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[Graph Paper]

B.Sc. (Hons.) 5th Semester Examination.

December–2022

MATH

Paper–BHM-356

Operations Research

Time allowed : 3 hours] *[Maximum marks : 60*

Note : *Attempt* ***five*** *questions in all, selecting one question from each section.* ***Question*** *No. 9 is* ***compulsory.***

Section–I (6+6=12)

1. (a) How can operations Research models be classified ? What is the best classification in terms of learning and understanding the fundamentals of O.R. ?

(b) A cold drinks company has two bottling plants, located at two different places. Each plant produces three different drinks A, B and C. The

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capacities of two plants, in number of bottles per day are as follows :

	Product A	Product B	Product C
Plant I :	3,000	1,000	2,000
Plant II :	1,000	1,000	6,000

A market survey indicates that during any particular month there will be a demand of 24,000 bottles of A; 16000 bottles as B;, and 48000 bottles of C. The operating costs, per day, of running plants I and II are respectively 600 monetary units and 400 monetary units. How many days should the company run each plant during the month so that the production cost is minimised, while still meeting the market demand ? Formulate the L.P.P.

2. (a) Use the graphical method to solve the following L.P.P. Minimize $Z = -x_1 + 2x_2$: subject to the constraints : $-x_1 + 3x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$ and $x_1, x_2 \geq 0$.

(b) Find the maximum value of $x_1 + 2x_2$ subject to the constraents :

$x_1 - x_2 \leq 1$, $x_1 + x_2 \geq 3$ and $x_1 \geq 0$, $x_2 \geq 0$

Section–II (12 Marks)

3. (a) Use Simplex method to

Minimize $Z = x_2 - 3x_3 + 2x_5$ subject to the constraints :

$3x_2 - x_3 + 2x_5 \leq 7$, $-2x_2 + 4x_3 \leq 12$, $-4x_2 + 3x_3 + 8x_5 \leq 10$, $x_2 \geq 0$, $x_3 \geq 0$ and $x_5 \geq 0$.

(b) Use two phase Simplex method to

Maximize $Z = 3x_1 - x_2$ subject to the constraints :

$2x_1 + x_2 \geq 2$, $x_1 + 3x_2 \leq 2$, $x_2 \leq 4$; $x_1 \geq 0$, $x_2 \geq 0$.

4. (a) Explain the Big-M method for solving a L.P.P.

(b) Solve the following L.P.P.

Maximize $Z = x_1 + 1.5x_2 + 2x_3 + 5x_4$ subject to the constraints :

$3x_1 + 2x_2 + 4x_3 + x_4 \leq 6$, $2x_1 + x_2 + x_3 + 5x_4 \leq 4$

$2x_1 + 6x_2 - 8x_3 + 4x_4 = 0$, $x_1 + 3x_2 - 4x_3 + 3x_4 = 0$

$x_1, x_2, x_3, x_4 \geq 0$.

Section–III (12 Marks)

5. (a) Use duality to solve the following L.P.P.

Maximize $Z = 2x_1 + x_2$ subject to the constraints

$x_1 + 2x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$, $x_1 - 2x_2 \leq 1$, $x_1, x_2 \geq 0$

(b) Obtain an initial basic feasible solution to the following T.P. using least-cost method or Matrix

minima method :

	D_1	D_2	D_3	D_4	Capacity
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

Where O_i and D_j denote i^{th} origin and j^{th} destination respectively.

6. (a) Solve the following transportation problem

Origin	Destination				
	D_1	D_2	D_3	D_4	Availability
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
Requirement	20	40	30	10	

(b) What is a transhipment problem ? Explain how a transhipment problem can be formulated and solved as a transportation problem ?

Section–IV (12 Marks)

7. (a) Explain Hungarian algorithm.

(b) Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows :

		Job				
		1	2	3	4	5
Person	A	8	4	2	6	1
	B	0	9	5	5	4
	C	3	8	9	2	6
	D	4	3	1	0	3
	E	9	5	8	9	5

8. (a) How can a two-person, zero sum game' problem be converted upto a L.P.P. ? Illustrate with an example.

(b) Solve the following game

Player B

$$\text{Player A} \quad \begin{pmatrix} 1 & -1 & 3 \\ 3 & 5 & -3 \\ 6 & 2 & -2 \end{pmatrix}$$

Compulsory Question

9. (a) Games which involve more than two players are called _____

(b) Write a short note on Travelling Salesman Problem.

(c) Explain "Degenerate Transportation Problem".

(d) Write down the dual of the L.P.P.

Minimize $Z = 2x_1 + 9x_2 + x_3$ subject to the constraints $x_1 + 4x_2 + 2x_3 \geq 5$, $3x_1 + x_2 + 2x_3 \geq 4$ and $x_1, x_2, x_3 \geq 0$.

(e) What are the limitations of O.R. ?

(f) Reduce the following L.P.P. to its standard form

Max $Z = x_1 - 3x_2$ subject to the constraints $-x_1 + 2x_2 \leq 15$, $x_1 + 3x_2 = 10$, x_1 and x_2 unrestricted in sign.

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