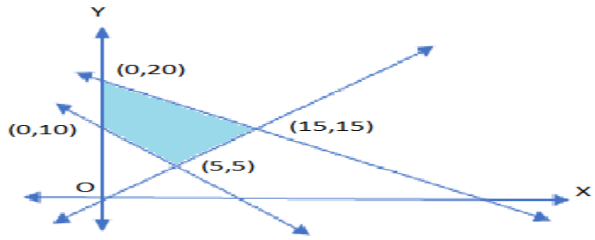
CHAPTER-12

LINEAR PROGRAMMING PROBLEMS

01 MARK TYPE QUESTIONS

Q. NO	**QUESTION**	**MARK**
1.	The optimum value of the objective function is attained at the points (A) given by the intersections of inequalities with the xx- axis only. (B) given by the intersections of inequalities with xx- axis and yy- axis only. (C) given by the corner points of the feasible region. (D) none of these.	1
2.	Objective function of an LPP is ….. (A) a constraints (B) a function which is to be optimized. (C) A relation between variables. (D) none of these.	1
3.	Which of the following is correct? (A) LPP always has a unique solution. (B) every LPP has a unique solution. (C) LPP admits two optimal solution. (D) if an LPP admits two optimal solution, then it has infinitely many optimal solution.	1
4.	The feasible region of an LPP is shown in figure. If Z = 3x + 9y, then the minimum value of Z occurs at  (A) (5,5) (B) (0,5) (C) (0,20) (D) (15,15)	1
5.	The corner points of the feasible region determined by the system of linear constraints are $(0,2),(3,0),(6,0),(6,8)(0,2),(3,0),(6,0),(6,8)$ and $(0,5)(0,5)$. The objective function is $F=4x+6y.F=4x+6y.$ The minimum value of FF occurs at (A) $(0,2)(0,2)$ only (B) $(3,0)(3,0)$ only (C) the mid-point of the line segment joining the points $(0,2)(0,2)$ and $(3,0)(3,0)$ (D) any point on the line segment joining the points $(0,2)(0,2)$ and $(3,0)(3,0)$	1
6.	An LPP is one that is concerned with finding __________________of a linear function called__________________function of several variables (say xx and yy), subject to the conditions that the variables are _____________ and satisfy set of linear inequalities called linear constraints. (A) objective, optimal value, negative. (B) optimal value, objective, negative. (C) optimal value, objective, negative. (D) objective, optimal value, non – negative..	1

7.	Which of the following points is not in the feasible region of the constraints : $x + 2y \leq 8 , 3x + 2y \leq 12 , x \geq 0 , y \geq 0$ $x + 2y \leq 8 , 3x + 2y \leq 12 , x \geq 0 , y \geq 0$ (A) (0 , -1) (B) (0 ,1) (C) (2 , 2) (D) (4 , 0)	1
8.	If the feasible region for an LPP is ___________, then the optimal value of the objective function $Z = ax + byZ = ax + by$ may or may not exist. (A) bounded. (B) unbounded. (C) in circle form. (D) in pentagon form.	1
9.	The solution set of the inequation $x + 2y > 3\, x + 2y > 3$ is ….. (A) half plane containing the origin. (B) open half plane not containing the origin. (C) first quadrant (D) none of these.	1
10.	Corner points of the feasible region determined by the system of linear constraints are $(0,3), (1,1)(0,3), (1,1)$ and $(3,0)(3,0)$. The objective function is $Z = px + qy$ $Z = px + qy$, where $p, q > 0 . p, q > 0.$ Condition on pp and qq so that the minimum of ZZ occurs at $(3,0)(3,0)$ and $(1,1)(1,1)$ is (A) $p = 2qp = 2q$ (B) $p = \frac{q}{2}p = \frac{q}{2}$ (C) $p = 3qp = 3q$ (D) $p = qp = q$	1
11.	The solution set of the inequality $3x + 4y \ < 4$ is (a) An open half-plane not containing the origin (b) An open half-plane containing the origin (c) The whole xy plane not containing the line $3x + 4y = 4$ (d) A closed half-plane containing the origin	1
12.	The corner points of the shaded unbounded feasible region of an LPP are $(0,4), (0.6,1.6)$ and $(3,0)$ as shown in the figure. The minimum value of the objective function $Z = 4x + 6y$ occurs at (a) $(0.6, 1.6)$ only (b) $(3,0)$ only (c) $(0.6, 1.6)$ and $(3,0)$ only (d) At every point of the line segment joining the points $(0.6, 1.6)$ and $(3,0)$	1
13.	The corner points of the feasible region determined by the system of linear constraints are $(0,3), (1,1)$ and $(3,0)$. Let $Z = px + qy$, where $p, q \ > 0$. Conditions on p and q so that the minimum of z occurs at $(3,0)$ and $(1,1)$. (a) $p = 3q$ (c) p = 3q (b) $2p = q$ (d) p = q	1
14.	Objective function of an LPP is (a) a constraint (b) a function to be optimized (c) a relation between variables (d) none of these	1
15.	Let X_1 and X_2 are optimal solutions of a LPP, then (a) $X = \lambda X_1 + (1 - \lambda) X_2$, where $\lambda \in R$ is also an optimal solution.	1

	(b) $X = \lambda X_1 + (1-\lambda)X_2$, where $0 \le \lambda \le 1$ gives an optimal solution. (c) $X = \lambda X_1 + (1+\lambda)X_2$, where $0 \le \lambda \le 1$ gives an optimal solution. (d) None of these	
16.	For the LP problem Minimize z = 2x + 3y the coordinates of the corner points of the bounded feasible region are $A(3,3), B(20,3), C(20,10), D(18,12)$ and $E(12,12)$. The minimum value of Z is (a) 49 (b) 15 (c) 10 (d) 05	1
17.	For the LP problem maximize z = 2x + 3y. The coordinates of the corner points of the bounded feasible region are $A(3,3), B(20,3), C(20,10), D(18,12)$ and $E(12,12)$. The minimum value of z is (a) 72 (b) 80 (c) 82 (d) 70	1
18.	Solution of following LP problem Maximize z= $2x + 6y$ subject to $-x + y \le 1,\ 2x + y \le 2, x, y \ge 0$ (a) $\frac{4}{3}$ (b) $\frac{1}{3}$ (c) $\frac{26}{3}$ (d) No feasible region	1
19.	Solution of the following LP problem Minimize $z = -3x + 2y$ subject to $0 \le x \le 4, 1 \le y \le 6, x + y \le 5$ is (a) -10 (b) 0 (c) 2 (d) 10	1
20.	For the LP problem Minimize $z = 2x + 3y$ the coordinates of the corner points of the bounded feasible region are $A(3,3), B(20,3), C(20,10), D(18,12)$ and $E(12,12)$. The minimum value of z is_____ (a) 49 (b) 15 (c) 10 (d) 05	1
21.	Objective function of a linear programming problem is (A) constant (B) A relation between variables (C) function to be optimized (D) none	1
22.	The maximum value of the objective function Z =5x+10y subject to constraints x+2y ≤ 120 x+y≥60 x-2y ≥0 x,y≥ 0 is A) 300 (B)600 (C) 400 (D)none	1
23.	Observe the following : 3x-y≥ 3 and 4x -4y > 4 . Choose the correct option . Both	1

