Sixth Semester B.E. Degree Examination, June/July 2015

Operation Research

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1. a. Solve the given LPP, using graphical method.
   Maximize $z = 3x_1 + 5x_2$
   Subject to $x_1 + 2x_2 \leq 2000$
   $x_1 + x_2 \leq 1500$
   $x_2 \leq 600$
   $x_1, x_2 \geq 0$ **(06 Marks)**

   b. A firm manufactures two types of products P_1 and P_2 and sells them at a profit of Rs 2 on product P_1 and Rs 3 on product P_2. Each product is processed on two machines M_1 and M_2 product p_1 requires one minute of processing time on M_1 and two minutes of processing time on M_2. Product P_2 requires one minute on M_1 and one minute on M_2. Machine M_1 is available for not more than 6 hours 40 minutes while machine M_2 is available for 10 hours during any day. Formulate the problem as a LPP.   **(04 Marks)**

   c. Use two phase simplex method to
   Minimize $z = x_1 + x_2 + x_3$
   Subject to $x_1 - 3x_2 + 4x_3 = 5$
   $x_1 - 2x_2 \leq 3$
   $2x_2 + x_3 \geq 4$
   $x_1, x_2, x_3 \geq 0$ **(10 Marks)**

2. a. Solve using simplex method
   Maximize $z = 3x_1 + 9x_2$
   Subject to $x_1 + 4x_2 \leq 8$
   $x_1 + 2x_2 \leq 4$
   $x_1, x_2 \geq 0$ **(10 Marks)**

   b. Solve using Big M method and read the solution for dual from primal optimal solution
   Maximize $z = 5x_1 + 12x_2 + 4x_3$
   Subject to $x_1 + 2x_2 + x_3 \geq 5$
   $2x_1 - x_2 + 3x_3 = 2$
   $x_1, x_2, x_3 \geq 0$ **(10 Marks)**

3. a. Define dual problem. find the dual of the following LP problem.
   Maximize $z = 2x_1 + 3x_2 + x_3$
   Subject to $4x_1 + 3x_2 + x_3 = 6$
   $x_1 + 2x_2 + 5x_3 = 4$
   $x_1, x_2, x_3 \geq 0$ **(06 Marks)**

b. Define (i) Feasible solution (ii) Optimal solution in a linear programming problem.

(04 Marks)

c. Solve using simplex method.

Maximize $z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \le 430$

$3x_1 + 2x_3 \le 460$

$x_1 + 4x_2 \le 420$

$x_1, x_2, x_3 \ge 0$

(10 Marks)

4 a. Five employees are available to do five different jobs. From the past records the time in hrs that each employee takes to do each job is known and given in the table below. How should the jobs be allotted one per person so as to minimize the total man hours?

(10 Marks)

Employees

		I	II	III	IV	V
	A	2	9	2	7	1
	B	6	8	7	6	1
Jobs	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

b. Solve the travelling sales man problem given by the following data:

$C_{12} = 20$, $C_{13} = 4$, $C_{14} = 20$, $C_{23} = 5$, $C_{34} = 6$,

$C_{25} = 10$, $C_{35} = 6$, $C_{45} = 10$ where $C_{ij} = C_{ji}$

And there is no route between cities i and j if the value of C_{ij} is not given.

(10 Marks)

PART – B

5 a. Obtain an initial basic feasible solution for the following transportation problem using
i) North – west corner rule   ii) Vogels Approximation method

	1	2	3	4	5	Supply
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	

(10 Marks)

b. Find the optimum solution for the transportation problem using MODI method.

	W_1	W_2	W_3	W_4	Factory capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Ware house requirement	5	8	7	14	

(10 Marks)

6 a. Solve the following game graphically and find the value of the game

Player b

|		b_1	b_2	b_3	b_4
Player a	a_1	8	5	-7	9
	a_2	-6	6	4	-2

(10 Marks)

b. Determine the best sequencing of 6 jobs on 4 machines from the given table of processing time. The sequence of operation to be considered is $M_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4$

Jobs	Processing Time on Machines			
	M_1	M_2	M_3	M_4
A	6	5	3	4
B	7	2	5	5
C	9	6	3	3
D	8	5	5	4
E	8	3	4	3
F	9	5	5	4

(10 Marks)

7   a. Obtain the critical path and project duration for the following PERT network   **(10 Marks)**

Fig. Q7 (a)
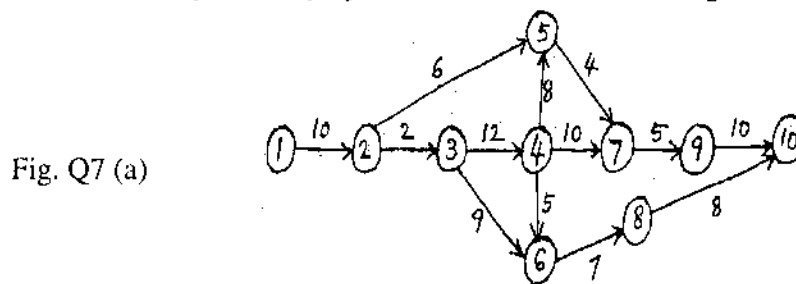
b. Explain the following terms in PERT/CPM
   i)   Earliest time
   ii) Latest time
   iii) Total activity slack
   iv) Event slack
   v)   Critical path

(10 Marks)

8   a. In a plant we have 105 machines operating. The average preventive maintenance cost for a machine has been worked out to be Rs 35. The breakdown cost is Rs 500 and the breakdown history of the machines is given below. Decide an appropriate maintenance policy?

Month of the year	1	2	3	4	5	6	7	8	9	10	11	12
Break down Frequency	2	3	4	5	5	6	9	12	12	14	15	15

(10 Marks)

b. We have the lots of 1000 bulbs, supplied to shop cost of individual replacement is Rs 10 and the bulk replacement cost is Rs 2.50 per bulb. The failure pattern noticed is as follows :

Period in months	1	2	3	4	5
Failure rate %	0.10	0.15	0.25	0.30	0.20

Work out the optimum replacement policy.

(10 Marks)

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