CUET (UG) – MATHEMATICS

Chapter Test -Unit V: Linear Programming

SOLUTIONS

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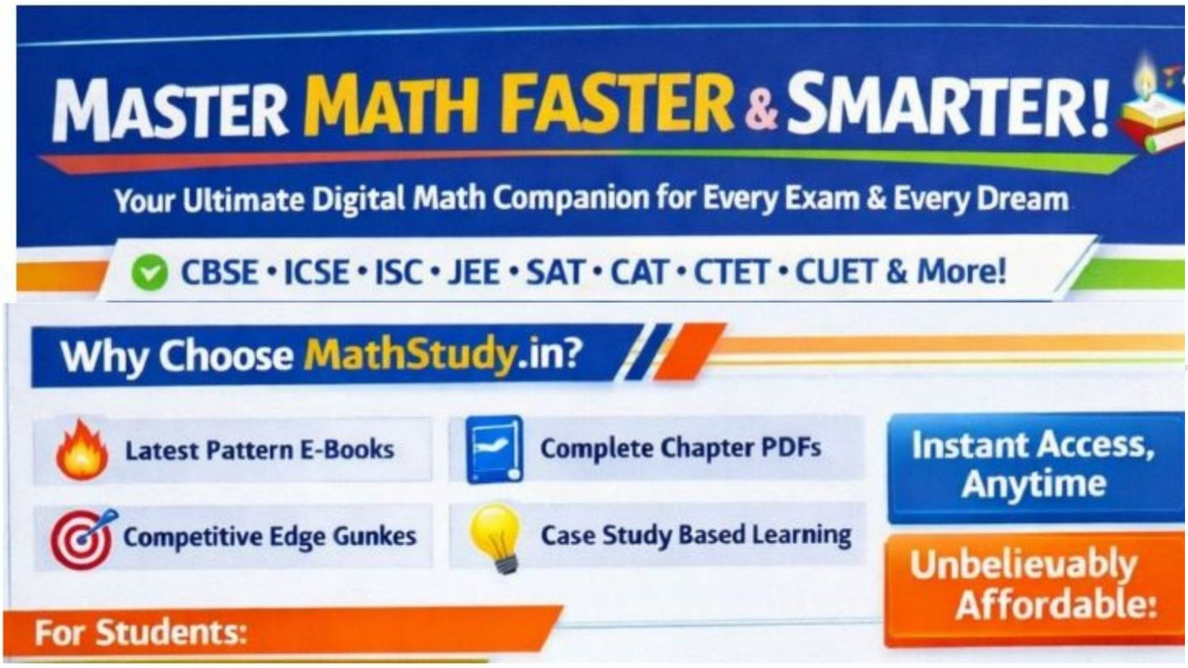

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Solutions

1. **Correct Option: (C)**. The objective function is the linear relationship that needs to be optimized (maximized or minimized).

2. **Correct Option: (B)**. The intersection of all half-planes defined by the constraints is the feasible region.

3. **Correct Option: (C)**. An unbounded region does not guarantee the existence of an optimal value. A separate check using a parallel objective line is required.

4. **Correct Option: (D)**. $Z(0,2) = 12$ and $Z(3,0) = 12$. Since both are the minimum corner values, every point on the segment connecting them yields the same minimum.

5. **Correct Option: (D)**. If an optimal value is found at two vertices, the entire segment connecting them consists of optimal solutions.

6. **Correct Option: (C)**. To be bounded by the y-axis ($x \geq 0$), $x \leq 2$, and $x + y \leq 6$ defines the interior region in the first quadrant.

7. **Correct Option: (B)**. Corner points are $(0,0), (4,0), (0,4)$. $Z(0,4) = 4(4) = 16$.

8. **Correct Option: (D)**. The region outside a parabola ($y^2 \geq x$) is not convex because a line segment between two points in the region can pass through the interior of the parabola.

9. **Correct Option: (B)**. Intersection of $x + 2y = 120, x + y = 60, x - 2y = 0$. The points are $(40,20), (60,30), (120,0), (60,0)$.

10. **Correct Option: (C)**. This is the property of multiple optimal solutions in linear programming.

11. **Correct Option: (B)**. The Corner Point Theorem states that if an optimal solution exists, it must occur at at least one corner point.

12. **Correct Option: (C)**. $Z(15,15) = 15p + 15q$ and $Z(0,20) = 20q$. $15p + 15q = 20q \implies 15p = 5q \implies q = 3p$.

13. **Correct Option: (D)**. For $(1,1)$, $1 + 1 = 2 \leq 3$ and $2(1) + 5(1) = 7 \leq 12$. Both hold.

14. **Correct Option: (A)**. $x \geq 0, y \geq 0$ restricts the solution to the first quadrant.

15. **Correct Option: (C)**. Intersection of $x + 2y = 10$ and $3x + y = 15$ is $(4,3)$. $Z(4,3) = 3(4) + 2(3) = 18$.

16. **Correct Option: (C)**. Maximize $Z = 11x + 7y$ at corner $(3,2)$. $Z = 33 + 14 = 47$.

17. **Correct Option: (A)**. The vertices are the origin, the x-intercept of the steeper line $(30,0)$, the y-intercept of the flatter line $(0,50)$, and the intersection $(20,30)$.

18. **Correct Option: (B)**. $Z(0,6) = 2(0) + 3(6) = 18$.

19. **Correct Option: (A)**. Max at $(5,0) = 10$. Min at $(0,1) = 1$ or $(1,0) = 2$? No, $Z(1,0) = 2, Z(0,1) = 1$. Min is 1.

20. **Correct Option: (B)**. $Z(5,0) = 3(5) - 4(0) = 15$. Other points like $(4,3)$ give $12 - 12 = 0$.