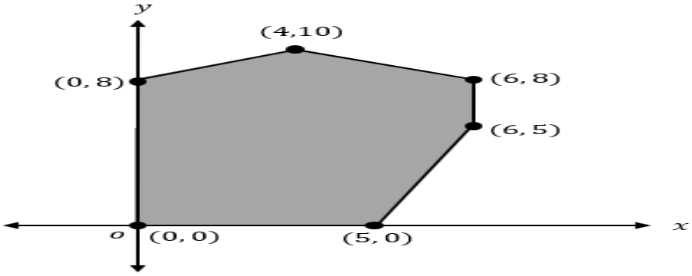
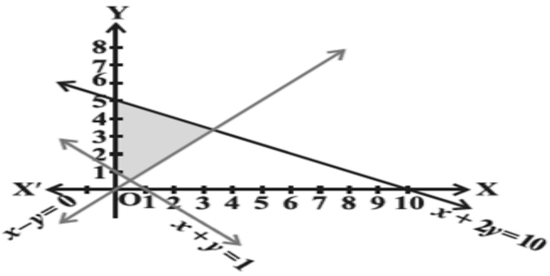
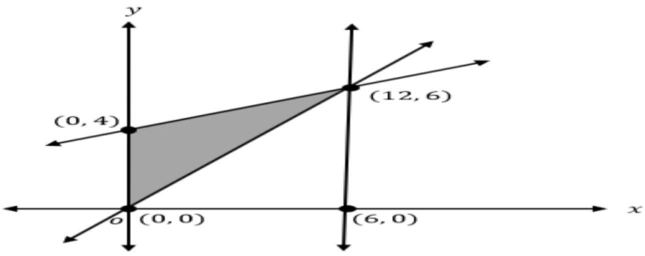
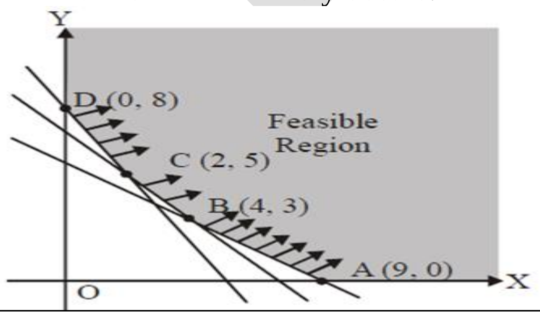
	(A) have solution for positive x and y (B) have no solution for positive x and y (C) have solution for all x (D) have solution for all y	
24.	The maximum value of Z =3x + 4y subject to constraints $x+y\leq 40$ $x+2y \leq 60$, x and y both positive is (A) 120 (B)140 (C)100 (D) none	1
25.	The minimum value of the objective function Z =x+2y subject to constraints $x+2y \geq 100$, $2x-y \leq 0$, $2x+y\leq 200$ $x,y\geq 0$ is A) 100 (B)600 (C) 400 (D)none	1
26.	The optimal value of the objective function is attained at the points (A) on x axis (B)on y axis (C)which are common points of the feasible region (D)none	1
27.	What do you mean by the optimal value? A) The minimum value only (B)The maximum value only (C) The maximum or minimum value (D)none	1
28.	The restrictions on the variables in linear programming problem are known as (A) optimal values (B)constraints (C) feasible region (D)none	1
29.	The maximum value of the objective function Z =x+2y subject to constraints $x+2y \geq 100$, $2x-y \leq 0$, $2x+y \leq 200$ $x, y\geq 0$ is (A) 100 (B)600 (C) 400 (D)none	1
30.	If the feasible region lies only on a line segment , the optimal value (A) lies on the line segment (B) lies on the line if produced to one side (C) lies on the line if produced to both sides (D)none	1

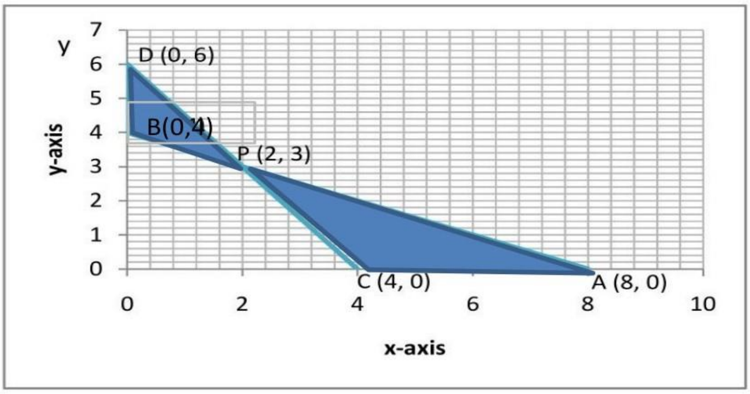
ANSWERS:

Q. NO	ANSWER	MARKS
1.	ANSWER: C	1
2.	ANSWER: B	1
3.	ANSWER: D	1
4.	ANSWER -A	1
5.	ANSWER: D	1
6.	ANSWER: C	1
7.	ANSWER -A	1
8.	ANSWER: B	1
9.	ANSWER: B	1
10.	ANSWER: B	1
11.	(b)	1
12.	(d)	1
13.	(b)	1
14.	(b)	1
15.	(b)	1
16.	(a)	1
17.	(a)	1
18.	(c)	1
19.	(a)	1
20.	(b)	1
21.	B	1
22.	B	1
23.	A	1
24.	B	1
25.	A	1
26.	C	1
27.	C	1
28.	B	1
29.	C	1
30.	A	1

LINEAR PROGRAMMING PROBLEMS

02 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	The feasible solution for an LPP is shown in given figure. Let, $Z = 3x - 4yZ = 3x - 4y$ be the objective function. Determine a point in which ZZ attains its minimum value .  	2
2.	Write the linear inequations for which the shaded area in the following figure is the solution set.  	2
3.	The feasible region for an LPP is shown in the given figure. Let, $F = 3x - 4yF = 3x - 4y$ be the objective function. Find the Maximum value of FF  	2
4.	Determine the minimum value of Z = 6x + 16y, in which the constraints are x $\leq 40\leq 40$, y $\geq\geq$20 and x, y $\geq\geq$ 0	2
5.	. Feasible region for an LPP is shown shaded in the following figure. Find the point where minimum of Z = 4 x + 3 y occurs.  	2
6.	Maximize $Z = 3x + 4y$ subject to the constraints: $x + y \leq 4, x, y \geq 0$.	2
7.	Solve the following LPP graphically: Minimize $Z = 5x + 10y$ subject to the constraints	2

