Finite Math - Spring 2017
Lecture Notes - 4/28/2017

Homework

- Section 5.3 - 1, 2, 5, 6, 9, 17, 19, 21, 23, 25, 27, 35, 43, 50, 53

Section 5.3 - Linear Programming in Two Dimensions: A Geometric Approach

Applications.

Example 1. *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 standard and portable 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?*

Solution. *Let $x = $ # of standard model and $y = $ # of portable model. Let's find the feasible region for this problem before continuing. From capital, we get the inequality*
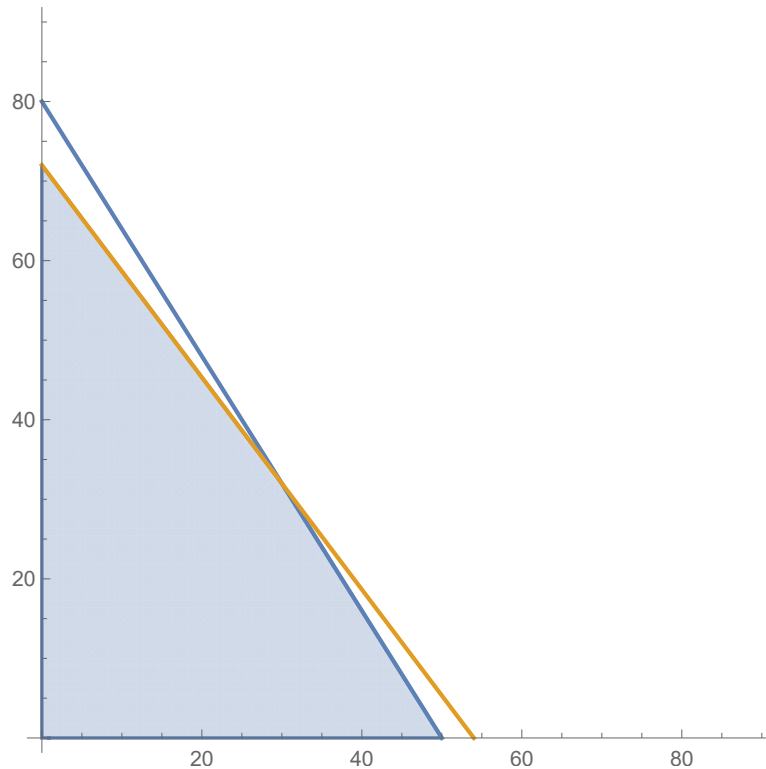
$$400x + 250y \leq 20000$$

and from labor-hours we get

$$40x + 30y \leq 2160$$

and of course we add in

$$x, y \geq 0$$

since a negative number of computers cannot be produced. The graph of the feasible region is

Observe that the feasible region is bounded. The corner points of the feasible region are

$$(0,0), (0,72), (50,0), (30,32).$$

(a) *The amount of computers produced is simply*

$$C = x + y$$

so to figure out the maximum number of computers the company is capable of producing we just have to maximize C. Test C at the corner points

Corner Point	C value
$(0,0)$	0
$(0,72)$	72
$(50,0)$	50
$(30,32)$	62

So to produce the largest amount of computers, they should produce 72 laptops and no desktops.

(b) *The profit function is*

$$P = 320x + 220y.$$

By producing the largest amount of computers, the company would make

$$320(0) + 220(72) = 15840 \ dollars$$

(c) *To check if this gives the highest profit, we should check the profit function at all of the corner points.*

Corner Point	Profit
$(0, 0)$	$0
$(0, 72)$	$15,840
$(50, 0)$	$16,000
$(30, 32)$	$16,640

So we see that producing 30 *desktops and* 32 *laptops will produce the highest profit for the company.*

Example 2. *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 acid and at most* 400 *pounds of chloride.*

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

(a) *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?*

(b) *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?*

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*