Total number of printed pages–8

25 (2) OPRE 208

2013

OPERATION RESEARCH

Paper : 208

Full Marks : 70

Time : Three hours

*The figures in the margin indicate full marks
for the questions.*

Answer *any five questions.*

1.   (a)   Discuss is brief, the role of Operations
Research in managerial decision-making.

6

(b)   A manufacturing company is engaged in
producing three types of products : A, B
& C. The production department
produces, each day, components
sufficient to make 50 units of A, 25 units
of B and 30 units of C. The management
is confronted with the problem of
optimizing the daily production of the
products in the assembly department,

Contd.

where only 100 man-hours are available daily for assembling the products. The following additional information is available :

TYPE OF PRODUCT	PROFIT CONTRIBUTION PER UNIT OF PRODUCT (Rs.)	ASSEMBLY TIME (hrs)
A	12	0·8
B	20	1·7
C	45	2·5

The company has a daily order commitment for 20 units of product A and a total of 15 units of products B and C. Formulate this problem as an LP model so as to maximize the total profit.

8

2. (a) An advertising agency wishes to reach two types of audience — target audience A and target audience B. The total advertising budget is Rs. 2,00,000. One TV advertising costs Rs. 50,000; one radio advertising costs Rs. 20,000. For contract reasons, at least three programmes ought to be on TV and the number of radio programmes must be limited to 5. Surveys indicate that a single TV programme reaches 4,50,000 prospective customers in target audience A and 50,000 in target audience B. One radio programme reaches 20,000 prospective customers in target audience A and 80,000 in target audience B. Determine the media mix so as to maximize the total reach. (Solve graphically).

10

(b) Explain how a profit maximization transportation problem can be converted to an equivalent cost minimization transportation problem.

4

3. (a) ABC Limited has three production centres that supply a product to five warehouses. The cost of production varies from shop to shop. The cost of transportation also varies from one production centre to a warehouse. The costs of transportation are given below :

		WAREHOUSE					
		I	II	III	IV	V	SUPPLY
PRODUCTION	A	6	4	4	7	5	100
CENTRE	B	5	6	7	4	8	125
	C	3	4	6	3	4	175
DEMAND		60	80	85	105	70	400

The cost of manufacturing the product at different production centres is :

PRODUCTION CENTRE	VARIABLE COST	FIXED COST
A	14	7,000
B	16	4,000
C	15	5,000

Find the quantity to be supplied from each production centre to different warehouses using the Vogels' Approximation Method. (initial solution only) 8

(b) A corporation has floated tenders for carrying out road repairs on four main roads of the city and five contractors have sent in their bids.

One road will be awarded to only one contractor. Cost of repairs (in lakhs) for the four roads by the different contractors is given below :

	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

(i) Find the best way of assigning the repair work to the contractors and the total cost.

(ii) Which of the five contractors will be unsuccessful in his bid ? 6

4. (a) What is a 0 – 1 integer programming problem (IPP) ? Describe two 0 – I IPPs. 6

(b) The following maintenance job comprising of 10 activities has to be performed periodically.

ACTIVITY	:	A	B	C	D	E	F	G	H	I	J
IMMEDIATE PREDECESSORS	:	A	B	B	B	C	C	F,G	D,E,H	I	
TIME (DAYS)	:	14	22	10	16	12	10	6	8	24	

(i) Draw a network diagram of activities of the project.

(ii) Identify the critical path. What is its length ?

(iii) Find the total float for each activity. 8

5. (a) Higgins Plumbing and Heating Maintains a stock of 30 gallon hot water heaters that it sells to home owners and installs for them. The owner likes the idea of having large supply on hand so as to

meet all customer demand, but he also recognises that it is expensive to do so. He examines hot water heater sales over the past 50 weeks and notes the following :

HOT WATER HEATER SALES PER WEEK	NUMBER OF WEEKS IT IS SOLD
4	6
5	5
6	9
7	12
8	8
9	7
10	3

Using the random numbers given below, simulate demand for 10 weeks and answer the following questions :

(i) If Higgins maintains a constant supply of 8 hot water heaters in any given week, how many times will he be out of stock during the 10-week simulation period ?

(ii) What is the average number heaters demanded per week over the 10-week interval.

Random Nos :
08, 48, 66, 97, 03, 96, 46, 74, 77, 44

10

(b) How can the concept of duality be useful in managerial decision-making ?
4

6. (a) Players A and B play a game in which each has three coins, a 5 paise, 10 paise and a 20 paise. Each selects a coin without knowledge of the other's choice. If the sum of the coins is odd, then A wins B's coin. But, if the sum is even, then B wins A's coin. Find the best strategy for each player and the value of the game.
8

(b) What is goal programming ? How does it differ from linear programming ? Why are all goal programming problems minimization problems ?
6

7. (a) A small project consists of seven activities, the details of which are given below :

ACTIVITY	DURATION (days)			IMMEDIATE PREDECESSOR
	MOST LIKELY	OPTIMISTIC	PESSIMISTIC	
A	3	1	7	–
B	6	2	14	A
C	3	3	3	A
D	10	4	22	B,C
E	7	3	15	B
F	5	2	14	D,E
G	4	4	4	D

(i) Draw the network and find the expected project completion time.

(ii) Identify the critical activities.

(iii) What is the probability of completing the project in 28 days ?

(iv) What project duration will have 95 per cent confidence of completion ?

$$9=(3+2+1+1 \cdot 5+1 \cdot 5)$$

(b) The marketing manager for Zenith Ltd. needs to determine the best location for the next national sales meeting. Three locations have been proposed : A, B and C. One criterion considered important is the desirability of the location in terms of the availability entertainment facilities. The manager made the following judgements with regard to this criterion :   5

    C is very strongly more preferred than A

    C is moderately more preferred than B

    B is moderately to strongly more preferred than A

(i) Set up the pairwise comparison matrix for this problem.

(ii) Determine the priorities for the desirability criterion.

———————