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10EE661

Sixth Semester B.E. Degree Examination, June/July 2017
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 tables are permitted.***

PART – A

1 a. Briefly explain the engineering applications and limitations of Operation Research. **(10 Marks)**

b. The XYZ electric appliance Company produces two types of products : Refrigeration and televisions. The Company's two product are produced and sold on a weekly basis. The weekly production cannot exceed 25 refrigerators and 35 televisions. The Company regularly employs a total of 60 workers. A refrigerator requires 2 – man – weeks of labour, while TV requires 1 – man – week of labour. A refrigerator contributes a profit of Rs 60 and TV contributes a profit of Rs 40. How many units of refrigerators and TV's should the company produce to realize maximum profit? Formulate LPP and solve it by graphical method. **(10 Marks)**

2 a. Solve the following LPP using Simplex method and comment on the results.
Maximize $Z = 3x_1 + 2x_2$
Subject to $x_1 - x_2 \leq 1$
$3x_1 - 2x_2 \leq 6$
$x_1, x_2 \geq 0.$ **(08 Marks)**

b. Solve the following LPP using two – phase Simplex method.
Maximize $Z = 8x_2$
Subject to $x_1 - x_2 \geq 0$
$1 + 3x_2 \leq -6$
x_1 and x_2 are unrestricted. **(12 Marks)**

3 a. Construct the dual for the following LPP : **(10 Marks)**
i) Maximize $Z = 5x_1 + 12x_2 + 4x_3$
Subject to $x_1 + 2x_2 + x_3 \leq 10$
$2x_1 - x_2 + 3x_3 = 8$
x_1, x_2 and $x_3 \geq 0.$
ii) Minimize $Z = x_2 + 3x_3$
Subject to $2x_1 + x_2 \leq 3$
$x_1 + 2x_2 + 6x_3 \geq 5$
$-x_1 + x_2 + 2x_3 = 2$
x_1, x_2 & $x_3 \geq 0.$

b. Solve the following LPP using dual Simplex method. **(10 Marks)**
Minimize $Z = 2x_1 + x_2$
Subject to $3x_1 + x_2 \geq 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 3$
x_1, & $x_2 \geq 0.$

4 a. Four different jobs can be done on four different machines. The matrix below gives the cost in rupees of producing job 'i' and on machines 'j'.

		Machines			
		M_1	M_2	M_3	M_4
Jobs	J_1	5	7	11	6
	J_2	8	5	9	6
	J_3	4	7	10	7
	J_4	10	4	8	3

Represent the problem as an LP problem and how should the jobs be assigned to the various machines, so that the total cost is minimized. **(08 Marks)**

b. An electrical service engineer has to visit five places A, B, C, D and E. The cost of going from one place to another are given below. Determine the optimal route and cost. **(08 Marks)**

	A	B	C	D	E
A	∞	7	6	8	4
B	7	∞	8	5	6
C	6	8	∞	9	7
D	8	5	9	∞	8
E	4	6	7	8	∞

c. Write the algorithm for revised Simplex method. **(04 Marks)**

PART – B

5 a. The power company has three power plants that supply the needs of four cities. The cost of sending 1 million kWh of electricity from plant to city is given in the following table :
Solve the following transportation problem to minimize the cost of meeting each city peak power demand. (Use North – west corner method and UV method). **(12 Marks)**

	City - 1	City - 2	City - 3	City - 4	Supply (million)
Plant - 1	8	6	10	9	35
Plant - 2	9	12	13	7	50
Plant - 3	14	9	16	5	40
Demand (in million)	45	20	30	30	

b. Obtain the initial basic feasible solution (IBFS) to the following TP using Vogel's Approximation method.

		Destinations				
		D_1	D_2	D_3	D_4	Supply
Sources	S_1	5	1	3	3	34
	S_2	3	3	5	4	15
	S_3	6	4	4	3	12
	S_4	4	1	4	2	19
Demand		21	25	17	17	

The unit transportation costs are represented in the TP table. **(08 Marks)**

6 a. Briefly explain the Maxmin and Minmax principle. **(05 Marks)**

b. Solve the following game graphically whose payoff matrix for the player – A is given in the following table : **(10 Marks)**

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

c. Using dominance property, obtain the optimal strategies for both the players and determine the value of game. The Payoff matrix for Player 'A' is given by **(05 Marks)**

		Player B				
		I	II	III	IV	V
Player A	I	2	4	3	8	4
	II	5	6	3	7	8
	III	6	7	9	8	7
	IV	4	2	8	4	3

7 a. Draw the PERT network for the following project and number the events. **(06 Marks)**

Event Number	A	B	C	D	E	F	G	H	J	K	L
Preceded by :	Start event	A	B	B	D	B	E	G,E	D,F,H	C,J	K

b. Define the following :
i) Optimistic time estimate ii) Pessimistic time estimates iii) Most likely time estimate iv) Average time. **(04 Marks)**

c. For the network shown in fig. Q7(c), calculate the probability of finishing the project within 22 days. **(10 Marks)**

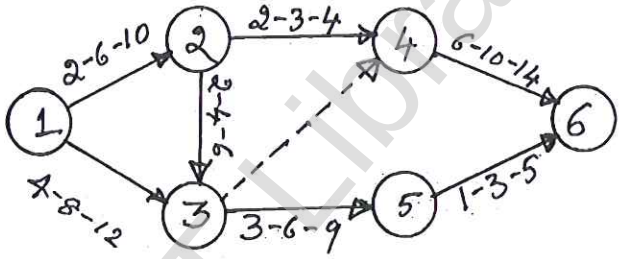

Fig.Q7(c)

8 a. The cost of a electric machine is Rs 6100 and its scrap value is Rs 100. The maintenance costs found from the experience are as follows : **(10 Marks)**

Year	1	2	3	4	5	6	7	8
Maintenance cost (in Rs)	100	250	400	600	900	1200	1600	2000

When should the machine be replaced?

b. A computer contains 10,000 resistors. The cost of replacing a single resistor is Re 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percent surviving by the end of month 't' is given by :

Month (t)	0	1	2	3	4	5	6
Percent surviving by the end of month	100	97	90	70	30	15	0

What is the Optimum plan? **(10 Marks)**

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