Seventh Semester B.E. Degree Examination, June/July 2017
Operation Research

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.

PART – A

1 a. Define a operation research. Briefly explain the characteristics of operations. **(05 Marks)**

b. A company manufactures tow products X and Y, which requires, the following resources. The resources are the capacities machines M_1, and M_2 and M_3. The available capacities are 50, 25 and 15 hours, respectively in the planning period. Product 'X' requires 1 hour of machine M_2 and 1 hour of machine M_3. Product 'Y' requires 2 hour of machine M_1, 2 hours of machine M_2 and 1 hour of machine M_3. The profit contribution of products X and Y are Rs. 5/- and Rs. 4/- respectively. Formulate the problem as a linear programming problem. **(07 Marks)**

c. Use graphical method to solve the LPP :

Maximize $Z = 6x_1 + 4x_2$

Subject to, $-2x_1 + x_2 \le 2$

$x_1 - x_2 \le 2$

$3x_1 + 2x_2 \le 9$

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

2 a. Use simplex method of solve the LPP :

Minimum $Z = x_2 - 3x_3 + 2x_5$

Subject to, $3y_2 - y_3 + 2x_5 \le 7$

$-2y_2 + 4x_3 \le 12$

$-4x_2 + 3x_3 + 8x_5 \le 10$

$x_2, x_3, x_5 \ge 0.$ **(10 Marks)**

b. Find the dual of the following LPP :

Max $Z = 3x_1 - x_2 + x_3$

Subject to, $4x_1 - x_2 \le 8$

$8x_1 + x_2 + 3x_3 \ge 12$

$5x_1 - 6x_3 \le 13$

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

3 a. Give the mathematical formulation of transportation problem. **(04 Marks)**

b. Four factories A, B, C and D produce small sugar and the capacity of each factor is given below. Factory 'A' produce 10 tons of sugar and B produce 8 tons of sugar, C produce 5 tons of sugar and that of D is 6 tons of sugar. The sugar has demand in three markets X, Y and Z. The demand of market is 7 tons that of market Y is 12 tons and the demand of market Z is 4 tons, the following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations. Find the optimal solution by using North–West corner method.

Factories	Cost in Rs./ton (x 100) market			Available in tons
	X	Y	Z	
A	4	3	2	10
B	5	6	1	8
C	6	4	3	5
D	3	5	4	6
Requirement in tons	7	12	5	

(08 Marks)

c. A leading firm has three auditors. Each auditors can work upto 160 hours during the next month, during which time, three projects must be completed. Project 1 will take 130 hrs, project 2 140 hrs and project 3 will take 160 hrs. The amount /hr that can be billed for assigning each auditor to each project is given in the table :

Auditor	Project		
	1(Rs)	2(Rs)	3(Rs)
1	1,400	1,500	1,900
2	1,400	1,300	1,200
3	1,600	1,400	1,500

Formulate this as a transportation problem and find the optimal solution (Maximization case). **(08 Marks)**

4 a. A city corporation has decided to carry out road repairs on main four arteries of the city the government has agreed to make a special grant of Rs. 50 Lakhs towards the cost with a condition that the repairs must be done at the lowest cost and quickest time. If conditions warrant, then a supplementary token grant will also be considered favorable the corporation has floated tenders and 5 contractors have sent in their bids. In order to expedite work over road will be awarded to only one contractor. Cost of repairs (Rs. Lakhs) **(10 Marks)**

Contractors/Road

	R_1	R_2	R_3	R_4
C_1	9	14	19	15
C_2	7	17	20	19
C_3	9	18	21	18
C_4	10	12	18	19
C_5	10	15	21	16

Find the best way of assigning he repair work to the contractors and the costs. **(10 Marks)**

b. An airline that operates seven days a week has the time table show 5 hours between flights. Obtaining the pairing of flights that minimizes layover time away from home for any given pairing, the crew will be based at the city that results in the smaller layover. For each pair also mention the city where crew should based.

Belagavi – Bangalore			Bangalore –Belagavi		
Flight no	Departure	Arrival	Flight no	Departure	Arrival
101	7 : 00 am	8 : 00 am	201	8 : 00 am	9 : 00 am
102	8 : 00 am	9 : 00 am	202	9 : 00 am	10 : 00 am
103	1: 00 pm	2 : 00 pm	203	12 : 00 noon	1 : 00 pm
104	6 :00 pm	7 :00 pm	204	8 : 00 pm	9 : 00 pm

(10 Marks)

PART – B

5 a. Explain the principal assumption made while dealing with sequencing problem. **(04 Marks)**
   b. There are five jobs each of which must go through the machines A, B and C in the order ABC. Determine that sequence that minimize the total elapsed time. **(08 Marks)**

Job No	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

   c. Use graphical method to minimize the time needed to process the following jobs on the machines as shown. For each machine find which job is to be loaded first? Calculate the time required to process the jobs. The time given in hours the machining order for job 1 is ABCDE and for job2 is BCADE.

Sequence	A	B	C	D	E
Job 1 time in hrs	3	4	2	6	2
Sequence	B	C	A	D	E
Job 2 time n hrs	5	4	3	2	6

(08 Marks)

6 a. With reference to the game theory explains the following terms :
       i) saddle point   ii) strategy. **(04 Marks)**
   b. Solve the following game and determine the value of game. **(08 Marks)**

$$A = \begin{bmatrix} 4 & -4 \\ -4 & 4 \end{bmatrix}.$$

   c. Using the principle of dominance, solve of the following game. **(08 Marks)**

Player B

$$\text{Player A} \begin{bmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 1 & 6 \end{bmatrix}.$$

7 a. In a railway Marshalling yard, good trains arrive at a rate of 30 trains per day. Assuming that inter arrival time and service time distribution follows an exponential distribution with an averages of 30 minutes.
       Calculate the following :
       i)   The mean queue size
       ii) The probability that queue size exceeds
       iii) If the input of the train increases to an average of 33 per day, what will be the changes in (i) and (ii)? **(10 Marks)**
   b. A petrol station has two pumps the service time follows the exponential distribution with mean and minutes and cars arrive for service in a Poisson process at the rate of 10 cars per hour. Find the probability that a customer has to wait service. What proportion of time the pumps remain idle? **(10 Marks)**

8 a. Differentiate between the PERT and CPM. (04 Marks)

b. Draw the network for the following : (04 Marks)

i)

Activity	A	B	C	D	E	F	G	H	I
Predecessor	–	–	A, B	B	B	A, B	F, D	F, D	C, G

ii)

Activity	A	B	C	D	E	F	G	H	I	J	K
Predecessor	–	–	–	A	C	B, D	B, D	E, F	A	G	E, F

c. The following table shows the jobs of a network along their time estimates. The time estimates are in days :

Job	1 – 2	1 – 6	2 – 3	2 – 4	3 – 5	4 – 5	5 – 8	6 – 7	7 – 8
a	3	2	6	2	5	3	1	3	4
M	6	5	12	5	11	6	4	9	19
b	15	14	30	8	17	15	7	27	28

i) Draw the project network

ii) Find the critical path

iii) Find the probability that the project is completed in 31 days. (12 Marks)

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