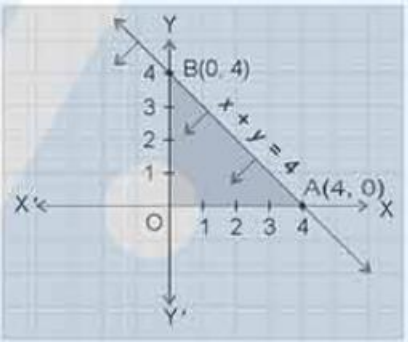
	$x + 2y \leq 120$ $x + y \geq 60,$ $x - 2y > 0$ and $x, y \geq 0$	
8.	Solve the following LPP graphically: Maximize $Z = 40x + 50y$ subject to the constraints $3x + y \leq 9$ $x + 2y \leq 8,$ $x, y \geq 0$	2
9.	Solve the following linear programming problem graphically: Minimize Z = 200 x + 500 y subject to the constraints: $x + 2y \geq 10$ $3x + 4y \leq 24$ $x \geq 0, y \geq 0$	2
10.	Minimize $Z = 3x + 2y$ subject to the constraints $x + y \geq 8, 3x + 5y \leq 15, x \geq 0, y \geq 0$	2
11.	Find the Corner points of the following LPP: To maximize $Z = 2x + 5y$ Subject to $0 \leq x \leq 4,$ $0 \leq y \leq 3,$ $x + y \leq 6$	2
12.	 i) Vertically shaded region is determined by the following constraints: a) $x \geq 0, x + 2y \leq 8, 3x + 2y \geq 12$ b) $x \geq 0, x + 2y \leq 8, 3x + 2y \leq 12$ c) $x \geq 0, x + 2y \geq 8, 3x + 2y \leq 12$ d) None of the above ii) Horizontally shaded region is determined by the following constraints: a) $y \geq 0, 3x + 2y \geq 12, x + 2y \leq 8$ b) $y \geq 0, 3x + 2y \leq 12, x + 2y \leq 8$ c) $y \geq 0, 3x + 2y \geq 12, x + 2y \geq 8$ d) None of the above	2
13.	To minimize $Z = x + 2y$ Subject to $3x + 4y \leq 12$ $5x + 3y \leq 15$ $x, y \geq 0$ Solve the LPP.	2
14.	A manufacturer of bags makes two types of bags A and B. In a factory maximum 48 hours of time per week is available to get the work done. It takes 2 hours to make a bag A and 3	2

	hours to make a bag B. The profit per unit of A and B are Rs. 30 and Rs. 50 respectively. In a week highest 15 units of bag A and 10 units of bag B are to be sold.  Find out the production of each type of bags such that the profit be maximum.	
15.	A soft drink plant has two bottling machines P and Q. It produces and sells 500ml and 800ml bottles.  Weekly productions of the drink can not exceed 40,00,000 ml. and the market can absorb 4000 bottles of 500 ml and 1500 bottles of 800 ml per week. Profit on two types of bottles is 15 paise and 25 paise respectively. The planner wishes to maximize his profit to all the productions and marketing restrictions. Solve it as a LPP.	2
16.	Maximize $Z = 5x+7y$ subject to the constraints $x + y \leq 4$, $3x+8y \leq 24$, $10x+7y \leq 35$ $x,y \geq 0$	2
17.	Minimize $Z = 3x+5y$ subject to constraints $-2x+y \leq 4$, $x+y \geq 3$, $x-2y \leq 2$ $x,y \geq 0$	2
18.	Maximize $Z = 8x+9y$ subject to the constraints $2x + 3y \leq 6$, $3x - 2y \leq 6$, $y < 1$, $x,y \geq 0$	2

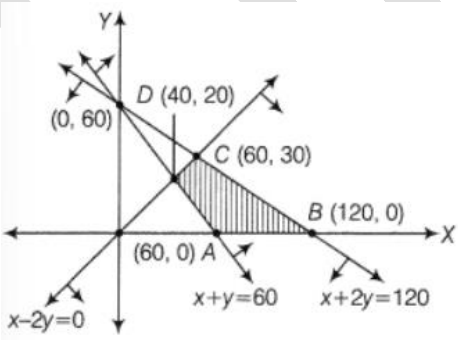
19.	Maximize $Z = 25x+15y$ subject to constraints $2x+y \leq 12$, $3x+2y \leq 20$, $x, y \geq 0$ is	2
20.	Minimize $Z=4x+6y$ subject to constraints $4x+3y \geq 100$, $3x+6y \geq 80$, and $x, y \geq 0$ is	2

<u>**ANSWERS:**</u>

<table>
<tr><th>Q. NO</th><th>ANSWER</th><th>MARKS</th></tr>
<tr><td>1.</td><td>(0,8)(0,8)</td><td>2</td></tr>
<tr><td>2.</td><td>x + 2y ≤ 10, x + y ≥ 1, x – y ≤ 0, x , y≥ 0</td><td>2</td></tr>
<tr><td>3.</td><td>1212</td><td>2</td></tr>
<tr><td>4.</td><td>320</td><td>2</td></tr>
<tr><td>5.</td><td>(2,5)</td><td>2</td></tr>
<tr><td>6.</td><td>Table of values for line $x + y = 4$
<table>
<tr><td>x</td><td>0</td><td>4</td></tr>
<tr><td>y</td><td>4</td><td>0</td></tr>
</table>
Feasible region of the LPP is as shown in the figure

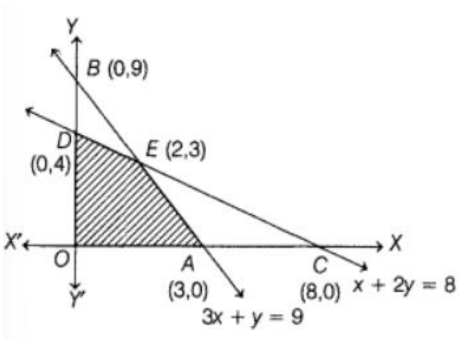


Corner point of the LPP is (0,0), (0,4), (4,0)
<table>
<tr><th>Corner Point</th><th>$z = 3x + 4y$</th></tr>
<tr><td>(0,0)</td><td>0</td></tr>
<tr><td>(4,0)</td><td>12</td></tr>
<tr><td>(0,4)</td><td>16= M</td></tr>
</table>
Hence max value of Z is 16 at point (0,4).</td><td></td></tr>
<tr><td>7.</td><td>The feasible region of the LPP is shown in the figure



<table>
<tr><th>Corner Points</th><th>$Z = 5x + 10y$</th></tr>
<tr><td>(60,0)</td><td>300(minimum)</td></tr>
<tr><td>(120,0)</td><td>600</td></tr>
<tr><td>(60,30)</td><td>600</td></tr>
<tr><td>(40,20)</td><td>400</td></tr>
</table>
Hence the minimum value of the Z is 300 at the point (60,0).</td><td></td></tr>
</table>

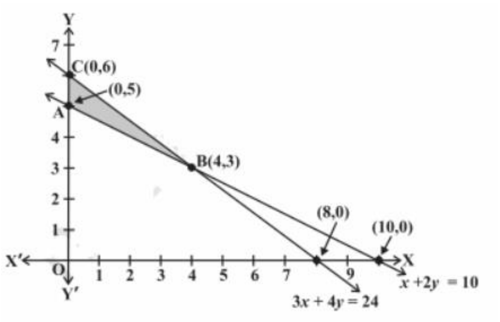
8. The feasible region of the LPP is shown in the figure



Corner Points	$Z = 40x + 50y$
(0,0)	0
(3,0)	120
(2,3)	230
(0,4)	200

Hence the maximum value of Z is 230 at point (2,3).

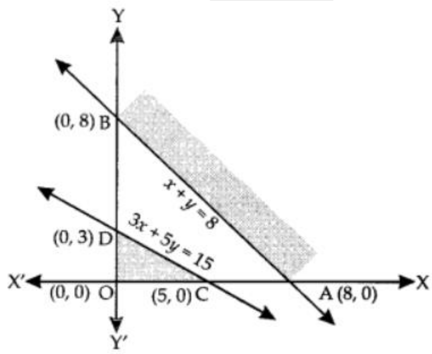
9. The feasible region of the given LPP is as shown below



Corner Points	Z
(0,5)	2500
(4,3)	2300 Minimum
(0,6)	3000

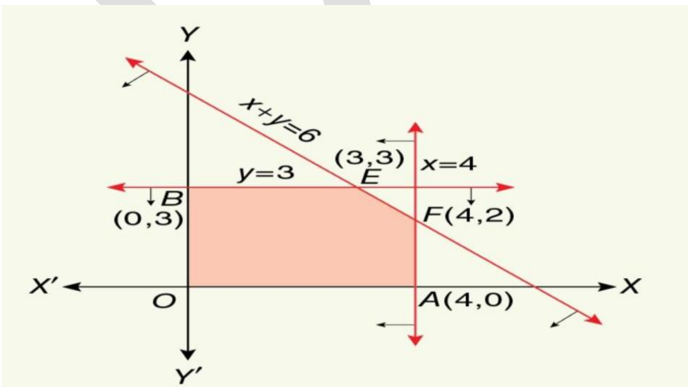
Hence the minimum value of Z is 2300 at point (4,3).

