

How to use this sheet. Every problem reduces to the same three steps: formulate the objective function and constraints, find the corner points of the feasible region, and evaluate the objective function at each corner to find the optimum.

Quick reference — LPP = objective function + constraints + non-negativity · Corner point theorem: the optimum occurs at a vertex of the feasible region · Evaluate Z at every corner, compare

Section A · Level 1

Seven questions. None should take more than twenty seconds.

1. A linear programming problem consists of:

(1) Only an objective function (2) An objective function and a set of linear constraints (3) Only constraints, with no objective (4) A single equation to solve

2. The objective function in a linear programming problem is:

(1) A quantity to be maximised or minimised, expressed as a linear function of the decision variables (2) One of the constraints (3) Always equal to zero (4) A fixed constant

3. The feasible region of a linear programming problem is:

(1) The region where the objective function is undefined (2) The set of all points satisfying every constraint simultaneously (3) Only the corner points (4) The region outside all constraints

4. A feasible region that can be enclosed within a circle of finite radius is called:

(1) Unbounded (2) Bounded (3) Infinite (4) Empty

5. According to the corner point theorem, if an optimal value of the objective function exists over a bounded feasible region, it occurs at:

(1) The centre of the feasible region (2) A corner point of the feasible region (3) Any random point inside the region (4) The origin only

6. The non-negativity restrictions $x \geq 0$ and $y \geq 0$ in a linear programming problem exist because:

(1) They are a mathematical convenience with no real meaning (2) The decision variables usually represent quantities like items produced or resources used, which cannot be negative (3) They simplify the objective function only (4) They are optional and rarely used

7. The first step in solving a linear programming problem graphically is to:

(1) Immediately calculate the objective function (2) Formulate the objective function and constraints from the given situation (3) Guess a solution (4) Convert the problem to a differential equation

Section B · Level 2

Seven questions. Evaluate the objective function at every corner, then compare.

8. For the constraints $x + y \leq 4$, $x \geq 0$, $y \geq 0$, the corner points of the feasible region are:

(1) (0,0), (4,0), (0,4) (2) (0,0), (4,4) (3) (4,0), (0,4) only (4) (1,1), (2,2), (3,3)

9. For the objective function $Z = 3x + 4y$ with corner points (0,0), (4,0) and (0,4), the maximum value of Z is:

(1) 12 (2) 16 (3) 0 (4) 20

10. For the objective function $Z = 3x + 4y$ with corner points $(0,0)$, $(4,0)$ and $(0,4)$, the minimum value of Z is:

(1) 0 (2) 12 (3) 16 (4) 4

11. For the constraints $x + 2y \geq 10$, $3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$, one of the corner points of the feasible region is the intersection of the two boundary lines, found by solving them together. This point is:

(1) $(4,3)$ (2) $(3,4)$ (3) $(5,5)$ (4) $(2,4)$

12. For the objective function $Z = 200x + 500y$ with corner points $(0,5)$, $(4,3)$ and $(0,6)$ from the feasible region above, the minimum value of Z is:

(1) 2500 (2) 2300 (3) 3000 (4) 2000

13. If two corner points of a bounded feasible region give the same optimal value of the objective function, then:

(1) The problem has no solution (2) Every point on the line segment joining those two corners also gives that same optimal value (3) Only one of the two points is actually a valid solution (4) The objective function must be constant everywhere

14. A linear programming problem with an unbounded feasible region:

(1) Can never have an optimal solution (2) May or may not have an optimal solution, depending on the direction the objective function increases or decreases (3) Always has its optimum at the origin (4) Has no corner points at all

Section C · Level 3

Seven questions. Translate the situation into an objective function and constraints first.

15. A factory produces two products, x units of product A and y units of product B. If profit is 50 per unit of A and 40 per unit of B, the objective function to maximise total profit is:

(1) $Z = 50x + 40y$ (2) $Z = 40x + 50y$ (3) $Z = 50x - 40y$ (4) $Z = 90(x+y)$

16. A constraint stating that a machine can work for at most 8 hours, when product A takes 2 hours and product B takes 1 hour per unit, is written as:

(1) $2x + y \leq 8$ (2) $x + 2y \leq 8$ (3) $2x + y \geq 8$ (4) $2x + y = 8$

17. In a diet problem where the goal is to minimise cost while meeting minimum nutritional requirements, the constraints typically use which inequality sign?

(1) $\leq$ only (2) $\geq$ only, for the nutritional minimums (3) $=$ only (4) Both $\leq$ and $\geq$ are equally likely depending on the specific requirement

18. In a linear programming problem, the phrase 'decision variables' refers to:

(1) The constraints themselves (2) The unknown quantities the problem is trying to determine, such as how many units to produce (3) The coefficients in the objective function (4) The corner points

19. If a linear programming problem asks to maximise profit but every feasible point gives the same profit value, the objective function's line must be:

(1) Perpendicular to one of the constraint boundaries (2) Parallel to one of the edges of the feasible region (3) Passing through the origin only (4) Undefined

20. A company wants to minimise the cost of transporting goods from two warehouses to meet demand at several stores, subject to supply and demand limits. This is a classic example of:

(1) A quadratic programming problem (2) A linear programming problem, specifically a transportation problem (3) A problem with no feasible solution (4) A problem requiring calculus

21. Once the feasible region has been graphed, the most efficient way to find the optimal value of the objective function is to:

(1) Test every single point inside the region (2) Evaluate the objective function only at the corner points and compare (3) Guess based on the shape of the region (4) Always assume the origin is optimal

Answer key: 1. (2) 2. (1) 3. (2) 4. (2) 5. (2) 6. (2) 7. (2) 8. (1) 9. (2) 10. (1) 11. (1) 12. (2) 13. (2) 14. (2) 15. (1) 16. (1) 17. (4) 18. (2) 19. (2) 20. (2) 21. (2)

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