

Linear Programming

Finite Math

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Geometric Method for Solving Linear Programming Problems

Procedure (Geometric Method for Solving a Linear Programming Problem with Two Decision Variables)

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- 2 *Construct a corner point table listing the value of the objective function at each corner point.*
- 3 *Determine the optimal solution(s) from the table in Step 2 (smallest=minimum, largest=maximum).*
- 4 *For an applied problem, interpret the optimal solution(s) in terms of the original problem.*

Linear Programming Example

Example

Maximize and minimize $z = 3x + y$ subject to the inequalities

$$2x + y \leq 20$$

$$10x + y \geq 36$$

$$2x + 5y \geq 36$$

$$x, y \geq 0$$

Now You Try It!

Example

Maximize and minimize $z = 2x + 3y$ subject to

$$2x + y \geq 10$$

$$x + 2y \geq 8$$

$$x, y \geq 0$$

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Example

Maximize and minimize $z = 2x + 3y$ subject to

$$2x + y \geq 10$$

$$x + 2y \geq 8$$

$$x, y \geq 0$$

Solution

Minimum of $z = 14$ at $(4, 2)$. No maximum.

Now You Try It!

Example

Maximize and minimize $P = 3x + 5y$ subject to

$$x + 2y \leq 6$$

$$x + y \leq 4$$

$$2x + 3y \geq 12$$

$$x, y \geq 0$$

Now You Try It!

Example

Maximize and minimize $P = 3x + 5y$ subject to

$$x + 2y \leq 6$$

$$x + y \leq 4$$

$$2x + 3y \geq 12$$

$$x, y \geq 0$$

Solution

No optimal solutions.

Applications

Example

An electronics firm manufactures two types of personal computers—a desktop model and a laptop model. The production of a desktop requires a capital expenditure of \$400 and 40 hours of labor. The production of a laptop requires a capital expenditure of \$250 and 30 hours of labor. The firm has \$20,000 capital and 2,160 labor-hours available for production of desktop and laptop computers.

- (a) What is the maximum number of computers the company is capable of producing?*
- (b) If each desktop contributes a profit of \$320 and each laptop contributes a profit of \$220, how much profit will the company make by producing the maximum number of computers?*
- (c) Does producing as many computers as possible produce the highest profit? If not, what is the highest profit and how many of each computer should be made in that case?*

Now You Try It!

Example

A fruit grower can use two types of fertilizer in his orange grove, brand A and brand B. The amounts (in pounds) of nitrogen, phosphoric acid, and chloride in a bag of each brand are given in the table. Tests indicate that the grove needs at least 1,000 pounds of phosphoric

	Brand A	Brand B
Nitrogen	8	3
Phosphoric Acid	4	4
Chloride	2	1

acid and at most 400 pounds of chloride.

- If the grower wants to maximize the amount of nitrogen added to the grove, how many bags of each mix should be used? How much nitrogen will be added?
- If the grower wants to minimize the amount of nitrogen added to the grove, how many bags of each mix should be used? How much nitrogen will be added?

Answer

Solution

- (a) 150 *bags brand A*, 100 *bags brand B*, 1,500 *lbs of nitrogen*
- (b) 0 *bags brand A*, 250 *bags brand B*, 750 *lbs of nitrogen*