Seat No. : _______________

MT-134

March-2019

T.Y. M.B.A. Integrated, Sem.-VI

Operations Research

Time : 2:30 Hours] **[Max. Marks : 70**

Note : Log and statistical tables will be provided on demand and use of non-programmable scientific calculator is permitted.

1. (a) Define linear programming problem. Mention its uses. **6**

(b) Solve the following graphically : (any **one**) **8**

(1) Minimize $Z = x_1 + x_2$ under the following constraints, where $x_1, x_2 \geq 0$.

$5x_1 + 10x_2 \leq 50$

$x_1 + x_2 \geq 1$

$x_2 \leq 4$

(2) Two types of hens are kept in a poultry farm. Type A hen costs ₹ 20 each and Type B hen costs ₹ 30 each. Type A hen lays 4 eggs per week and Type B hen lays 6 eggs per week. At the most, 40 hens can be kept in the poultry farm. Not more than ₹ 1050 is to be spent on the hens. How many hens of each type should be purchased to get maximum eggs ?

2. Solve the following : (any **two**) **14**

(1) Solve the following LPP by simplex method.

Maximize $Z = 2x_1 + 4x_2 + x_3$ subject to the following constraints,

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

$x_1 + 2x_2 \leq 4$

$2x_1 + x_2 \leq 3$

$x_2 + 4x_3 \leq 3$

(2) Solve the following LPP by Big M method.

Minimize $Z = 12x + 20y$ subject to the following constraints,

where $x, y \geq 0$.

$6x + 8y \geq 100$

$7x + 12y \geq 120$

(3) Solve the following LPP by simplex method. Also show that the problem has multiple solution.

Maximize $Z = 6x_1 + 2x_2 + 4x_3$ subject to the following constraints,

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

$2x_1 + 3x_2 + x_3 \leq 28$

$3x_1 + x_2 + 2x_3 \leq 24$

$x_1 + 2x_2 + 3x_3 \leq 35$

3. (a) Define dual LPP. Explain dual primal relationship in general. **6**

(b) Solve the following : (any **one**) **8**

1. Obtain the dual of maximize $Z = 3x_1 + 4x_2$ subject to the following constraints, where $x_1, x_2, \geq 0$.

   $2x_1 + 3x_2 \leq 16$

   $5x_1 + 2x_2 \geq 20$

2. Solve the following LPP.

   Maximize $Z = 4x_1 + 6x_2 + 2x_3$ subject to the following constraints,

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

   $x_1 + x_2 + x_3 \leq 3$

   $x_1 + 4x_2 + 7x_3 \leq 9$

   Find the optimal product mix and the corresponding profit of the company. Also find the range of profit contribution of product coefficient c_3 of variable x_3 in the objective function such that current optimal product mix remains unchanged.

4. (a) Solve the following : (any **one**) **6**

1. Obtain initial basic feasible by North West Corner Rule.

Origins	**Destinations**				
	P	**Q**	**R**	**S**	**Supply**
A	7	5	2	6	13
B	9	10	3	8	17
C	5	4	7	3	5
Requirement	5	11	15	4	35

2. Obtain initial basic feasible by Matrix Minima Method.

Origins	**Destinations**			
	D	**E**	**F**	**Supply**
A	60	40	240	3
B	100	65	180	5
C	260	210	60	6
Demand	6	4	4	14

(b) Solve the following : (any **one**) **8**

1. Obtain optimal solution using MODI method.

	$\mathbf{D_1}$	$\mathbf{D_2}$	$\mathbf{D_3}$	$\mathbf{D_4}$	**Supply**
$\mathbf{S_1}$	19	30	50	10	7
$\mathbf{S_2}$	70	30	40	60	9
$\mathbf{S_3}$	40	8	70	20	18
Demand	5	8	7	14	34

2. The number of units available at factories X and Y are 200 and 300 respectively. The units demanded at retail stores A, B and C are 100, 150 and 250 respectively. Investigate the possibility of trans-shipment. The transportation cost in rupees per unit is given in the following table. Find the optimal shipping schedule.

	Factory X	Factory Y	Retail Store A	B	C
Factory X	0	8	7	8	9
Y	6	0	5	4	3
Retail Store					
A	7	2	0	5	1
B	1	5	1	0	4
C	8	9	7	8	0

5. (a) What is assignment problem ? State the similarities and differences between assignment problem and transportation problem. **6**

(b) Solve the following : (any **one**) **8**

1. Solve the following assignment problem and explain how the jobs be allocated, one per employee, so as to minimize the total man – hours ?

		Employees				
		I	**II**	**III**	**IV**	**V**
	A	10	5	13	15	16
Jobs	**B**	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

2. What should be the sequence of visit of the salesman from city to city so that the cost is minimum for the given problem ?

		To City				
		A	**B**	**C**	**D**	**E**
	A	∞	2	5	7	1
From City	**B**	6	∞	3	8	2
	C	8	7	∞	4	7
	D	12	4	6	∞	5
	E	1	3	2	8	∞