Math 210 Finite Mathematics

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3.3 Linear Programming: Graphical Solutions

Example 1

Consider the system of linear inequalities from our 3.2 - Example 1 word problem.

Maximize: $P = 50x + 54y$

Subject to:

$$\begin{aligned} 3x + 2y &\leq 16 \\ x + 2y &\leq 8 \\ x \geq 0, &\quad y \geq 0 \end{aligned}$$

1. Sketch the feasible set

2. Goal:

Theorem 1: Corner Point Theorem

1. If a linear programming program has a solution, it must occur at a corner point of the feasible set.
2. If the objective function P is optimized at two adjacent corners of the feasible set, then any point on the line connecting those points is considered an optimal solution.

Steps 1

1.
2.
3.
4.
5.

Example 2

Brian has a small carpentry business that employs two carpenters and a finisher. They sell two types of tables: standard and amazing. Each standard table will result in a profit of $50, and each amazing table results in a profit of $54. A standard table requires 3 hours of carpentry and 1 hour of finishing. An amazing table requires 2 hours of carpentry and 2 hours of finishing. Each day there are 16 hours available for carpentry and 8 hours for finishing. How many tables of each type should be made to maximize profit?

Example 3

A finance company has \$120 million to invest in stocks S and T. Since stock T is riskier, management stipulated that the total amount invested in stock S be at least five times more than the amount invested in stock T. Stock T is expected to return an average of 20% and stock S an average of 12%. Determine the total amount that should be invested in each stock to maximize returns.

Example 4

Brian uses two types of fertilizers. A 50-lb bag of Fertilizer A contains 8 lbs of nitrogen, 2 lbs of phosphorus, and 4 lbs of potassium. A 50-lb bag of Fertilizer B contains 5 lbs of nitrogen, 5 lbs of phosphorus, and 5 lbs of potassium. The minimum requirements for a field are 440 lbs of nitrogen, 260 lbs of phosphorus, and 360 lbs of potassium. If a 50-lb bag of A costs \$30 and a 50-lb bag of B costs \$20, find the amount of each type Brian should use to minimize cost while still meeting his requirements.

Example 5

Minimize: $P = 2x + 2y$

$$\begin{aligned} 2x + 3y &\leq 30 \\ y - x &\leq 5 \\ x + y &\geq 5 \\ x &\leq 10 \\ x \geq 0, &\quad y \geq 0 \end{aligned}$$