

Code No: 821AJ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**MCA II Semester Examinations, June/July - 2018**
**OPERATIONS RESEARCH**
**Time: 3hrs**
**Max.Marks:75**
**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A**
**5 × 5 Marks = 25**

- 1.a) Give the merits and demerits of graphical solutions in operations research. [5]
- b) Draw the flow chart for optimization of Transportation problem including its initial solution. [5]
- c) What are the costs involved in failure and replacement analysis of equipment. Explain.[5]
- d) Explain the terms “pay off matrix” and “saddle points”, used in game theory. [5]
- e) Discuss the arrival and service patterns used in Q-models. [5]

**PART - B**
**5 × 10 Marks = 50**

2. Sreeja & Co wishes to plan its advertising strategy. There are two media under consideration, Siti cable and Popular channel. Siti cable has a reach of 2000 potential customers and Popular channel has a reach of 3000 potential customers. The cost per appearance of one minute is Rs. 6000 and Rs. 9000 in Siti and Popular respectively. The budget of Sreeja is Rs. 80,000 per month. There is an important requirement that the total reach for the income group under Rs. 60,000 per annum should not exceed 3000 potential customers. The reach in Siti cable and Popular channel for this income group is 300 and 150 potential customers. How many appearances of one minute advertisements should Sreeja plan so as to maximise the total reach? Formulate the problem and solve it. [10]

**OR**

3. Solve the following problem by simplex method adding artificial variable

$$\begin{aligned} \text{Max. } Z &= 2x_1 + 5x_2 + 7x_3 \\ \text{Subject to } 3x_1 + 2x_2 + 4x_3 &\leq 100 \\ x_1 + 4x_2 + 2x_3 &\leq 100 \\ x_1 + x_2 + 3x_3 &\leq 100 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

[10]

4. A company has 3 factories and 3 ware houses with the following shipping cost and other information

Ware house	factories			Sales price	Ware house capacity
	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>		
W <sub>1</sub>	3	9	5	34	80
W <sub>2</sub>	1	7	4	32	120
W <sub>3</sub>	5	8	3	31	150
R/M cost	15	18	14		
Labor cost	10	9	12		
Factory capacity	150	100	130		

Due to prior commitment  $F_1$  must supply 50 units to  $W_2$  and for every unit sent to  $W_1$  an octroi of Rs. 2/- per unit is imposed, also at  $F_3$  left out inventory costs Rs. 1/- per unit left out.

Find the optimal solution for the company so as to make maximum profits or minimum cost/loss. [10]

**OR**

5. Five swimmers are eligible to complete in a relay team which is to consist of four swimmers, swimming four different swimming styles; *back stroke*, *breast stroke*, *free style* and *butterfly*. The time taken for the five swimmers — Anand, Bhasker, Chandu, Dolly and Easwar — to cover a distance of 100 meters in various swimming styles are given below in minutes, seconds.

- *Anand* swims the back stroke in 1: 09, the breast stroke in 1:15 and has never competed in the free style or butterfly.
- *Bhasker* is a free style specialist averaging 1:01 for the 100 meters but can also swim the breast stroke in 1:16 and butterfly in 1:20.
- *Chandu* swims all styles — back 1:10 butterfly 1:12 free style 1:05 and breast stroke 1:20.
- *Dolly* swims only the butterfly 1:11 while Easwar swims the back stroke 1:20 the breast stroke in 1:16 and the free style 1:06 and the butterfly 1:10.

Which swimmer should be assigned to which swimming style? Who will not be in the relay. [10]

6. A computer has a large number of electronic tube, that are subject to mortality as given below:

Period	Age of failure	Probability of failure
1	0-100	0.10
2	101-200	0.26
3	201-300	0.35
4	301-400	0.22
5	401-500	0.07

If the tubes are group replaced, the cost of replacement is Rs. 15 per tube. Group replacement can be done at fixed intervals in the night shift when the computer is not normally used. Replacement of individuals tubes which fails in services costs Rs. 60 per tube. How frequently should the tubes be replaced? [10]

**OR**

7. Find the sequence that minimizes the total elapsed time (in hours) required to complete the following tasks. Each job is processed in the order ACB. [10]

JOB	1	2	3	4	5	6	7
Machine A	12	6	5	11	5	7	6
Machine B	7	8	9	4	7	8	3
Machine C	3	4	1	5	2	3	4

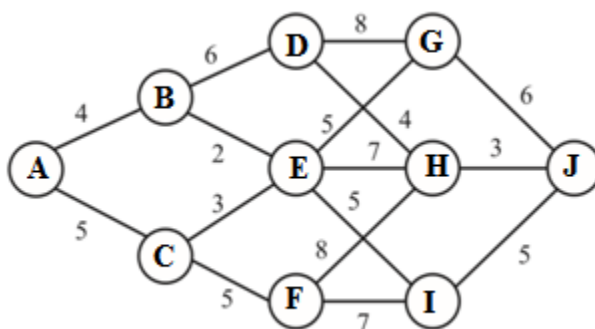
8. A soft drink company calculated the market share of two products against its major competitor having three products and found out the impact of additional advertisement in any one of its products against the order.

		Competitor B		
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
Company A	A <sub>1</sub>	6	7	15
	A <sub>2</sub>	20	12	10

What is the best strategy for the company as well as the competitor? What is the payoff obtained by the company and the competitor in the long run? Use graphical method to obtain the solution. [10]

**OR**

9. Find the shortest path from the initial state to the final state as given in Figure. The lengths of paths are also shown in this network. [10]



10. The demand for an item in a company is 15000 units per year and the company can produce the items at a rate of 300 per month. The cost of one set-up is Rs. 500 and holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per month. Determine
- Optimum production batch quantity and number of shortages
  - Optimum cycle time and production time
  - Maximum inventory level in the cycle
  - Total associated cost per year if the cost of the items is Rs. 20 per unit. [10]

**OR**

11. A T.V. repairman finds that the time spent on his jobs have an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they come in, and if the arrival of sets is approximately Poisson distribution with an average rate of 10 per 8 hour day, what is repairmen's expected idle time each day? How many jobs are ahead of the average set just brought in? [10]

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