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10EE661

**Sixth Semester B.E. Degree Examination, June/July 2018**  
**Operations Research**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions, selecting at least TWO questions from each part.  
2. Use of statistical /normal distribution tables permitted.  
3. Missing data, if any, may be suitably assumed.

**PART – A**

- 1 a. Define the term "Operations Research" and list main phases of operations study. Also explain any one phase briefly. (06 Marks)  
b. Mohan and Meakin Breweries Limited has two bottling plants, one located at Solan and other at Mohan Nagar. Each plant produces three drinks, whisky, beer and fruit juice named A, B and C respectively. The number of bottles produced per day of follows :

	Solan	Mohan Nagar
Whisky – A	1500	1500
Beer – B	3000	1000
Fruit juice – C	2000	5000

A market survey indicates that during month of April, there will be demand of 20,000 bottles of whisky, 40,000 of beer and 44,000 of fruit juice. The operating cost per day for plant at Solan and Mohan nagar are 600 and 400 rupees respectively. For how many days each plant be run in April so as to minimize the production cost, while meeting the market demand. (14 Marks)

- 2 a. What is meant by degeneracy with respect to Simplex method? How do you resolve it? (06 Marks)  
b. Solve the following LPP :  
Max  $z = 3x_1 + 2z_2$   
Subject to the constraints : $2x_1 + x_2 \leq 40$   
 $x_1 + x_2 \leq 24$   
 $2x_1 + 3x_2 \leq 60$   
 $x_1, x_2 \geq 0.$  (14 Marks)
- 3 a. Solve the following LPP by two phase Simplex method :  
Minimize  $z = 12x_1 + 20x_2$   
Subjected to the constraints :  $6x_1 + 8x_2 \geq 100$   
 $7x_1 + 12x_2 \geq 120$   
 $x_1, x_2 \geq 0.$  (10 Marks)  
b. Solve the LPP by dual Simplex method :  
Maximize  $z = x_1 + 2x_2 + 3x_3$   
Subjected to the constraints  $2x_1 - x_2 + x_3 \geq 4$   
 $x_1 + x_2 + 2x_3 \leq 8$   
 $0x_1 + x_2 - x_3 \geq 2$   
 $x_1, x_2, x_3 \geq 0.$  (10 Marks)

- 4 a. What is an assignment problem? Describe the mathematical formulation of an assignment problem. (05 Marks)
- b. Solve the following assignment problem : (07 Marks)

	1	2	3	4	5	6
A	12	10	15	22	18	08
B	10	18	25	15	16	12
C	11	10	03	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

- c. Solve the following travelling sales man problem. The salesman is on visit city once and only once. What is the total distance travelled? (08 Marks)

		To city					
		1	2	3	4	5	6
From city	1	$\infty$	20	23	27	29	34
	2	21	$\infty$	19	26	31	24
	3	26	28	$\infty$	15	36	26
	4	25	16	25	$\infty$	23	18
	5	23	40	23	31	$\infty$	10
	6	27	18	12	35	16	$\infty$

PART - B

- 5 a. Differentiate between transformation and assignment problem. (04 Marks)
- b. i) Obtain an initial basic feasible solution to the transformation problem. Is the solution an optimal solution? If not obtain the optimal solution.
- ii) If the company is spending Rs. 1000 on transportation of its units to 4 warehouses from 3 factories. What can be the maximum saving by optimal scheduling? (16 Marks)

	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	Availability
F <sub>1</sub>	19	30	50	10	7
F <sub>2</sub>	70	30	40	60	9
F <sub>3</sub>	40	8	70	20	18
Requirements	5	8	7	14	

- 6 a. Use dominance to solve the following game : (08 Marks)

		B					
		I	II	III	IV	V	VI
A	I	0	0	0	0	0	0
	II	4	2	1	2	1	1
	III	4	3	1	3	2	2
	IV	4	3	7	-5	1	2
	V	4	3	4	-1	2	2
	VI	4	3	3	-2	2	2

- b. Solve the game graphically whose pay-off matrix of player A's is given in the table :

		Player B	
		I	II
Player A	I	2	4
	II	2	3
	III	3	2
	IV	-2	6

(12 Marks)

- 7 a. For a given table below, determine the total float, free float, independent float and interfering floats of each activity. Time for activities in months. (10 Marks)

Activity	1-2	1-3	2-3	2-4	3-4	3-5	4-5	4-8	5-6	5-7	6-7	6-8	7-8
Durations (month)	8	10	4	0	5	6	4	8	5	7	3	5	3

- b. A small project is composed of seven activities whose time estimates are listed below along with activities.

Activity (i - j)	Estimated durations in weeks		
	Optimistic	Most likely	Pessimistic
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

- Draw the network and find expected duration and variance for each activity
- Determine expected project length and standard deviation of the project length
- What is the probability that the project will be completed at least two weeks earlier than expected?
- If the project due is 18 weeks, what is the probability of not meeting the due date.

(10 Marks)

- 8 a. A machine owner finds from the past records that the cost per year of maintaining a machine whose purchase price is Rs. 6000 are as given below : (08 Marks)

Year	1	2	3	4	5	6	7	8
Maintenance	1000	1200	1400	1800	2300	2800	3400	4000
Resale price	3000	1500	750	375	200	200	200	200

- b. The following failure rates are for resistors in an electrical system. The number of resistors in an electrical system is 1000 in the beginning :

End of week	1	2	3	4	5	6	7	8
Cumulative probability of failure	0.03	0.15	0.24	0.44	0.67	0.85	0.95	1.00

The cost of replacement of individual failed resistor is Rs. 1.30. If all the resistors are replaced in a group, the cost/resistor is 32 paise. If the decision is made to replace all the resistors at a time at fixed intervals and replace the individual resistor as and when they fail in service, what will be the optimal group replacement period at what group replacement price/resistor will a policy of strictly individual replacement become preferable to the adopted group replacement policy? (12 Marks)

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