10AU71

Seventh Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs.   Max. Marks:100

Note: *1. Answer any FIVE full questions.*
2. Missing data, if any, may be suitably assumed.

1   a.   What is meant by a linear programming problem?   **(02 Marks)**
    b.   List the phases of operations research.   **(03 Marks)**
    c.   A chemical company has two bottling plants situated at two cities A and B. Each plant produces 3 types of chemicals : type–I, type–II, type –III. The number of bottles produced per day is as follows :

Chemical type	Plant at cities	
	A	B
I	1500	1500
II	3000	1000
III	2000	5000

A market survey indicates that there will be a demand of 20,000 bottles of type – I chemical, 40,000 bottles of type – II chemical and 44,000 bottles of types – III chemical. The operating cost per day of the plants A and B are Rs. 600 and Rs. 400 respectively. for how many days each plant should run in the month of may so as to have a minimum production cost, while still meeting the market demand. Obtain the solution by graphical method.
                                                                                          (15 Marks)

2   a.   Solve the LPP maximize : $z = 5x_1 + 2x_2$
         Subject to $4x_1 + 2x_2 \leq 16$
         $\qquad 3x_1 - x_2 \leq 9$
         $\qquad 3x_1 + x_2 \leq 9$
         $\qquad x_1, x_2 \geq 0$.   **(10 Marks)**
    b.   Use two phase simplex method to minimize : $z = x_1 + x_2 + x_3$
         subject to the constraints $x_1 - 3x_2 + 4x_3 = 5$
         $\qquad x_1 - 2x_2 \leq 3$
         $\qquad 2x_2 - x_3 \geq 4$
         $\qquad x_1 \geq 0, x_2 \geq 0, x_3$ is unrestricted.   **(10 Marks)**

3   a.   What do you mean by unbalanced transportation problem?   **(04 Marks)**
    b.   Solve the following transportation problem and find minimum transportation cost (optimal).

		Destination				
		D_1	D_2	D_3	D_4	Supply
Origins	O_1	6	1	9	3	70
	O_2	11	5	2	8	55
	O_3	10	12	4	7	70
	Demand	85	35	50	45	

                                                                                          (16 Marks)

4 a. A company has five machines that are used for four jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table :

	A	B	C	D	E
1	5	7	11	6	7
2	8	5	5	6	5
3	6	7	10	7	3
4	10	4	8	2	4

Job (rows 1–4)

Determine the optimal assignment. **(10 Marks)**

b. Solve the following travelling salesman problem :

	1	2	3	4
1	∞	4	9	5
2	6	∞	4	8
3	9	4	∞	9
4	5	8	9	∞

(10 Marks)

5 a. Use the graphical method to obtain the sequencing of jobs and machines and find the total elapsed time, idle times of the jobs. **(10 Marks)**

Job 1	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence	B	C	A	D	E
	Time	5	4	3	2	6

b. Find an optimal sequence for processing nine jobs through the machines A, B, C in the order A, B, C. processing times are given below in hours. Find the total elapsed time for the optimal sequence. **(10 Marks)**

Jobs	1	2	3	4	5	6	7	8	9
Machine A	4	9	5	10	6	12	8	3	8
Machine B	6	4	8	9	4	6	2	6	4
Machine C	10	12	9	11	14	15	10	14	12

6 a. Explain :
   i) two person zero from game
   ii) saddle point. **(04 Marks)**

b. Solve the following game and hence find value of game. **(06 Marks)**

	B_1	B_2	B_3	B_4
A_1	−5	2	0	7
A_2	5	6	4	8
A_3	4	0	2	−3

c. Solve the following zero sum game and find valve of game.

Player A / Player B

5	−10	9	0
6	7	8	1
8	7	15	1
3	4	−1	4

(10 Marks)

7 a. List the important characteristics of queuing model. **(02 Marks)**

b. Arrivals at a public telephone both are considered to be Poisson with an average time of 8 minutes between one arrival and the ally distributed with a mean value of 2 minutes :
   i) What will be the probability that a person arriving at the both will have to wait
   ii) Determine the average queue length that is formed time to time
   iii) The telephone department is interested to install a second both if convened that an arrival would expect to have to wait atleast 5 minutes for phone. Determine the increase in flow of arrivals which will justify a second booth. **(12 Marks)**

c. A small internet café has tow computer terminals the arrival rate of internet users in the café is 10 users per hour. Each user spends 10 minutes on the computer. The arrival and service process follow exponential distribution. What is the probability that both computers are free? **(06 Marks)**

8 a. Define the following :
   i) dummy activity   ii) burst event   iii) optimistic time   iv) cost slope. **(08 Marks)**

b. Determine the optimum project duration (days) and cost for 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 if Rs. 70/day. **(12 Marks)**

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