53 (IE 811) OPRE

2013

(December)

OPERATION RESEARCH

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Discuss briefly about the scope of Operation Research. Write down the applications of various Operation Research techniques. 5+5=10

(b) Given the following information : 3+4+3=10

Activity	Duration
0-1	2
1-2	8
1-3	10
2-4	6
2-5	3
3-4	3
3-6	7
4-7	5
5-7	2
6-7	8

(i) Draw the project diagram.

(ii) Identify critical path and find the total project duration.

(iii) Determine total, free and independent floats.

2. *(a)* What are the conditions for the occurrence of degeneracy in a L.P.P. ? Check for degeneracy of the following problem : 2+8=10

Maximize $Z = 2x_1 + 3x_2 + 10x_3$

subject to $x_1 + 2x_3 = 0$

$x_2 + x_3 = 1$

$x_1, x_2, x_3 \geq 0$

(b) Solve the assignment problem represented by the following matrix : 10

	I	*II*	*III*	*IV*	*V*	*VI*
A	9	22	58	11	19	27
B	43	78	72	50	63	48
C	41	28	91	37	45	33
D	74	42	27	49	39	32
E	36	11	57	22	25	18
F	3	56	53	31	17	28

3. *(a)* A plant manufactures washing machines and dryers. The major manufacturing departments are the stamping deptt., motor and transmission deptt., and assembly deptt. The first two departments produce parts for both the products while the assembly lines are different for the two products. The monthly department capacities are

Stamping deptt. : 1,000 washers or 1,000 dryers.

Motor and transmission deptt : 1,600 washers
or
7,000 dryers.

Washer assembly line : 9,000 washers only.

Dryer assembly line : 5,000 dryers only.

Profits per piece of washers and dryers are Rs. 270 and Rs. 300 respectively. Formulate the L.P. model. 5

(b) Using Simplex Algorithm, solve the following L.P.P 15

Maximize $Z = 2x_1 + 5x_2 + 7x_3$

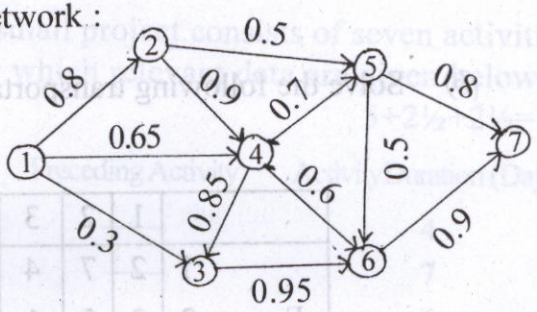
$3x_1 + 2x_2 + 4x_3 \leq 100$

$x_1 + 4x_2 + 2x_3 \leq 100$

$x_1 + x_2 + 3x_3 \leq 100$

$x_1, x_2, x_3 \geq 0$

4. (a) Use Dijkstra's algorithm to find the shortest route between node 1 and node 7 in the network : 10



(b) Using dual simplex method, solve the following L.P.P. 10

Minimize $Z = 2x_1 + 2x_2 + 4x_3$

subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 \leq 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$

5. *(a)* Use graphical method to solve the following problem : 5

Maximize $Z = 40x_1 + 100x_2$

subject to $12x_1 + 6x_2 \leq 3{,}000$

$4x_1 + 10x_2 \leq 2{,}000$

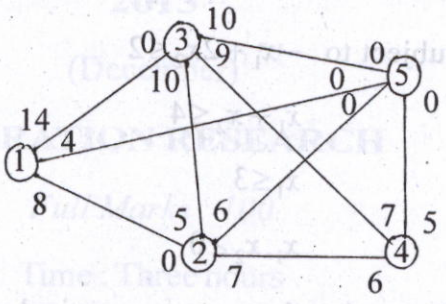
$2x_1 + 3x_2 \leq 900$

$x_1, x_2 \geq 0$

(b) Solve the following transportation problem : 15

		1	2	3	Supply
From	1	2	7	4	5
	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
Demand		7	9	18	34

6. *(a)* Determine the maximum flow and amount of flow in each arc for the following network : 10



(b) A small project consists of seven activities for which relevant data are given below : 5+2½+2½=10

Activity	Preceding Activity	Activity Duration (Days)
A	——	4
B	——	7
C	——	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

(i) Draw the network diagram and find the project completion time.

(ii) Calculate total float for each of the activities.

(iii) Draw the time scaled diagram.

7. *(a)* Using duality theory solve the following problem : 10

Maximize $Z = 2x_1 + x_2$

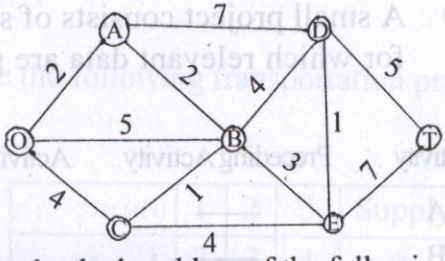
subject to $-x_1 + 2x_2 \leq 2$

$x_1 + x_2 \leq 4$

$x_1 \leq 3$

$x_1, x_2 \geq 0$

(b) Determine the most economical network : 5



(c) Obtain the dual problem of the following primal problem : 5

Maximize $Z = 2x_1 + x_2$

subject to the constraints

$x_1 + 5x_2 \leq 10$

$x_1 + 3x_2 \leq 6$

$2x_1 + 3x_2 = 8$

$x_2 \geq 0$ and x_1 is unrestricted.