) forward pass
- (iii) critical path activities
- (iv) crashing.

(8 marks)

6. (a) The expected completion time of a project is 35 weeks and the variance of the project is 6.69 weeks. The project can be completed in less than 30 weeks and it will cost Sh1.0 million. If the project is completed between 30 and 35 weeks, it will cost Sh1.2 million and if it takes more than 35 weeks, it will cost Sh1.5 million. Calculate the expected cost of the project on completion.

(12 marks)

- (b) Explain four costs that may arise from selecting an inappropriate technique of production.

(8 marks)