Sixth Semester B.E. Degree Examination, June/July 2016
Operation Research

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.
2. *Normal distribution table is permitted.*

PART – A

1 a. Define Operation Research. List the applications of LPP.   **(05 Marks)**
   b. Using Graphical method find, $Z_{max} = 3x_1 + 4x_2$

   Subject to $5x_1 + 4x_2 \le 200$

   $3x_1 + 5x_2 \le 150$

   $8x_1 + 4x_2 \ge 80$

   $5x_1 + 4x_2 \ge 100$

   and $x_1, x_2 \ge 0$.   **(08 Marks)**

   c. Solve the following LPP by Simplex method

   $Z_{min} = x_1 - 3x_2 - 2x_3$

   Subject to $3x_1 - x_2 + 2x_3 \le 7$

   $-2x_1 + 4x_2 \le 12$

   $-4x_1 + 3x_2 + 8x_3 \le 10$.   **(07 Marks)**

2 a. Explain degeneracy in LPP and also explain the procedure to resolve degeneracy.
                                                                                (08 Marks)
   b. Write the dual for the following LPP

   $Z_{max} = 3x_1 + 5x_2 + 7x_3$.

   Subject to the constraints $x_1 + x_2 + 3x_3 \le 10$

   $4x_1 - x_2 + 2x_3 \ge 15$

   $x_1, x_2 \ge 0$

   x_3 is unrestricted variable.   **(12 Marks)**

3 a. Solve the LPP by dual Simplex method.

   Max $Z = -3x_1 - 2x_2$

   Subject to $x_1 + x_2 \ge 1$

   $x_1 + x_2 \le 7$

   $x_1 + 2x_2 \ge 10$

   $x_2 \le 3$; $x_1, x_3 \ge 0$.   **(10 Marks)**

   b. Solve the LPP by using revised Simplex method.

   Max. $Z = x_1 + x_2 + 3x_3$

   Subject to constraints $3x_1 + 2x_2 + x_3 \le 3$

   $2x_1 + x_2 + 2x_3 \le 2$

   $x_1, x_2, x_3 \ge 0$.   **(10 Marks)**

4 a. A company has 5 tasks and 5 persons to perform the same. The matrix shows the returns (profit) in hundreds of Rupees, for assigning jobs to the persons. Assign 5 tasks to 5 persons to maximize the total returns. **(08 Marks)**

		PERSONS				
		P_1	P_2	P_3	P_4	P_5
	J_1	5	11	10	12	4
	J_2	2	4	6	3	5
TASK	J_3	3	12	5	14	6
	J_4	6	14	4	11	7
	J_5	7	9	8	12	5

b. Solve the traveling salesman problem given by the following data : $C_{12} = 20$; $C_{13} = 4$; $C_{14} = 10$; $C_{23} = 5$; $C_{34} = 6$; $C_{25} = 10$; $C_{35} = 6$; $C_{45} = 20$, where $C_{ij} = C_{ji}$. There is no route between i and j, if the value of C_{ij} is not shown. **(12 Marks)**

PART – B

5 a. List the difference between transportation and assignment problems. **(06 Marks)**

b. A product is produced by 4 factories A, B, C and D. The unit production costs in them are Rs 2, Rs 3, Rs 1 and Rs 5 respectively. Their production capacities are factory A = 50 units and B = 70 units , C = 30 units and D = 50 units. These factories supply the product to 4 stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transport cost in rupees from each factory to each store is given in the table.

		1	2	3	4
	A	2	4	6	11
Factory	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum. **(14 Marks)**

6 a. Define Optimal strategy. Using dominance concept, obtain the optimal strategies for both the players and determine the value of game. The pay off matrix for player A is given **(12 Marks)**

	I	II	III	IV
I	3	2	4	0
II	3	4	2	4
III	4	2	4	0
IV	0	4	0	8

b. Use graphical method to solve the following sequencing problem, also calculate the total time required to complete both the jobs. **(08 Marks)**

JOB 1	Sequencing order and time	A	B	C	D	E
		2	3	4	6	2
JOB 2	Sequencing order and time	C	A	D	E	B
		4	5	3	2	6

7 a. The following table shows the jobs of a network along with their time estimation in days.

JOB	1-2	1-3	1-4	2-5	3-5	4-6	5-6
T_o	1	1	2	1	2	2	3
T_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

i) Draw the project network.
ii) Compute the expected duration and variance, also critical path.
iii) Calculate standard deviation.
iv) What is the probability of completion of project :
   a) 4 days earlier than expected.
   b) Not more than 4 days later than expected. **(12 Marks)**

b. Determine the optimum project duration (days) and cost (Rs) for the following data :

Activities	Normal		Crash	
	Time	Cost	Time	Cost
1-2	8	100	6	200
1-3	4	150	2	350
2-4	2	50	1	90
2-5	10	100	5	400
3-4	5	100	1	200
4-5	3	80	1	100

Indirect cost is Rs 70 per day. **(08 Marks)**

8 a. Explain Economic life of an equipment by illustrating chart. **(08 Marks)**

b. Below table gives the operation cost, maintenance cost and salvage value at the end of every year of a machine whose purchase value is Rs 12,000. Find the economic life of the machine assuming.
   i) The interest rate is 0%.
   ii) The interest rate as 15%. **(12 Marks)**

End of year (n)	Operation cost at the end of year (Rs)	Maintenance cost at the end of year (Rs)	Salvage value at the end of year (Rs)
1	2000	2500	8000
2	3000	3000	7000
3	4000	3500	6000
4	5000	4000	5000
5	6000	4500	4000
6	7000	5000	3000
7	8000	5500	2000
8	9000	6000	1000

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