10. The region made by the given linear constrains as given in the figure



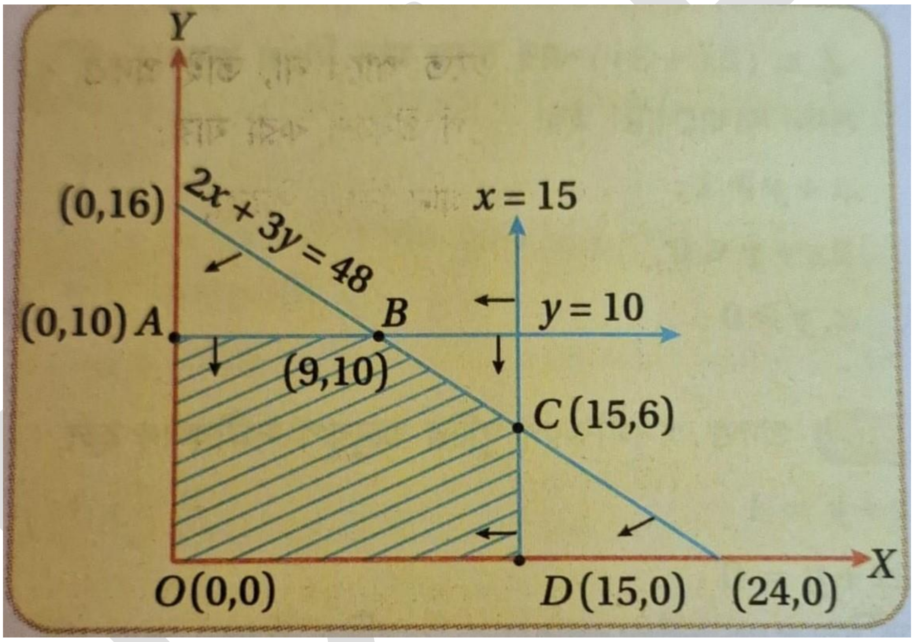
It is observed that there is no point which satisfies all the linear constrains simultaneously. Thus, there is no feasible region.
Hence, there is no feasible solution.

11. (2)



In the feasible region OAFEB
The Corner points are O(0,0), A(4,0),F(4,2), E(3,3), B(0,3)

12. (2)
i) c)
ii) a)

13.	OX and OY are two axes. $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$ represent the straight lines $5x + 3y = 15$ and $3x + 4y = 12$ respectively. The convex set of the feasible region is OABC where the extreme points O(0,0), A(3,0), B($\frac{24}{11}, \frac{15}{11}$), C(0,3) Now, At O, $Z = 0 + 2 \times 0 = 0$ At A, $Z = 3 + 2 \times 0 = 3$ At B, $Z = \frac{24}{11} + 2 \times \frac{15}{11} = \frac{54}{11}$ At C, $Z = 0 + 2 \times 3 = 6$ Thus Min $Z = 0$ At O(0,0)	2
14.	Let, the number of bag A and bag B are x and y respectively. Then the profit is $30x + 50y$ From the conditions, we get $2x + 3y \leq 48$, Since x and y can not be negative, then, $x, y \geq 0$ Thus the required problem is, Maximize, $Z = 30x + 50y$, Subject to $2x + 3y \leq 48$ $x \leq 15$, $y \leq 10$ and $x, y \geq 0$  In Cartesian Plane, we have drawn three straight lines such that $2x + 3y = 48, x = 15, y = 10$. The convex set of the feasible region is PQRSO. It is a bounded region and the corner points are O(0,0), P(0,10), Q(9,10), R(15,6), S(15,0). Now, At O, $Z = 30 \times 0 + 50 \times 0 = 0$ At P, $Z = 30 \times 0 + 50 \times 10 = 500$ At Q, $Z = 30 \times 9 + 50 \times 10 = 770$ At R, $Z = 30 \times 15 + 50 \times 6 = 750$ At S, $Z = 30 \times 15 + 50 \times 0 = 450$ Thus Max Z= 770 at Q(9,10), Hence, the productions of Bag A and B are 9 and 10 respectively. And maximum profit is Rs. 770	2

15.	Let, x and y be number of 500 ml and 800 ml bottles produced to get over all maximum profit. Then the profit is Rs. $\left(x \times \frac{15}{100} + y \times \frac{25}{100}\right) =$ Rs. $(0.15x + 0.25y)$ (say) From the market condition, we get $x \leq 4000$ $y \leq 1500$ The amount of soft drinks is $(500x + 800y)$ ml Then $(500x + 800y) \leq 40{,}00{,}000$ Thus the problem is, Maximize, $Z = 0.15x + 0.25y$ Subject to $(500x + 800y) \leq 40{,}00{,}000$ $x \leq 4000$ $y \leq 1500$ and $x, y \geq 0$ Here from the equations $(500x + 800y) = 40{,}00{,}000$, $x = 2500$, $y = 7000$ we get the extreme points. They are O(0,0), C(4000,0), A(4000,2500), B(5600,1500), D(0,1500) Now, At O, $Z = 0.15 \times 0 + 0.25 \times 0 = 0$ At C, $Z = 0.15 \times 4000 + 0.25 \times 0 = 600$ At A, $Z = 0.15 \times 4000 + 0.25 \times 2500 = 1225$ At B, $Z = 0.15 \times 5600 + 0.25 \times 1500 = 1215$ At D, $Z = 0.15 \times 0 + 0.25 \times 1500 = 375$ Thus, Max $Z = 1225$ at $x = 4000, y = 2500$	2
16.	Maximum value of Z = 124/5 at (8/5,12/5)	2
17.	Minimum value of Z =9 at (3,0)	2
18.	Maximum value of Z =22.62 at x= 30/13 and y =6/13	2
19.	Z= 60 at x=4 and y =4	2
20.	Z = 104 when x =24 and y =4/3	2

