

# OR02

## Operation Research

Roll No.

Total No. Of Printed Pages :04

Total No. Of Questions : 06

Maximum Marks : 60

Duration (hrs.) : 3 hrs.

Note : Solve any four out of given six questions. Each Question is of 15 marks ( 15 x 4 = 60 marks ). Draw neat and clean diagram as per requirement of question.

( Marks 15 )

- Q) 1) Define slack and surplus variables in linear programming problem . Solve the following problem using simplex method :

$$\begin{aligned} \text{Maximize } Z &= 4X_1 + 3X_2 \\ \text{Subject to, } X_1 + X_2 &\leq 30 \\ 3X_1 + 2X_2 &\leq 50 \end{aligned}$$

Q) 2)

( Marks 7 1/2 )

- (a) Formulate LPP for the given problem and solve it with graphical method :

A company manufactures two products A and B . Both the products pass through two machines , M1 and M2. The time required to process each unit of product A and B on each machine and available capacity on each machine is given below :

Products / Machines	Machine M1 Processing time per unit(hrs.)	Machine M2 Processing time per unit(hrs.)
A	6	2
B	4	4
Available capacity	3600	2000

The availability of material is sufficient to produce 500 nos. of product A and 400 nos. of product B .

Each unit of product A gives a profit of Rs. 25 and each unit of product B gives a profit of Rs. 20 . How much quantity of each product should be manufactured to maximize profit ?

(Marks 7½)

Q.2)(b) Explain feasible solution. Define LPP with suitable examples. Find dual of given LP Problems

$$\begin{aligned} \text{Max } Z_x &= 5X_1 + 3X_2 \\ \text{Subject to,} \\ 5X_1 + 3X_2 &\geq 2 \\ X_1 - 3X_2 &\geq 3 \\ X_1, X_2 &\geq 0 \end{aligned}$$

(Marks 15)

Q) 3) A departmental head has four tasks and equal number of subordinates to perform these tasks. The subordinates differ in their capabilities and tasks differ in their work content and intrinsic difficulties. His estimate of time for each subordinate and each task is given in the matrix below subordinates and each task is given in the matrix below:

Tasks	Subordinates			
	I	II	III	IV
A	27	35	36	30
B	33	37	36	35
C	30	26	28	24
D	38	29	35	33

How the tasks should be assigned to minimize requirements of man – hours.

(Marks 7½)

Q) 4) a) Activity time data of a maintenance project is as follows:

Activity	Preceding Activity	Optimistic Time	Most Likely Time	Pessimistic Time
A	—	6	8	10
B	A	4	5	12
C	—	1	2	3
D	C	3	4	5
E	B, D	1	2	3
F	E	2	4	6
G	B, D	1	2	3
H	G	3	4	5
I	F	2	4	6

1. Draw the network of this project
2. Find critical path and time duration for the completion of project.

(Marks 7 ½ )

- Q.4) b Four factories A, B, C, and D produce sugar and the capacity of each factory is given. The sugar has demand in three markets X, Y, and Z. The following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations.

Factories / Markets	Cost in Rs per ton(x100)			Availability in tons.
	X	Y	Z	
A	4	3	2	10
B	5	6	1	8
C	6	4	3	5
D	3	5	4	6
Requirements in tons.	7	12	4	

Find the feasible solution for the given problem. Also test the non – degeneracy and optimality of the obtained solution

(Note: obtaining optimal solution is not required , only test the optimality of the obtained feasible solution.)

(Marks 7 ½ )

- Q.5) a) Solve the game whose payoff matrix is :

	Player X			
	X1	X2	X3	X4
Y1	1	4	- 2	- 3
Y2	2	1	4	5

(Marks 7 1/2 )

Q) 5) b. Explain running cost for equipment in the manufacturing company.

A firm is thinking of replacing a particular machine whose cost price is 12,200. The scrap value of machine is Rs. 200 /-. The maintenance costs are found to be as follows:

Year	1	2	3	4	5	6	7	8
Maintenance Cost in Rs.	220	500	800	1200	1800	2500	3200	4000

Determine when the firm should get the machine replaced.

(Marks 7 1/2 )

Q) 6) a) Inter – arrival time of workmen at a tool crib are exponential with an average time of 10 minutes. The length of the service time is distributed exponentially with a mean of 6 minutes. Find :

- average number of workmen at the crib stores .
- average time spent by the workman waiting for his turn .
- average time spent by the workmen at the crib store .
- fraction of the day that the crib clerk is idle .

(Marks 7 1/2 )

Q) 6) b) Write short notes on Inventory . Explain any one Inventory model.

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