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) – 2019

July – 2025

BCOM E 3035 - Operations Research

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

Answer all questions

Question No. 01

a) Define Operations Research and Provide relevant examples.

(04 Marks)

b) A bakery uses flour and sugar to make cookies and cakes. The ingredients required are as follows: One batch of cookies requires 2 kg of flour and 1 kg of sugar. One cake requires 3 kg of flour and 2 kg of sugar. The bakery has 60 kg of flour and 40 kg of sugar available daily. The profit from one batch of cookies is Rs. 120, and from one cake is Rs. 180. Using the graphing method, find the number of cookie batches and cakes that should be produced to maximize daily profit.

(08 Marks)

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

MAX $Z = 850\ x_1 + 920\ x_2$

subject to

$6\ x_1 + 4\ x_2 \geq 240$

$5\ x_1 + 8\ x_2 \geq 400$

$3\ x_1 + 2\ x_2 \leq 600$

$4\ x_1 + 7\ x_2 \leq 840$

$x_1 + 3\ x_2 \leq 450$

and $x_1, x_2 \geq 0$

(08 Marks)

(Total 20 marks)

Question No. 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)	10	10	12	3850
Materials (Kg)	8	8	9	8280
Machine Hours (hr)	10	9	11	7920
Profit (Rs)	40	48	52	

(16 Marks)

(Total 20 Marks)

Question No. 03

a) Examine the various problems and real-world applications that can be solved using network shortest path algorithms.

(05 Marks)

b) You are a project manager for the following scheduled construction project of XYZ 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	Optimistic (Weeks)	Most Probably (Weeks)	Pessimistic (Weeks)
A	....	2	5	8
B	....	3	6	9
C	B	4	5	6
D	A,B	2	3	10
E	C	8	10	24
F	A	2	9	10
G	D,E	1	3	11
H	F,G	3	12	15
I	H	8	15	16
J	G	2	4	12
K	I,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 No. 04

a) Explain the use cases of the assignment problem , giving examples.

(05 Marks)

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

Factories	Stores				Supply (Units)
	L	M	N	P	
G	10	3	2	7	1200
H	7	9	6	1	1500
L	5	8	8	9	2000
M	4	3	5	2	2000
Demand (Units)	1700	1500	1300	2200	6700

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

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

(15 Marks)

(Total 20 Marks)

Question No. 05

a) Explain with a suitable example how constructing of a decision tree is essential for evaluating investment alternatives under uncertainty and selecting the optimal investment strategy.

(04 Marks)

b) A factory orders a basic raw material with a demand of 40,000 units per year. The cost per order is Rs: 3,500 , and the annual cost of holding one unit is Rs: 1,800.

i. Calculate the EOQ (Economic Order Quantity).

ii. 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:)**
Consumer survey	High acceptance	20,000 (cost)
Consumer survey	Low acceptance	20,000 (cost)
Launch product (after survey)	High acceptance	140,000 (profit)
Launch product (after survey)	Low acceptance	35,000 (profit)
Not launching (after survey)	Any acceptance	0
Launch product (without survey)	High acceptance	110,000 (profit)
Launch product (without survey)	Low acceptance	25,000 (profit)
No action	Any acceptance	0

Probability of receiving high response 0.6

The probability of receiving the lower response is 0.4

Following are the problems:

i. Build a decision tree.

ii. Calculate expected monetary value (EMV).

iii. Suggest the best decision to the businessman.

(12 Marks)

(Total 20 Marks)