CHAPTER-12
LINEAR PROGRAMMING PROBLEMS
03 MARKS TYPE QUESTIONS

Q. NO	**QUESTION**	**MARK**
1.	If The corner points of the feasible region of an LPP are (0, 0) (0, 8) , (2, 7), (5,4) and (6,0). Then at what point the maximum profit $\boldsymbol{P = 3x + 2y}$ $\boldsymbol{P = 3x + 2y}$ occurs .	3
2.	A health enthusiast wishes to mix two types of foods in his diet, in such a way that vitamin content of the mixture contains at least 10 units of vitamin B and 13 units of vitamin C. Food (F1) contains 1 unit/kg of vitamin B and 2 units/kg of vitamin C. Food (F2) contains 2 unit/kg of vitamin B and contains 1 unit/kg of vitamin C. F1 costs Rs 60/kg and F2 costs Rs 80/kg. Frame his diet plan making a linear programming problem in order to minimize the cost of the mixture.	3
3.	A small firm manufacturers gold rings and chains. The total number of rings and chains manufactured per day is atmost 24. it takes 1 hour to make ring and 30 minutes to make a chain. The maximum number of hours available per day is 16 . If the profit on a ring is Rs.300 and that on a chain is Rs.190. Firm is concerned about earning maximum profit on the number of rings$(x)(x)$ and chains$(y)(y)$ that have to be manufactured per day. Using the above information formulate the LPP.	3
4.	Maximize $Z = 3x + 2y$ subject to $x + 2y \leq 10, 3x + y \leq 15, x, y \geq 0$.	3
5.	Minimize $Z = x + 2y$ Subject to $2x + y \geq 3, x + 2y \geq 6, x, y \geq 0$. Show that the minimum of Z occurs at more than two points.	3
6.	Minimize and maximize $Z = x + 2y$ subject to $x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0$	3
7.	Minimize Z=150x +200y subject to constraints 3x +5y ≥30 x+y≥8 and for positive x and y	3
8.	If Z=24x+18y with the constraints The maximum value of the objective function Z =x+2y subject to constraints x+2y ≥ 100, 2x +3y ≤ 10, 3x+2y ≤ 10 x,y≥ 0 . Can we get (0,2) as a corner point?	3
9.	Given that Z=7x +4y Constraints 3x+2y ≤12, 3x+y ≤ 9, x,y≥ 0 Find the corner points .	3

ANSWERS:

Q. NO	ANSWER	MARKS
1.	(5,4)	3
2.	**Solution:** Let x and y represent the number of units of vitamin B and C, respectively.	3

Subject to constraints:

$x, y \geq 0$ (Non−negative constraints)

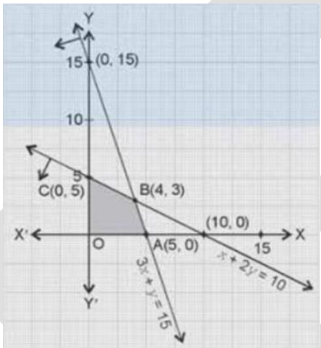
$x + 2y \geq 10$ (Vitamin B constraint)

$2x + y \geq 13$ (Vitamin C constraint)

Resources	Food (F1)	Food (F2)
Vitamin (B)	1	2
Vitamin (C)	2	1
Total Cost	Rs 60/kg	Rs 80/kg

Objective function: Z = 60x + 80y (objective is to minimize cost)

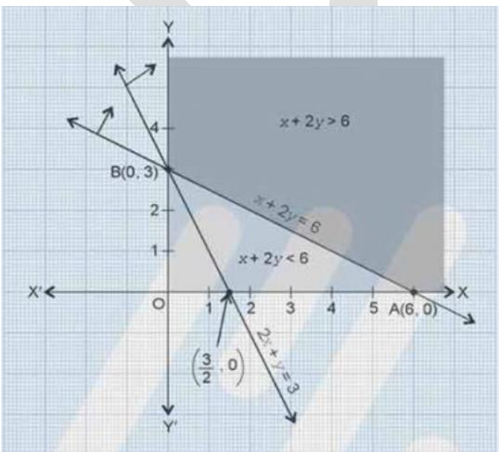
Q. NO	ANSWER	MARKS
3.	(i) Objective function ,maximize Z=$300x + 190y300x + 190y$ s.t $2x + y \leq 322x + y \leq 32$	3
4.	The feasible region the given LPP is as shown in the figure	



Corner Point	$z = 3x + 2y$
(0,0)	0
(5,0)	15
(4,3)	18= M
(0,5)	10

Hence maximum value of $Z = 18$ at point(4,3).

5.



Feasible region of the following LPP is as shown in the figure

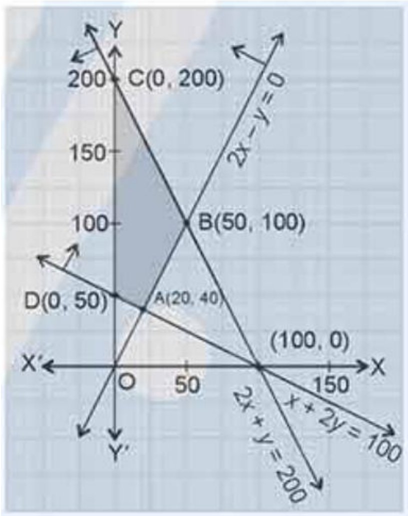
Now note that the feasible region is unbounded and has two corner points.

Corner Points	$Z = x + 2y$
(6,0)	6
(0,3)	6

Since feasible region is unbounded. To decide whether 6 is the minimum or not we draw $Z < m$ i.e., $x + 2y < 6$.

The line $x + 2y = 6$ for this constraint $Z < m$ is the same as the line AB for constraint. Put (0,0) in $Z < m \Rightarrow 0 < 6$ hence there in no point common to the

<table>
<tr><td></td><td>feasible line and $Z < m$.
Hence 6 is the minimum value of Z occur at least two different points.
Hence minimum of Z Occur at two corner points $(6,0)$ and $(0,3)$.</td><td></td></tr>
<tr><td>6.</td><td>



The feasible region of the following LPP is as shown in the following figure

<table>
<tr><td>Corner Point</td><td>$Z = x + 2y$</td></tr>
<tr><td>$(20,40)$</td><td>$100 = m$</td></tr>
<tr><td>$(50,100)$</td><td>250</td></tr>
<tr><td>$(0,200)$</td><td>$400 = M$</td></tr>
<tr><td>$(0,50)$</td><td>$100 = m$</td></tr>
</table>

Hence the maximum value of Z is 400 and minimum value of Z is 100 at each and every point of the line segment joining the points $(20,40)$ and $(0,50)$.

</td><td></td></tr>
<tr><td>7.</td><td>Z =1350 at x=5 and y =3</td><td>3</td></tr>
<tr><td>8.</td><td>Yes</td><td>3</td></tr>
<tr><td>9.</td><td>(0,0) (3,0) (2,3) and (0,6)</td><td>3</td></tr>
</table>

