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) – 2022

March 2025

BCOM E3055 – Operations Research

No. of questions: five (05) **Time: 03 hours**

Answer all the questions

Question Number 01

a) i. Define Operations Research

ii. Explain the steps to solve a problem of Operations Research.

(04 Marks)

b) A sports equipment manufacturing company uses rubber and fiber to produce tennis balls and soccer balls. The amount of material required for these products is as follows: One tennis ball requires 400 grams of rubber and 150 grams of fiber. One soccer ball requires 500 grams of rubber and 300 grams of fiber. The company has only 40kg of rubber and 30kg of fiber. One tennis ball for the company is Rs. 80, and one soccer ball for Rs. 150 is expected to be a profit. Using the graphing method, calculate the number of tennis balls and soccer balls that should be produced to maximize profit.

(08 Marks)

c) Calculate the optimal solution using the information given below with a maximization objective.

MAX Z = $1170x1 + 1110x2$

subject to

$9x1 + 5x2 \geq 500$

$7x1 + 9x2 \geq 300$

$5x1 + 3x2 \leq 1500$

$7x1 + 9x2 \leq 1900$

$2x1 + 4x2 \leq 1000$

and $x1, x2 \geq 0$;

(08 Marks)
(Total 20 marks)

Question number 02

a) Define what linear programming is and briefly explain its uses.

(04 Marks)

b) The table below shows the details of the production of three products using three types of resources. Calculate the number of units to be produced to maximize profit using the Simplex Method.

Resources	Product 01	Product 02	Product 03	Resource (Quantity)
Labor (hr)	2	3	6	1780
Materials (Kg)	3	2	5	2150
Machine Hours (hr)	3	2	4	3320
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(16 Marks)

(Total 20 Marks)

Question Number 03

a) Discuss the problems and applications that can be analyzed by network line connectivity.

(05 Marks)

b) You are the project manager of the following scheduled construction project for LMN Construction Company. The management of the company is seeking your suggestions for the following situations as the client is not happy with the critical timing of this project. The time estimates obtained for each activity of the project are given in the table below.

Activities	Immediate Predecessor	Minimum time (Weeks)	Most Probably (Weeks)	Maximum time (Weeks)
A	....	2	5	8
B	....	3	6	9
C	A	4	5	6
D	B,C	2	3	10
E	A	8	10	24
F	E	2	9	10
G	D	1	3	11
H	F	3	12	15
I	G,H	8	15	16
J	I	2	4	12
K	J	1	8	9

i. Draw a network diagram with arrows representing activities and connections.

(08 Marks)

ii. Identify all paths highlighting Critical Path(s).

(02 Marks)

iii. Find the timings of all routes

(02 Marks)

iv. If activities E and G take minimum time to complete due to unavoidable circumstances, what is the effect on the project time or schedule?

(03 Marks)

(Total 20 Marks)

Question Number 04

a) Explain the use cases of Transportation Problem giving examples.

(05 Marks)

b) LMG Limited has four factories supplying product to four stores. Each store has specific production capacity and each store has specific requirements. The relevant details are given below:

Factories	Stores				Supply (Units)
	L	M	N	P	
G	7	3	2	7	1200
H	5	5	6	1	500
L	5	3	8	9	2000
M	4	2	5	6	1000
Demand (Units)	1700	500	1300	1200	4700

Determine a basic solution to the above transportation problem using the following methods.

i. North west coner rule
ii. Minimum cost method
iii. Vogel's Approximation method

(15 Marks)

(Total 20 Marks)

Question Number 05

a) Explain with a suitable example how the construction of a decision tree is important to easily identify the relationship between alternatives and select the best alternative.

(04 Marks)

b) A factory orders a basic raw material with a demand of 30,000 units per year. The cost per order is Rs: 2.,500 and the annual cost of holding one unit is Rs: 1,500.

a. Calculate the EOQ (Economic Order Quantity).
b. Calculate the total annual inventory cost if the company follows the EOQ model.

(04 Marks)

c) A small hotel owner is discussing whether to introduce a new food menu. The decision depends on the responses of "high" or "low" customers. He can conduct a customer investigation or introduce the new menu without an investigation.

Decisions and associated costs/benefits (Rs.):

Decision	Customer Responds	Cost/Return (Rs:)
Customer investigation	High Responds	15,000 (cost)
Customer investigation	Low Responds	15,000 (cost))
Introduction of new menu (after investigation)	High Responds	120,000 (Benefits)
Introduction of new menu (after investigation)	Low Responds	25,000 (Benefits)
Not introducing new menu (after investigation)	Any Responds	0
Introduction of new menu (without review)	High Responds	100,000 (Benefits)
Introduction of new menu (without review)	Low Responds	15,000 (Benefits)
doing nothing	Any Responds	0

Probability of receiving high response 0.6
The probability of receiving the lower response is 0.4
Following are the problems:

1. Build a decision tree.
2. Calculate expected monetary value (EMV).
3. Suggest the best decision to the businessman.

(12 Marks)
(Total 20 Marks)