Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Operations 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 operation research. Write the advantages and limitations of operation research. **(08 Marks)**

   b. A person requires 10, 12 and 12 units chemicals A, B and C respectively for his garden. A liquid product contains 5, 2, and 1 units of A, B and C respectively per jar. A dry product contains 1, 2 and 4 units of A, B, C per carton. If the liquid product sells for Rs.3 per jar and the dry product sells for Rs.2 per carton, how many of each should be purchased in order to minimize the cost and meet the requirements. **(04 Marks)**

   c. Find the maximum value of $Z = 5x_1 + 7x_2$
   Subject to the constraints $x_1 + x_2 \le 4$
   $$3x_1 + 8x_2 \le 24$$
   $$10x_1 + 7x_2 \le 35 \quad x_1, x_2 > 0.$$ **(08 Marks)**

2 Solve the following LP problem using Simplex method :
   Max $Z = 3x_1 + 2x_2 + 5x_3$
   Subject to $x_1 + 2x_2 + x_3 \le 430$
   $$3x_1 + 2x_3 \le 460$$
   $$x_1 + 4x_2 \le 420$$
   $$x_1, x_2, x_3 \ge 0.$$ **(20 Marks)**

3 a. Find the intial solution to the following TP using VAM. **(08 Marks)**

Destination

	D_1	D_2	D_3	D_4	Supply
F_1	3	3	4	1	100
F_2	4	2	4	2	125
F_3	1	5	3	2	75
Demand	120	80	75	25	300

   b. Find the IBFS by LCM and check the optimal solution by stepping stone method.

	D	E	F	G	Capacity
A	4	6	8	6	700
B	3	5	2	5	400
C	3	9	6	5	600
Requirements	400	450	350	500	

(12 Marks)

4 a. Write the difference between transportation problem and assignment problem. **(04 Marks)**

   b. Solve the assignment problem represented by the following matrix : **(08 Marks)**

	a	b	c	d	e
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

   c. Solve the following travelling salesman problem : **(08 Marks)**

	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

PART – B

5 a. There are 7 jobs each of which has to go through the machines A and B in the order of A–B. The processing times in the hours are given as :

Job	1	2	3	4	5	6	7
m/c A	3	12	15	6	10	11	9
m/c B	8	10	10	6	12	1	3

(08 Marks)

b. Use the graphical method to minimize the time needed to process the following jobs on the machine and also calculate the total elapse time to complete.

Job 1	A – 20	C – 10	D – 10	B – 30	E – 25	F - 15
Job 2	A – 10	C – 30	B – 15	D – 10	F – 20	E – 20

(12 Marks)

6 a. Explain the terms : i) Value of game ii) Fair game. **(04 Marks)**

b. Using dominance rule solve the pay off matrix :

$$\text{Player A} \begin{array}{c} \\ \\ \\ \\ \\ \end{array} \begin{bmatrix} 4 & 2 & 0 & 2 & 1 & 1 \\ 4 & 3 & 1 & 3 & 2 & 2 \\ 4 & 3 & 7 & -5 & 1 & 2 \\ 4 & 3 & 4 & -1 & 2 & 2 \\ 4 & 3 & 2 & -2 & 2 & 2 \end{bmatrix}$$

Player B

(10 Marks)

c. Solve by graphical method :

$$\begin{array}{c} A \\ B \end{array} \begin{bmatrix} 3 & 0 & 6 & -1 & 7 \\ -1 & 5 & -2 & 2 & 1 \end{bmatrix}$$

(06 Marks)

7 a. In a bank, 20 customers on the average, are served by a cashier in an hour. if the service time has exponential distribution. What is the probability that :
   i) It will take more than 10 min to serve a customer?
   ii) A customer shall be free within 4 minutes? **(06 Marks)**

b. Goods trucks arrive randomly at a stockyard with a mean of 8 truck/hour. A crew of four operatives can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at the rate of Rs. 60 per hour. Operatives are paid a wage rate of Rs.20 per hour. It is possible to augment the crew strength to 2 or 3 when the unloading time will be 4 min or 3 min respectively per truck. Find the optimal crew size. **(14 Marks)**

8 a. Define the terms : i) Total float ii) Free float iii) Independent float. **(06 Marks)**

b. A project schedule has the following characteristics :

Job	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration day	15	15	3	5	8	12	1	14	3.	14

   i) Draw an arrow diagram representing the project
   ii) Find the total float for each activity?
   iii) Find the critical path and the total project duration. **(14 Marks)**

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