CHAPTER-12

LINEAR PROGRAMMING PROBLEMS

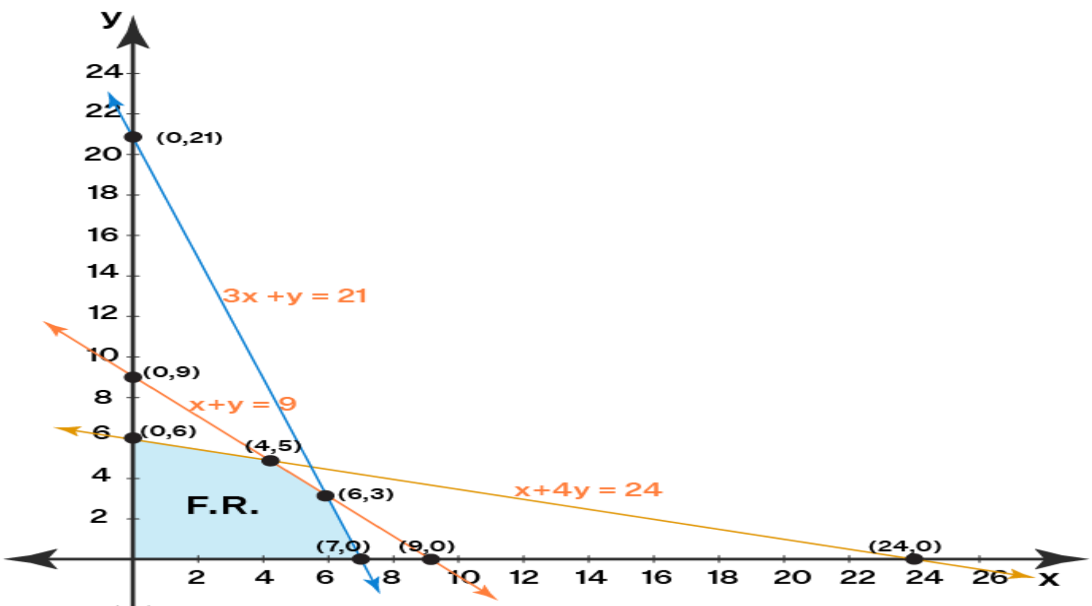
04 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Solve the following LPP using graphical method Maximize Z = 2x + 5y. Subject to constraints : x + 4y ≤ 24, 3x + y ≤ 21 and x + y ≤ 9 where, x ≥ 0 and y ≥ 0.	4
2.	Solve the linear programming problem using the graphical method. Maximize Z = 2x + 3y x + y ≤ 30, x ≤ 20, y ≤ 12 x, y ≥ 0	4
3.	Read the paragraph and answer the following questions If linear constraints of an LPP are $x - 2y \leq 2, 3x + 2y \leq 12, -3x + 2y \leq 3, x \geq 0, y \geq 0$. (a) Draw the graph of the feasible region made by the linear constraints. (b) If objective function $Z = 5x + 2y$ then find its maximum and minimum value of Z.	4
4.	Read the paragraph and answer the following questions If linear constraints of an LPP are $x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0$, $x \geq 0, y \geq 0$ (a) Draw the graph of the feasible region made by the linear constraints. (b) Find the corner points of the feasible region. (c) If objective function $Z = 5x + 10y$ then find its minimum value of Z.	4
5.	A bullet train can carry a maximum of 200 people. A profit of Rs 600 is made on each of YELLOW ticket and a profit of Rs 1000 is made on each BLUE ticket The bullet train reservation executive reserves 20 BLUE ticket seats .However, at least four times as many people prefer to travel by YELLOW ticket, than by BLUE ticket. If the number of BLUE tickets is x and that of YELLOW ticket is y .Now ,answer the following questions (i)The maximum value of x + y is (A) 200 (B) 100 (C) 80 (D)20 (II) What is the relation between x and y? (A) y > 80 (B) x>4y (C) y≥4x (D) None	4
6.	A bakery shop prepares two types of cakes type one and type two: type one cake requires 200 g of flour and 25 g of fat, type two cake requires 100 g of flour and 50 g of fat. (I)What is the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat , assuming that there is no shortage of other ingredients. (A) 20 (B) 50 (C) 40 (D) 30 (ii) Choose the correct constraint (A) x+ 2y ≤40 (B) x+2y < 40 (C) x+2y > 40 (D) none	4

ANSWERS:

<table>
<tr><th>Q. NO</th><th>ANSWER</th><th>MARKS</th></tr>
<tr><td>1</td><td>

Step 1: Write all inequality constraints in the form of equations.
$x + 4y = 24$
$3x + y = 21$
$x + y = 9$
Step 2: Plot these lines on a graph by identifying test points.
$x + 4y = 24$ is a line passing through (0, 6) and (24, 0). [By substituting x = 0 the point (0, 6) is obtained. Similarly, when y = 0 the point (24, 0) is determined.]
$3x + y = 21$ passes through (0, 21) and (7, 0).
$x + y = 9$ passes through (9, 0) and (0, 9).
Step 3: Identify the feasible region. The feasible region can be defined as the area that is bounded by a set of coordinates that can satisfy some particular system of inequalities.
Any point that lies on or below the line $x + 4y = 24$ will satisfy the constraint $x + 4y \leq 24$.
Similarly, a point that lies on or below $3x + y = 21$ satisfies $3x + y \leq 21$.
Also, a point lying on or below the line $x + y = 9$ satisfies $x + y \leq 9$.
The feasible region is represented by OABCD as it satisfies all the above-mentioned three restrictions.
Step 4: Determine the coordinates of the corner points. The corner points are the vertices of the feasible region.
O = (0, 0) ,A = (7, 0) , B = (6, 3).
B is the intersection of the two lines $3x + y = 21$ and $x + y = 9$. Thus, by substituting $y = 9 - x$ in $3x + y = 21$ we can determine the point of intersection.
C = (4, 5) formed by the intersection of $x + 4y = 24$ and $x + y = 9$
D = (0, 6)



Step 5: Substitute each corner point in the objective function. The point that gives the greatest (maximizing) or smallest (minimizing) value of the objective function will be the optimal point.
</td><td>4</td></tr>
</table>

Corner Points	Z = 2x + 5y
O = (0, 0)	0
A = (7, 0)	14
B = (6, 3)	27
C = (4, 5)	33 (maximum)
D = (0, 6)	30

33 is the maximum value of Z and it occurs at C. Thus, the solution is x = 4 and y = 5.

2 4

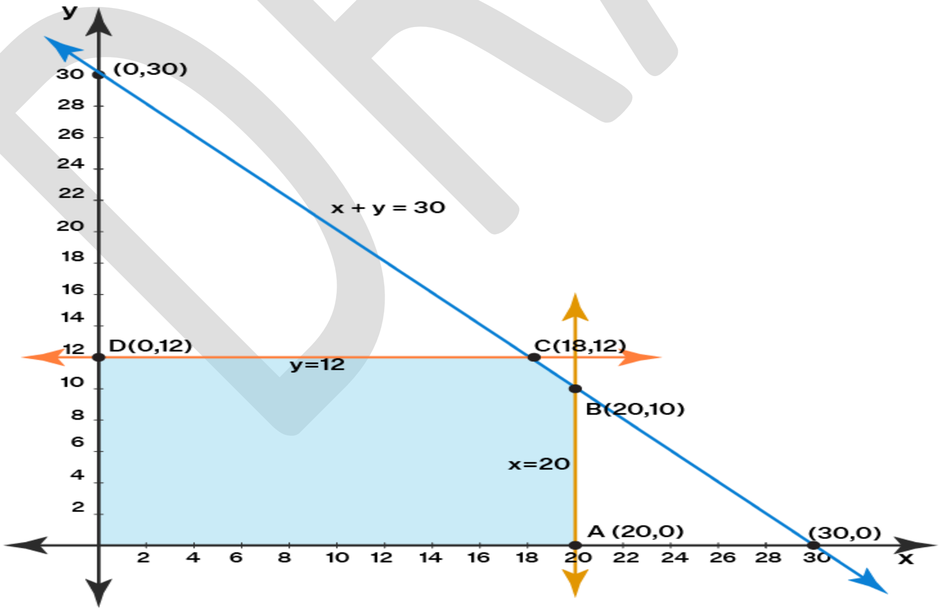
Corner points	Z = 2x + 3y
O = (0, 0)	0
A = (20, 0)	40
B = (20, 10)	70
C = (18, 12)	72
D = (0, 12)	36

Writing the inequalities as equations we get,

$x + y = 30$ passing through (0, 30) and (30, 0). Points on or below this line will satisfy $x + y \leq 30$

$x = 20$ is a line parallel to the y axis. Any point on or to the left of this line will satisfy $x \leq 20$.

