4.2: Linear Programming

Math 111

Minimize  subject to 

A farm co-op has 6000 acres available to plant with corn and soybeans. Each acre of corn requires 9 gallons of fertilizer/herbicide and ¾ hour of labor to harvest. Each acre of soybeans requires 3 gallons of fertilizer/herbicide and 1 hour of labor to harvest. The co-op has available at most 40,500 gallons of fertilizer/herbicide and at most 5250 hours of labor for harvesting. If the profit per acre is $60 for corn and $40 for soybeans, how many acres of each crop should the co-op plant in order to maximize their profit? What is the maximum profit?

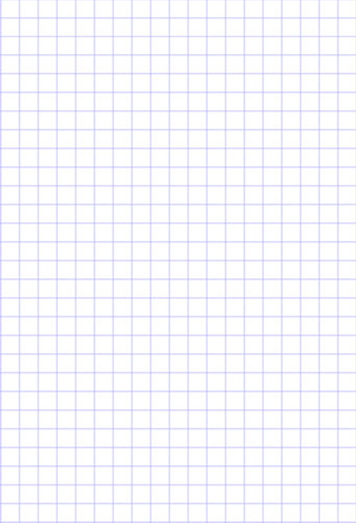
STEP 1: Read the problem and don’t freak out!!!

STEP 2: Identify your variables.

STEP 3: Note that you are trying to find the maximum profit. Write the profit function from the last sentence. This is also called the *objective* function.

STEP 4: Find the *constraint* equations. You can use a table to organize your data and come up with these inequalities.

STEP 5: Graph the constraints using intercepts. Make sure you label each line. And shade the *feasible* region.



STEP 6: Find the corners of the feasible region. Note that they are the points that two constraints meet. So either the intercepts or solve the system using matrices.

STEP 7: Substitute the corners into profit function and find the profit made on each corner.

STEP 8: Choose the maximum profit.

STEP 9: Write your solution in a form of a sentence.

Ikea manufactures two “high-quality” products: rockers and bookshelf units. Its profit is $30 per rocker and $42 per bookshelf unit. Next week’s production will be constrained by two limited resources, labor and wood. The labor available is expected to be at most 930 hours, and the amount of wood available is expected to be at most 2400 board feet. Each rocker requires 4 labor hours and 8 board feet of wood to produce. Each bookshelf unit requires 3 labor hours and 12 board feet of wood. Find out how many of each type of unit should be produced to maximize the weekly profit.

A candidate wishes to use a combination of radio and television advertisements in her campaign. Research has shown that each 1-minute spot on television reaches 0.09 million people and that each 1-minute spot on radio reaches 0.006 million. The candidate feels she must reach at least 10.8 million people, and she must buy a total of at least 400 minutes of advertisements. How many minutes of each medium should be used to minimize costs if television costs $400/minute and radio costs $100/minute?

A company manufactures two types of electric hedge trimmers, one of which is cordless. The cord-type trimmer requires 2 hours to make, and the cordless model requires 6 hours. The company has only 600 work hours to use in manufacturing each day, and the packaging department can package only 200 trimmers per day. If the company sells the cord-type model for $22.50 and the cordless model for $67.50, how many of each type should it produce per day to maximize its sales? What is the maximized revenue?

Centex Homes builds two types of homes. The Carolina requires one lot, $160,000 capital, and 160 worker-days of labor, whereas the Savannah requires one lot, $240,000 capital, and 160 worker-days of labor. The contractor owns 300 lots and has $48,000,000 available capital and 43,200 worker-days of labor. The profit on the Carolina is $40,000 and the profit on the Savannah is $50,000. Find how many of each type of home should be built to maximize profit. Find the maximum possible profit.