Total No. of Questions : 8]

SEAT No. :

PB2223

[Total No. of Pages : 4

[6263]-60
B.E. (Civil)
OPERATIONS RESEARCH
(2019 Pattern) (Semester - VII) (401003 F) (Elective - III)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Use of calculator is allowed.***
4) ***Assume suitable data if necessary.***

Q1) a) Solve following example using Big M Method. **[8]**

Maximize $Z = 9x_1 + 6x_2$

Subject to

$5x_1 + 4x_2 \geq 20$

$x_1 + 2x_2 \leq 8$

$x_1, x_2 \geq 0$

b) Explain the difference between Big M method and Two Phase method. **[4]**

c) Explain following terms: **[6]**

i) Slack variables

ii) Surplus variable

iii) Artificial variable

OR

Q2) a) Solve using Simplex method **[8]**

Maximize $Z = 6x_1 + 6x_2$

Subject to

$5x_1 + 4x_2 \leq 20$

$x_1 + 2x_2 \leq 8$

$x_1, x_2 \geq 0$

b) Explain the Linear Programming Problems and various terms used in it by giving suitable example. **[6]**

P.T.O.

c) Construct dual of the primal equations. **[4]**

Minimize $Z = 6x_1 - 5x_2 + 8x_3$

Subject to

$3x_1 + 5x_2 + 4x_3 \leq 15$

$6x_1 + x_2 + 3x_3 \geq 4$

$7x_1 - 2x_2 - x_3 \leq 10$

$x_1 - 2x_2 + 5x_3 \geq 3$

$4x_1 + 7x_2 - 2x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

Q3) a) What is degeneracy in transportation problem? How is it resolved? **[4]**

b) What is unbalanced transportation problem? How is it solved? **[4]**

c) A department head has 4 subordinates and 4 jobs. The subordinates differ in efficiency and requirement varies as per job. The time (in hours) estimates for each subordinate to perform each job are given below. Find the allocation that minimizes the total time giving one job to each person. **[10]**

Subordinates	Jobs 1	2	3	4
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

OR

Q4) a) Write a short note on assignment problem and its applications in Civil Engineering. **[4]**

b) Compare assignment problem with transportation problem. **[4]**

c) Find initial solution of the following transportation problem using. **[10]**

i) Least cost method

ii) N-W corner method

iii) Column minima method

	A	B	C	Supply
1	20	70	40	50
2	30	30	10	80
3	50	40	70	70
4	10	60	20	140
Demand	70	90	180	

Which method gives the least cost for the above problem?

Q5) a) Optimize Z = $x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$ **[6]**

Subject to $x_1 + x_2 + x_3 = 20$

$x_1, x_2, x_3 \geq 0$

Use Lagragian Multiplier technique.

b) Carry out the calculation for finding the maxima of following equation using Fibonacci method with 1% accuracy in the interval (0, 5) upto two iterations only. **[8]**

Maximize $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$

c) Distinguish between Golden section method and Dichotomous Search method. **[3]**

OR

Q6) a) Maximize $Z = 6x_1 + 8x_2 - x_1^2 - x_2^2$ using Lagrangian Multiplier method **[8]**

Subect to

$4x_1 + 3x_2 = 16$

$3x_1 + 5x_2 = 15$

$x_1, x_2 \geq 0$

b) What are the similarities between Golden section and Fibonacci method? **[5]**

c) What are the managerial decisions making applications of mathematical programming models in which non linear objective functions, constraints and their solutions are expected? **[4]**

Q7) a) Consider following payoff matrix for two firms. **[10]**

Firm X Y Z

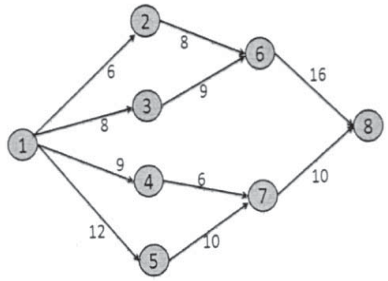
Firm ABC	X	Y	Z
A	75	52	44
B	84	80	55
C	92	74	81

i) Check whether there exists saddle point

ii) Give optimum strategy for both the firms

iii) Find the value of Game

b) Find the shortest path between nodes 1 and 8 using Dynamic programming method **[7]**



The numbers on the arrows represent the distance in kms.

OR

Q8) a) A wheel loader is purchased for Rs.30 lacs with expected life as 10 years. The running cost and resale price in lacs of Rs. is given in the following table.

Year	1	2	3	4	5	6	7	8	9	10
Running cost	1	2	2.5	3	4	7	9	11	12.5	15
Resale price	24	21	20	19	16	14	12	10	7	5

Find the replacement year for the wheel loader. **[9]**

b) Write the applications of following OR techniques in the field of Civil Engineering **[8]**

i) Dynamic Programming

ii) Games Theory

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