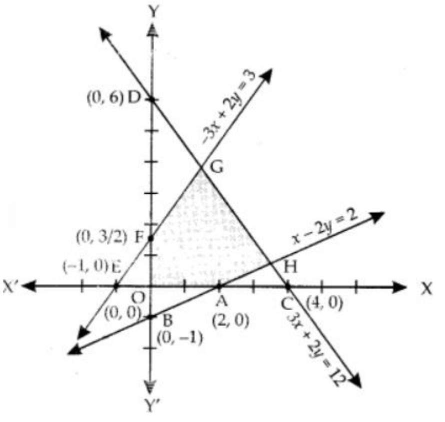
$y = 12$ is a line parallel to the x axis. Any point on or below this line will satisfy $y \leq 12$. The graph is given by



The maximum value of Z = 72 and it occurs at C (18, 12)

Therefore the maximum value of Z = 72 and the optimal solution is (18, 12)

3 (a) Feasible region of the linear constraints of the LPP is as shown in the figure

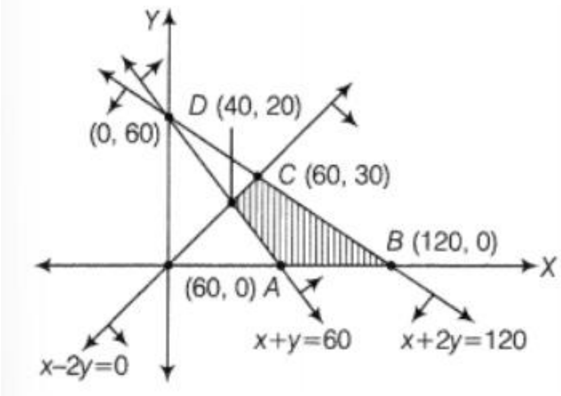


(b)

Corner Points	$Z = 5x + 2y$
(0,0)	0 (Minimum)
(2,0)	10
$\left(\frac{7}{2},\frac{3}{4}\right)$	19 (Maximum)
$\left(\frac{3}{2},\frac{15}{4}\right)$	15
$\left(0,\frac{3}{2}\right)$	3

Hence the maximum and minimum value of Z are 19 and 0 respectively at point $\left(\frac{7}{2},\frac{3}{4}\right)$ and (0,0).

4 (a) Feasible region of the linear constraints of the LPP is as shown in the figure



(b) Corner points of the feasible region of the LPP are (60,0), (120,0), (60,30), (40,20).

(c)

Corner Points	$Z = 5x + 2y$
(60,0)	300 (Minimum)
(120,0)	600
(60,30)	600 (Maximum)
(40,20)	400

Hence the minimum value of Z is 300 at point (60,0).

5 (I) …….. A (II) ………. C — 4

6 (I) …….. (D) 30 cakes : 20 of type one and 10 cakes of typ[e two
(II)……. (A)) x+ 2y ≤40 — 4

CHAPTER-12

LINEAR PROGRAMMING PROBLEMS

05 MARKS TYPE QUESTIONS

<table>
<tr><th>Q. NO</th><th>QUESTION</th><th>MARK</th></tr>
<tr><td>1.</td><td>A company produces two types of TVs, one is black and white, while the other is colour. The company has the resources to make at most 200 sets a week. Creating a black and white set costs Rs. 2700 and Rs. 3600 to create a coloured set. The business should spend no more than Rs. 648000 a week producing TV sets. If it benefits from Rs. 525 per set of black and white and Rs. 675 per set of colours, How many sets of black/white and coloured sets should it produce in order to get maximum profit? Formulate this using LPP.</td><td>5</td></tr>
<tr><td>2.</td><td>A jet fuel company has two X and Y depots with 7000 L and 4000 L capacities, respectively. The firm is distributing fuel to three jet fuel pumps, D, E and F, respectively in three cities containing 4500L, 3000L, and 3500L. In the following table, the distances (in km) between the depots and jet fuel pumps are given within the following desk:
<table>
<tr><td>DISTANCE (KM)</td><td></td><td></td></tr>
<tr><td>From/To</td><td>X</td><td>Y</td></tr>
<tr><td>D</td><td>7</td><td>3</td></tr>
<tr><td>E</td><td>6</td><td>4</td></tr>
<tr><td>F</td><td>3</td><td>2</td></tr>
</table>
If the transport cost of 10 litres of jet fuel is Re. 1 per km, how should the distribution be planned to mitigate the transport cost? What’s the lowest cost?</td><td>5</td></tr>
<tr><td>3.</td><td>Maximize $Z = -x + 2y$, subject to the constraints
$x \geq 3, x + y \geq 5, x + 2y \geq 6, y \geq 0.$</td><td>5</td></tr>
<tr><td>4.</td><td>Minimize $Z = 4x + 6y$
Subject to the constraints: $3x + 6y \geq 80,\ 4x + 3y \geq 100, x, y \geq 0$</td><td>5</td></tr>
<tr><td>5.</td><td>Minimize $Z = 5x + 7y$
subject to the constraints
$2x + y \geq 85000$,
$x + 2y \geq 10$
and $x, y \geq 0$</td><td>5</td></tr>
<tr><td>6.</td><td>Maximize $Z = 300x + 190y$
subject to the constraints
$x + y \leq 24$,
$2x + y \leq 32$
and $x, y \geq 0$</td><td>5</td></tr>
</table>

ANSWERS:

Q. NO	ANSWER	MARKS
1	See below	5

Solution: Let x and y be the number of black/white and coloured TVs, respectively

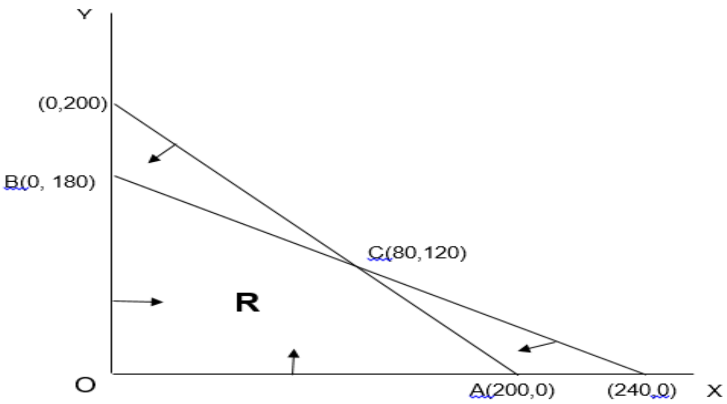
Subject to constraints:

x, y ≥ 0 (Non-negative constraint)

x + y ≤ 200 (Quantity constraints)

2700x + 3600y ≤ 648000 (Cost constraints)

Objective function: Z = 525x + 675y (objective is to maximize profit)

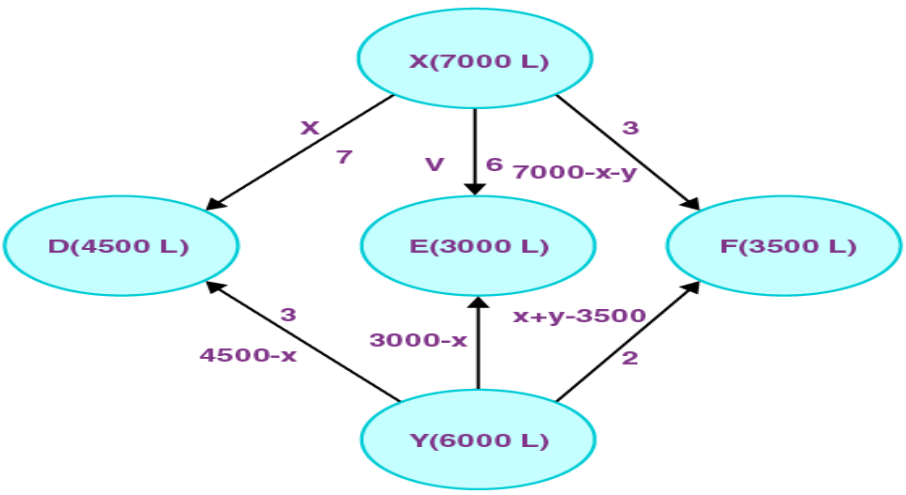


Feasible region R are bounded as shown in the figure above.

