20/2915

B.A./B.Sc. (Third Year) Examination, 2020

MATHEMATICS

Fourth Paper (Optional)

(B) Linear Programming

Time : Three Hours ***Maximum Marks : 75***

Note: Answer **five** questions in all. Question **No.1** is **compulsory**. Answer **one** question from each unit. Marks allotted to each question are indicated in the right-hand margin.

Note: The answers to short answer type questions should not exceed 200 words and the answers to long answer type questions should not exceed 500 words.

1. Answer the following in brief : $3\frac{1}{2} \times 10 = 35$

(i) Define slack and surplus variables in a L.P.P.

(ii) Convert the following L.P.P. into standard form :

Max $Z = x_1 + 5x_2$

Subject to constraints

$$2x_1 + 3x_2 \leq 6$$

$$5x_1 + x_2 \geq 4$$

and $x_1, x_2 \geq 0$

(iii) Prove that the hyperplane

$H = \{(x_1, x_2, x_3) \in IR^3 | \; x_1 + x_2 + x_3 = 5\}$

is a convex set.

(iv) Define balanced and unbalanced transportation problem.

(v) Define a strictly convex function.

(vi) Define a feasible and optimal solution of a L.P.P.

(vii) Find the solution set of the inequality

$x - y \geq 0$.

(viii) What is cycling? Define degenerate basic feasible solution.

(ix) Write the dual of the L.P.P. :

Find $x_1, x_2, \ldots, x_n$ which maximize the objective function

$$Z_p = c_1x_1+c_2x_2+\ldots+c_nx_n$$

s.t. $a_{11}x_1+a_{12}x_2+\ldots+a_{1n}x_n \leq b_1$

$a_{21}x_1+a_{22}x_2+\ldots+a_{2n}x_n \leq b_2$

:

:

$a_{m1}x_1+a_{m2}x_2+\ldots+a_{mn}x_n \leq b_n$

and $x_1, x_2, \ldots, x_n \geq 0$.

(x) Define integer programming problems. Give an example of an integer programming problem.

Unit - I

2. (a) Solve the following L.P.P. Graphically: 5

Max $z = 3x_1 + 2x_2$

s.t. $x_1 - x_2 \leq 1$

$x_1 + x_2 \geq 3$

$x_1, x_2 \geq 0$

(b) Express the following L.P.P. in standard form : 5

Minimize $Z = 2x_1 + 3x_2$

s.t. $2x_1 - 3x_2 \leq 5$

$-x_1 + 3x_2 \geq -21$,

$x_1 \geq 0$ and x_2 - unrestricted.

OR

3. (a) A goldsmith manufactures necklaces and bracelets. The total number of necklaces and bracelets that he can handle per day is at most 30. It takes 3 hours to make a bracelet and 5 hours to make a necklace. It is assumed that he

can work for a maximum of 26 hours a day. Further the profit on a bracelet is Rs. 500 and the profit on a necklace is Rs. 200. Formulate this problem as a linear programming problem so as to maximize the profit. 5

(b) Solve by the graphical method : 5

Max $Z = 10x_1+6x_2$

s.t. $5x_1+3x_2 \leq 30$

$x_1+2x_2 \leq 18,$

$x_1, x_2 \geq 0.$

Unit - II

4. Solve the following L.P.P. by Simplex-method

Max $Z = 3x_1 + 2x_2$ 10

s.t. $x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0.$

OR

5. Using Two-Phase method to solve the following L.P.P. 10

Min $Z = x_1+x_2$

s.t. $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 7$

$x_1, x_2 \geq 0$

Unit - III

6. Solve the following L.P.P. by Big M-method :

Max $z = -x_1 - x_2$ 10

subject to

$3x_1 + 2x_2 \geq 30$

$2x_1 - 3x_2 \geq 30$

$x_1 + x_2 \geq 5$

and $x_1, x_2 \geq 0$

OR

7. For the Linear Programming : 10

Max Z = $5x_1+3x_2$

s.t. $3x_1 + 5x_2 \leq 15$

$5x_1+ 2x_2 \leq 10$

and $x_1, x_2 \geq 0$

Find the optimal solution. Hence find how the component c_1 of the vector of the function z=cx can be increased without affecting the optimization of the solution.

Unit - IV

8. Solve the following transportation problem-

Plant	A	B	C	Available Plants a_i
X	11	21	16	14
Y	7	17	13	26
Z	11	23	21	36
Requirement	18	28	25	

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20/2914 - 20/2919

OR

9. (a) Find initial basic feasible solution of the transportation problem using North-West corner rule method : 5 1 5

		Warehouse W_1	W_2	W_3	W_4	Capacity
Factory	A	19	30	50	10	7
	B	70	30	40	60	9
	C	40	8	70	20	18
Requirement		5	8	7	14	

(b) Solve the minimal assignment problem whose effectiveness matrix is

	A	B	C	D
I	8	26	17	11
II	13	28	4	26
III	38	19	18	15
IV	19	26	24	10

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