UNIVERSITY OF RUHUNA

FACULTY OF MANAGEMENT AND FINANCE

Bachelor of Business Administration Degree Programme 2000 Level Semester I Examination (November/December 2021)

BBA 2104 – OPERATIONS RESEARCH (Old Syllabus)　　　　**Duration: Three hours**

The question paper contains six (06) questions.

Instructions:

- **Answer for five (05) questions**
- **Non-programmable calculators are permitted**

QUESTION ONE

I. Briefly explain the phases of operations research study.

(03 Marks)

II. Convert the following linear programming model into standard form of simplex method.

Minimize $Z = 2X_1 + 4X_2 + X_3$
Subject to,
$$X_1 - 2X_2 - X_3 \leq 5$$
$$2X_1 - X_2 + 2X_3 = 2$$
$$-X_1 + 2X_2 + 2X_3 \geq 1$$
$$X_1, X_2, X_3 \geq 0$$

(03 Marks)

III. The XYZ company is a producer of television sets and radios for many years. The company has just expanded into full scale production and marketing of AM and AM – FM radios. It has built a new plant that can operate 48 hours per week. Production of AM radio in the new plant will require 2 hours and production of AM – FM radio will require 3 hours. Each AM radio will contribute Rs. 4000 to profit while AM- FM radio will contribute Rs. 8000 to profit. The marketing department determines that a maximum of 15 AM radios and 10 AM–FM radios can be sold each week.

Formulate linear programming model and solve the problem using the graphical method.

(08 Marks)
(Total 14 Marks)

QUESTION TWO

I. Distinguish between balanced and unbalanced transportation problems.

(02 Marks)

II. Briefly explain two special cases of transportation problems.

(02 Marks)

III. Techno company Ltd has three production plants and five distribution centers in five different cities. The following table shows transportation cost from each plant to each distribution center.

Plant	Distribution centers				
	A	B	C	D	E
Plant 1	2	2	6	10	5
Plant 2	10	8	9	4	7
Plant 3	5	1	4	5	8

The production capacity of three plants is 140, 95, 160 units respectively. The five distribution centers require 74, 94, 69, 39 and 119 units respectively.

Find the most optimal distribution schedule for the company.

(Hint: Use Vogel's Approximation Method and Modified Distribution Method)

(10 marks)
(Total 14 Marks)

QUESTION THREE

I. Define following terms in relation to network analysis.

a) Predecessor activity

b) Successor activity

c) Concurrent activity

d) Dummy activity

(04 Marks)

II. What is the difference between critical and non-critical activities in a network analysis?

(02 Marks)

III. The following table shows information related to a new product development project in a company.

Activity	Duration (weeks)
1-2	8
1-3	7
1-5	12
2-3	4
2-4	10
3-4	3
3-5	5
3-6	10
4-6	7
5-6	4

You are required to,

a) Develop a network diagram.

b) Determine the critical path.

c) Calculate total slack time and free slack time of each activity.

(08 Marks)

(Total 14 Marks)

QUESTION FOUR

I. What is the assignment problem? Explain with examples.

(02 Marks)

II. Briefly explain "Large M" method in assignment problem.

(02 Marks)

III. A company is expecting to allocate their newly purchased four trucks 1,2,3 and 4 to vacant districts A, B, C, D, E and F. So that distance travelled is minimized. The following matrix shows the distance to each vacant district in miles.

	Districts			
Trucks	A	B	C	D
1	4	8	4	7
2	2	7	9	5
3	3	5	6	4
4	3	5	9	8

Decide the optimal allocation of trucks to each vacant district using Hungarian Method.

(10 Marks)

(Total 14 Marks)

QUESTION FIVE

I. Distinguish dynamic programming and linear programming.

(04 Marks)

II. Miyami Cargo Company is planning to transport four types of goods to its foreign customers. As per the recent agreement with an airline, the company can utilize only 7 tons in the flight storage capacity. The following table shows number of tons to be transport from each category of goods and the respective return.

Type of goods	Unit Weight (Tons)	Return per unit (Rs. Mn.)
A	2	20
B	1	8
C	4	42
D	3	28

Using dynamic programming, find the optimal transportation plan to use the full capacity of the flight and maximum return that the company can earn.

(10 Marks)
(Total 14 Marks)

QUESTION SIX

I.   Briefly explain the decision theory elements.

(03 marks)

II.   ODEL company has acquired a textile company and contemplating the future at one of its major plants located in Koggala. Three alternative decisions are being considered.
  a) Expand the plant
  b) Maintain the status quo at the plant
  c) Sell the plant now

The return that can be earned in these different alternative decisions will depends on foreign demand conditions. The following payoff table describes this decision situations.

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Decision	Foreign competitive conditions	
	Good	Poor
Expand	Rs. 800,000	Rs. 500,000
Maintain status quo	Rs. 1300,000	Rs. -150,000
Sell now	Rs. 320,000	Rs. 320,000

Determine the best decision by using following decision criteria assuming that the decision is taken under uncertainty.

a) Maximax
b) Maximin
c) Minimax regret
d) Hurwicz ($\alpha = 0.7$)
e) Laplace

(08 marks)

III. Determine the best decision by using expected value for perfect information if the probability of good foreign competitive condition is 0.7 and the probability of poor competitive condition is 0.3.

(03 marks)
(Total marks 14)

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