UNIVERSITY OF KELANIYA – SRI LANKA

Centre for Distance and Continuing Education

Faculty of Commerce & Management Studies

Bachelor of Commerce (Special) Degree Third Year Examination (External) – 2021
August – 2024

BCOM E 3055 - Operations Research

No. of Questions : Five (05)   **Time: 03 hours**
Answer all questions.

Question No. 01

a). Explain the importance of operations research modeling for business decision making with few examples.

(04 Marks)

b). A manufacturing company uses a specific component in its production process with an annual demand of 24,000 units. The ordering cost is Rs:3000 per order, and the holding cost is Rs: 1200 per unit per year. Calculate the EOQ for the component and determine the total annual inventory cost if the company follows the EOQ model.

(04 Marks)

c). A bookstore sells a popular novel and has an annual demand of 12,000 copies. The cost to place an order is Rs: 950, and the holding cost per copy per year is Rs: 2.50. What is the optimal order quantity (EOQ) for the bookstore, and how many orders should be placed each year?

(04 Marks)

d). Nisal company manufactures two products, and all related details are as follows. Calculate the optimal solution for maximum profit using the graphical method.

$$\text{MAX } Z = 50x_1 + 40x_2$$
subject to;
$$20\,x_1 + 10\,x_2 \le 1000$$
$$10\,x_1 + 10\,x_2 \le 800$$
$$20\,x_2 \ge 400$$
$$10\,x_1 \qquad \ge 200$$
and $x_1, x_2 \ge 0$;

(08 Marks)
(Total 20 Marks)

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Question No. 02

a). Explain the importance of linear programming with a few relevant examples.

(04 Marks)

b). The following table shows details regarding manufacturing of three products using three types of resources. Calculate the number of units to be produced in order to maximize the profit.

Resources	Product 1	Product 2	Product 3	Resources (Quantity)
Labor (hrs)	7	8	9	4000
Material (Kg)	8	12	10	2500
Machine time (hrs)	11	8	9	1800
Profit (Rs:)	45	62	54	

(16 Marks)

(Total 20 Marks)

Question No. 03

a). Explain the basic characteristics of a Project.

(05 Marks)

b). You are a Project Manager of the following scheduled construction project of XYZ Construction Company. The time estimates obtained for each activity of the project in the table given below.

Activity	Immed. Predec.	Optimistic (Days)	Most Likely (Days)	Pessimistic (Days)
A	....	3	6	9
B	....	3	4	11
C	....	2	4	6
D	A	1	6	11
E	C	8	10	18
F	C	1	10	13
G	B,D,F	3	6	15
H	E	5	12	19
I	G	8	15	16

i. Draw a Network Diagram with representing arrows as activities and relationships.

(08 Marks)

ii. Identify the all the paths with highlighting critical path(s)

(03 Marks)

iii. If you are informed Activity **B** gets its maximum time to finish because of the unavoidable circumstances what will be the effect on project time or diagram?

(04 Marks)

(Total 20 Marks)

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Question No. 04

a). Explain the importance of transportation modeling to the field of operations research.

(04 Marks)

b). Discuss why assignment modeling is important in the labor-oriented manufacturing fields?

(04 Marks)

c). FR Ltd has four factories supplying products to four warehouses. Each shop has a specific production capacity and each warehouse has a certain amount of requirement. The unit transportation costs are given below:

Factories	Warehouses				Supply
	A	B	C	D	
P	2	9	12	10	1600
Q	8	4	10	6	1400
R	5	8	15	9	1000
Demand	1700	800	1300	200	4000

Determine an initial basic solution to the above transportation problem using above details

i). North-west corner method

ii). Least cost method

iii). Vogal's approximation method

(12 Marks)

(Total 20 marks)

Question No. 05

a). A small business owner is considering whether to launch a new product. The decision depends on the potential market demand, which could be either "High" or "Low." The owner can either conduct a market research study or directly launch the product without research.

The costs and payoffs associated with each decision are summarized below:

Decision	Market Condition	Payoff/Cost (Rs)
Conduct Market Research	High Demand	10,000 (cost)
Conduct Market Research	Low Demand	10,000 (cost)
Launch Product (after research)	High Demand	100,000 (profit)
Launch Product (after research)	Low Demand	20,000 (profit)
Do Not Launch (after research)	Any Demand	0
Launch Product Without Research	High Demand	90,000 (profit)
Launch Product Without Research	Low Demand	10,000 (profit)
Do Nothing	Any Demand	0

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The probability of high demand is estimated at 0.7, and the probability of low demand is 0.3.

    i). Construct a decision tree to represent the decision-making process.

    ii). Calculate the expected monetary value (EMV) for each decision branch.

    iii). Determine the optimal decision for the business owner based on the decision tree analysis.

<div align="right">(08 Marks)</div>

b) A project manager at a technology company needs to decide how many high-performance servers to purchase for a new data processing service. The manager is considering two alternatives: purchase one server now or purchase two servers simultaneously. If only one server is purchased and demand exceeds the server's capacity, an additional server can be purchased later. However, purchasing two servers at the same time would reduce the cost per server.

The estimated probability of low demand is 0.40, and the estimated probability of high demand is 0.60.

- If two servers are purchased initially, the net present value (NPV) is Rs:50,000 if demand is low and Rs:120,000 if demand is high.

- If one server is purchased and demand is low, the NPV is Rs:80,000.

- If one server is purchased and demand is high, the manager has three options:

    i). Do nothing, with an NPV of Rs:80,000.

    ii). Outsource part of the work, with an NPV of Rs:100,000.

    iii). Purchase a second server, with an NPV of Rs:95,000.

How many servers should the manager purchase initially? Use a decision tree to analyze this problem.

<div align="right">(12 Marks)</div>

<div align="right">**(Total 20 Marks)**</div>