

Linear Programming — Assignment 2

Class 12 Maths · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Elements of an LPP

1. Write the objective function for maximising profit if x units of A and y units of B are produced, with profits ₹5 and ₹8.
2. State whether the objective function of an LPP is always linear.
3. Graph the feasible region for $x + y \leq 4$, $x \geq 0$, $y \geq 0$.

The Corner Point Method

1. Evaluate $Z = 3x + 5y$ at the vertices $(0, 0)$, $(4, 0)$, $(0, 4)$.
2. List the steps of the corner point method.
3. Maximise $Z = 4x + 3y$ subject to $x + y \leq 8$, $x, y \geq 0$ using the corner point method.

Formulating a Word Problem

1. Formulate an LPP for maximising profit where each unit of product A needs 2 hours and B needs 3 hours, with 100 hours available.
2. Write the constraints for a diet problem mixing two foods.
3. Formulate and solve: A factory makes two products with machine-hour limits.

Special Cases

1. Explain when an LPP has multiple optimal solutions.
2. Give an example of an unbounded feasible region.
3. Discuss the special case where the objective function is parallel to a constraint.

Part B — Integrated problems (multi-topic)

1. Define the objective function of an LPP.
2. Evaluate $Z = 3x + 5y$ at the vertices $(0, 0)$, $(4, 0)$, $(0, 4)$.
3. Maximise $Z = 4x + 3y$ subject to $x + y \leq 8$, $x, y \geq 0$.
4. When does an LPP have infinitely many solutions?
5. What is the first step in formulating an LPP?

Answer Key

Elements of an LPP

Maximise $Z = 5x + 8y$. Yes, always linear. Region bounded by the axes and the line $x + y = 4$.

The Corner Point Method

$Z = 0, 12, 20$ (max 20 at $(0, 4)$). Identify vertices, evaluate Z , pick optimum. Max $Z = 32$ at $(8, 0)$.

Formulating a Word Problem

Maximise profit subject to $2x + 3y \leq 100$, $x, y \geq 0$. Constraints on nutrient minimums. Formulate and solve by corner points.

Special Cases

When the objective is parallel to a boundary with the same optimum on both vertices. E.g. $x + y \geq 1$, $x, y \geq 0$. Multiple optimal solutions along a boundary.

Integrated problems

1: a linear function to optimise. 2: $Z = 0, 12, 20$. 3: max $Z = 32$ at $(8, 0)$. 4: When the objective is parallel to a constraint boundary. 5: Identify the decision variables.