

Day 4 Exercises: Primal and Dual Linear Programming

This handout combines both Day 4 problem-solving sessions.

Session 1

This session practices translating real contexts into the primal linear programming model. Focus on variables, constraints, objective functions, feasibility, and corner points.

1. A school club sells posters and flyers. Define two decision variables and write one objective for profit.
2. For the club model, explain what the constraints $2x + y \leq 120$, $x + 3y \leq 150$, and $x, y \geq 0$ mean in context, and say which rule is a resource limit and which rule just keeps the variables realistic.
3. Check whether each point is feasible: $(0, 0)$, $(20, 30)$, and $(40, 10)$.
4. Use $P = 5x + 4y$ to compare the three feasible points in Problem 3.
5. One student claims that $(50, 40)$ is the best point because it has larger coordinates, but that is not enough in LP.

Session 2

This session practices writing the dual of a primal LP and interpreting shadow prices. Focus on primal–dual connections, feasibility, and resource value.

1. For the primal $\max P = 2x + y$ with constraints $x + y \leq 10$, $2x + y \leq 14$, and $x, y \geq 0$, write the dual in standard form.
2. In words, what does a dual variable represent in the context of a resource limit?
3. Check whether $u = 1$, $v = \frac{1}{2}$ is feasible for the dual in Problem 1, and compute its dual objective value.
4. Explain why a dual value smaller than a claimed primal value would be impossible.
5. Reflection: describe one way the dual helps you understand the primal answer without drawing a graph.