



USN

Library

Date:

Time: 3 hrs.

10AU71

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
Operations Research

Max. Marks:100

- Note:1. Answer any FIVE full questions, selecting at least TWO full questions from each part.
2. Use of normal distribution table is permitted.

PART – A

- 1 a. Define Operations Research and explain its characteristics. (08 Marks)
b. The owner of Fancy Goods shop is interested to determine how many advertisements to release in the selected three magazines, A, B and C. His main purpose is to advertise in such a way that total exposure to principal buyers of his goods is maximized. Percentages of readers for each magazine are known. Exposure in any particular magazine is the number of advertisements released multiplied by the number of principal buyers. The following data is available.

Particulars	Magazine		
	A	B	C
Readers	1.0lakh	0.6lakh	0.4lakh
Principal buyers	20%	15%	8%
Cost per Adv.	8,000	6,000	5,000

The budgeted amount is at the most Rs.1.0 lakh for the advertisements. The owner has already decided that magazine A should have not more than 15 advertisements and that B and C each gets atleast 8 advertisements. Formulate a linear programming model for this.

(04 Marks)

- c. Using graphical method, solve the given LPP

$$\text{Minimize } Z = 1.5x_1 + 2.5x_2$$

$$\text{Subjected to } x_1 + 3x_2 \geq 3,$$

$$x_1 + x_2 \geq 2,$$

$$x_1, x_2 \geq 0$$

(08 Marks)

- 2 a. Use two-phase simplex method to solve the problem

$$\text{Minimize } Z = x_1 - 2x_2 - 3x_3$$

$$\text{Subjected to } 2x_1 + x_2 + 3x_3 = 2$$

$$2x_1 + 3x_2 + 4x_3 = 1$$

$$x_1, x_2, x_3 \geq 0$$

(08 Marks)

- b. Using dual simplex method solve

$$\text{Minimize } Z = 3x_1 + x_2$$

$$\text{Subjected to } x_1 + x_2 \geq 1,$$

$$2x_1 + 3x_2 \geq 2,$$

$$x_1, x_2 \geq 0$$

(12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 3 a. A canning company operates 2 canning plants 3 growers are willing to supply fruit in following amounts:

Grower 1 : 200 quintals at Rs.10 per quintal

Grower 2 : 300 quintals at Rs.9 per quintal

Grower 3 : 400 quintals at Rs.8 per quintal

Plant capacity and labor costs are:

Plant A	Plant B
450	350
Rs.25	Rs.20

Capacity in quintals labor cost/quintal

Labor cost/quintal

Shipping charge in Rs. Per quintals are

Grower	Plant	
	To	from
1	2	2.5
2	1	1.5
3	5	3

The canning fruits are sold at Rs.50 per quintal to the distributor. Formulate a transportation model and find operation that, the company should plan at the plant so as to maximize the profit. (08 Marks)

- b. Solve the given transportation problem using North west corner method and check for the optimality. If the solution obtained is not optimum, find the optimum solution.

	W ₁	W ₂	W ₃	W ₄	W ₅	Available
F ₁	4	3	1	2	6	40
F ₂	5	2	3	4	5	30
F ₃	3	5	6	3	2	20
F ₄	2	4	4	5	3	10
Required	30	30	15	20	5	

(12 Marks)

- 4 a. Explain Hungarian assignment method with steps. (04 Marks)
- b. Five salesmen are to be assigned to five territories. Based on the past performance, the following table shows the annual sales (in lakh rupees) that can be generated by each salesman in each territory. Determine the optimum assignment.

	T ₁	T ₂	T ₃	T ₄	T ₅
S ₁	26	14	10	12	9
S ₂	31	27	30	14	16
S ₃	15	18	16	25	30
S ₄	17	12	21	30	25
S ₅	20	19	25	16	10

(06 Marks)

- c. Solve the assignment problem represented by the following matrix:

	a	b	c	d	e	f
A	9	22	58	11	19	27
B	43	78	72	50	63	48
C	41	28	91	37	45	33
D	74	42	27	49	39	32
E	36	11	57	22	25	18
F	3	56	53	31	17	28

(10 Marks)

PART – B

- 5 a. List any five principle assumptions made in sequencing problems. (05 Marks)
- b. There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times are given in below table:

		Processing time (Hrs)				
Job		1	2	3	4	5
Time for A		5	1	9	3	10
Time for B		2	6	7	8	4

Determine a sequence for five jobs that will minimize the elapsed time T. And also find total idle time for the machine in this period. (08 Marks)

- c. Use graphical method to minimize the time needed to process the following jobs on the machines shown below, i.e. for each machine find the job which should be done first. Also determine the total time required to compute both the jobs.

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

(07 Marks)

- 6 a. Two players A and B without showing each other, put on a table a coin, with head or tail up. A wins Rs.8, when both the coins show head and Rs.1, when both are tails. B wins Rs.3 when coins do not match. Given the choice of being matching player (A) or non-matching player (B), which one would be chosen and what would be the strategy for A and B. (06 Marks)
- b. Solve the following game graphically to find optimum strategies and value of game for player A and B:

		B		
		I	II	III
A	I	1	3	11
	II	8	5	2

(14 Marks)

- 7 a. List and explain four types of Queueing system patterns. (08 Marks)
- b. At what average rate must a clerk at a supermarket work in order to ensure a probabilities of 0.90 that the customer will not have to wait longer than 12 minutes. It is assumed that there is only one counter to which customer arrive in Poisson fashion at an average rate of 15 per hour. The length of service by the clerk has an exponential distribution. (04 Marks)
- c. Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of phone call assumed to be distributed exponentially with mean 3 minutes. Then,
- Find the probability that a person arriving at the booth will have to wait.
 - Determine the average length of queues that form from time to time.
 - The telephone department will install a second booth when convinced that an arrival would expect to have to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth? (08 Marks)

- 8 a. Define: i) Node ii) Critical path iii) Resource allocation. (06 Marks)
 b. Table below shows jobs, their normal time and cost and crash time and cost for a project:

Job	Normal time (days)	Cost (Rs.)	Crash time (days)	Crash cost (Rs.)
1-2	6	1400	4	1900
1-3	8	2000	5	2800
2-3	4	1100	2	1500
2-4	3	800	2	1400
3-4	Dummy	-	-	-
3-5	6	900	3	1600
4-6	10	2500	6	3500
5-6	3	500	2	800

Indirect cost for the project is Rs.300 per day.

- i) Draw the network of the project
 ii) Find the normal duration cost of the project
 iii) If all activities are crashed, what will be the project duration and corresponding cost
 iv) Determine the optimum duration and minimum project cost. (14 Marks)