Corner Point	Objective Function(Z)
O(0,0)	525(0) + 675(0) = 0
A(200,0)	525(200) + 675(0) = 105000
C(80,120)	525(80) + 675(120)= 123000
B(0,180)	525(0) + 675(180) = 121500

Thus maximum value of Z occurs at C(80,120), i.e., 123000. So the company should manufacture 80 black/white and 120 coloured TV sets to get maximum profit.

Q. NO	ANSWER	MARKS
2	See below	5

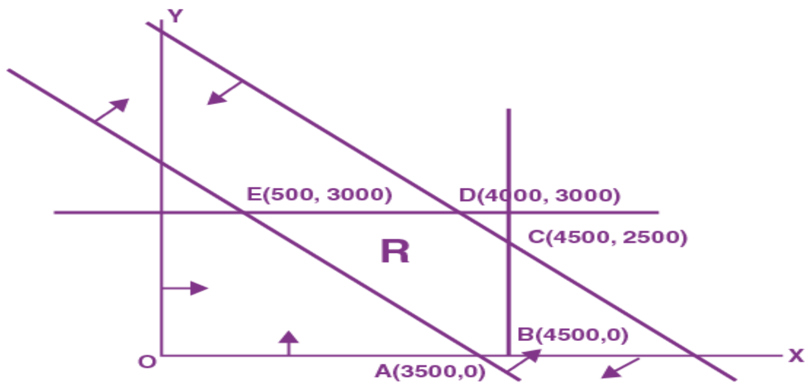


Let X supply the fuel pumps, D and E with x and y litres of jet fuel.
So, (7000 − x − y) from X to fuel pump F will be delivered. At fuel pump D, the requirement is 4500 L.
The remaining (4500 − x) L will be transferred from fuel pump Y while L is transported from depot X.
Similarly, (3000 − y) L and 3500 − (7000 − x − y) = (x + y − 3500) L will be transported from depot Y to F fuel pump.

Subject to constraints:
$x, y \geq 0$
$7000 - x - y \geq 0$ (XF constraint)
$4500 - x \geq 0$ (YD constraint)
$3000 - y \geq 0$ (YE constraint)
$x + y - 3500 \geq 0$ (YF constraint)
Cost of transporting 10 L of jet fuel is 1 rupee.
Objective function:

$$Z = \frac{7}{10} \times x + \frac{6}{10} \times y + \frac{3}{10} \times (7000 - x - y) + \frac{3}{10} \times (4500 - x) + \frac{4}{10} \times (3000 - y)$$

$$+ \frac{2}{10} \times (x + y - 3500)$$



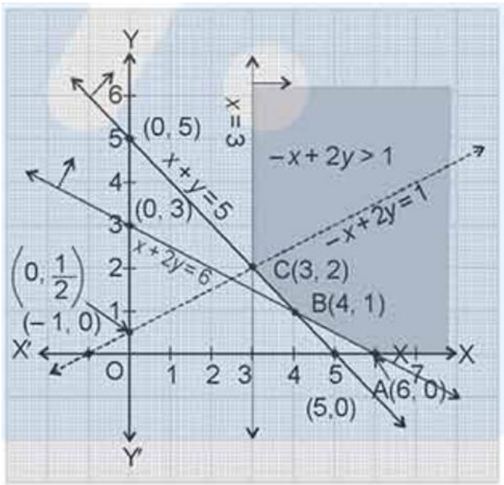
Corner Points	Z = 0.3x + 0.1y + 3950
A(3500, 0)	5000
B(4500, 0)	5300
C(4500, 2500)	5550
D(4000, 3000)	5450
E(500, 3000)	4400 (Minimum)

The minimum value of Z is 4400 at E (500, 3000).

Thus, the jet fuel supplied from depot A is 500 L, 3000 L, and 3500 L and from depot B is 4000 L, 0 L, and 0 L to fuel pumps D, E, and F, respectively.

Therefore, the minimum transportation cost is Rs. 4400.

3 The feasible region of the following LPP is as shown in the figure



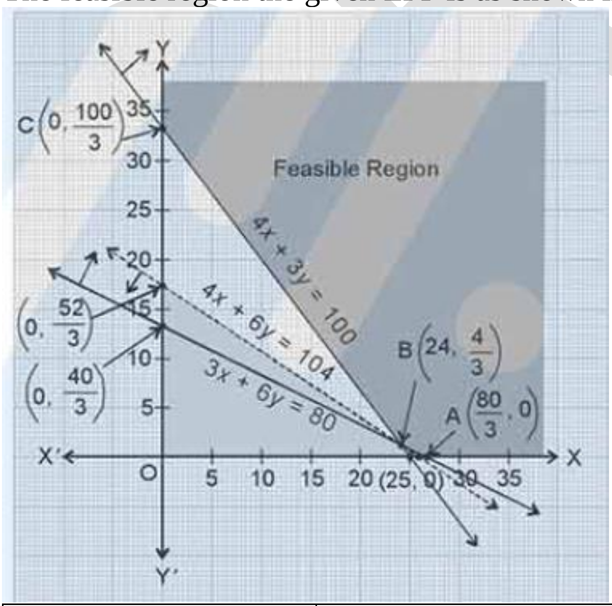
Corner Points	$z = -x + 2y$
$(6,0)$	-6
$(4,1)$	-2
$(3,2)$	$1 = M$

From this table we find that 1 is the maximum value of Z at $(3,2)$.

Since feasible region is unbounded so we have to check it further.

So, we draw the inequality $Z > M(-x + 2y > 1)$ by dotted line in the graph and will check whether this inequality and the feasible region has any other common points. Clearly there are common points with the feasible region. Therefore, $Z = -x + 2y$ has no maximum value subject to the given constraints.

4 The feasible region the given LPP is as shown in the figure



Corner Points	$Z = 4x + 6y$
$\left(\frac{80}{3}, 0\right)$	$\frac{320}{3}$
$\left(24, \frac{4}{3}\right)$	$104 = m$

$\left(0,\frac{100}{3}\right)$	200

From this table we find that 104 is the minimum value of Z at $\left(24,\frac{4}{3}\right)$.

Since feasible region is unbounded so we have to check it further.

So, we draw the inequality $Z > m(4x + 6y < 104)$ by dotted line in the graph and will check whether this inequality and the feasible region has any other common points. Clearly there are no common points with the feasible region. Therefore, $Z = 4x + 6y$ has 104 as the minimum value of Z at $\left(24,\frac{4}{3}\right)$.

5	Z= 38 at x=2 and y =4	5
6	Z=5440 when x = 8 and y =16	5

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Class 11 Biology Shorts (CBSE)	Click here for Playlist
ANIMATED VIDEOS PLAYLISTS (CLASS 12)	
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Rules & Regulations of the Group

1. No introduction
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3.No personal Chats & Messages
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