Reg. .....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2013

(CCSS)

Mathematics

MM 6B 13 (E02)—LINEAR PROGRAMMING

ıe : Three Hours Maximum : 30 Weightage

Part I

Answer **all** *questions.*

1. Define a slack variable.
2. Define a convex set in
3. State True or False :

   The union of two convex sets is convex.
4. Define non-degenerate basic solution of the system AX = B.
5. What is the optimality criterion for the basic feasible solution of a maximization L.P.P. ?
6. Define artificial variable.
7. The primal has 5 decision variables and 3 constraints. Then its dual has _____ decision variables and _____ constraints.
8. Dual of the dual is the ———
9. Define a loop in a Transportation Problem (TP).
10. State True *or* False :

    A balanced TP always possesses a finite feasible solution and an optimal solution.
11. The number of zeros in a non-degenerate basic feasible solution of a balanced Transportation Problem with 4 sources and 5 destinations is _____
12. The decision variables *in an Assignment problem are
    (a) 1 only.
    (b) 0 only.
    (c) Either 1 or 0.
    (d) None of these.

(12 x d = 3 weightage)

Turn over

Part II

Answer **any nine** *questions.*

13. Write in standard form :

Maximize $z = 3x_1 - x_2$

subject to

$x1 - 2x_2 \leq -3$

$4x_1 + x_2 < 4$

$x_i, X2 \geq 0.$

14. Show that $k = \{(x, y) \text{ E } R2 ; x^2 + y^2 < 9\}$ **is convex.**

15. Show that every hyperplane **in** $\mathbb{R}^n$ **is convex.**

16. Show that a set '5' is convex in E^n implies that every convex combination of points in S 1 in S.

17. Show that an optimal solution of

Minimize $z = cx$

subject to Ax s b, $x \geq 0$ **is also an optimal solution of**

Maximize $z' = -cx$,

$Ax \leq b \quad x \geq 0$.

18. Find the dual of :

Minimize $z = 4x_1 - x_2$

subject to

$x1 + x_2 5\_4$

$2x_1 - x_2 \quad 3$

$x_1 \quad 0$

x_2 **unrestricted.**

19. State the Fundamental Theorem of Linear Programming.

20. Find an IBFS by NWCR :

	A	B	C	D	
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
	6	10	12	15	

21. Find an IBFS to the above problem by the matrix minimum method.

22. Test optimality of the Basic Feasible Solution $x_{12} = 30$, $x_{21} = 10$, $x_{22} = 10$, $x_{23} = 30$, $x_{31} = 10$, $x_{33} = 10$ for the Transportation Problem given below :

	A	B	C	D	
I	2	1	3	4	30
II	3	2	1	4	50
III	5	2	3	8	20
	20	40	30	10	

23. Give the Mathematical Form of the Assignment Problem.

24. What is a restrictive Assignment Problem and how is it tackled ?

(9 x 1 = 9 weightage)

Part III

Answer any five *questions.*

25. State and prove a necessary and sufficient condition for a set S in E to be convex.

26. Show that the basic feasible solutions of Ax b are the extreme points.

27. Explain in simple steps the computational procedure of the simplex method.

28. Solve : Maximize $z = x_1 + 5x_2$

subject to

$x_1 + 10x_2$ 20

2

$x_1, x2 \geq 0.$

29. Solve Maximize $z = 2x_1 - 3x_2$

subject to

$-x_1 + x_2$ —2

$5x_1 + 4x_2$ 46

$7x_1 + 2x_2$ $2

xi, x_2 O.

Turn over

30. Find an IBFS by VAM and test for optimality :

A	B	C	
10	9	8	8
10	7	10	7
11	9	7	9
12	14	10	4
10	10	8	

31. Solve the following minimization Assignment Problem

	1	2	3	4	5
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

32. Prove that in a balanced TP, there are at most m n -1 basic variables (m – *no:* of sour
n – *no* : of destinations).

(5 x 2 = 10 weights

Part IV

Answer* both *questions.

33. Solve the following Transportation Problem to obtain the optimal solution :

	A	B	C	D	
I	6	1	9	3	70
II	11	5	2	8	55
III	10	12	4	7	90
	85	35	50	45	

34. Solve the following maximization Assignment Problem :

	1	2	3	4	5
A	9	3	4	2	10
B	12	10	8	11	9
C	11	2	9	0	8
D	8	0	10	3	7
	7	5	6	2	9

(2 x 4 = 8 weights