

Homework #2 – due Friday, February 5th, 2020

1. Plot on the (x, y) -plane the feasible region for the following linear constraints:

$$4x + 5y \leq 20$$

$$12x - 5y \leq 30$$

$$-x + 3y \leq 6$$

$$x - y \leq 6$$

$$x, y \geq 0$$

- (a) How many *extreme points* (points where two or more lines intersect) does the feasible region have?
- (b) Is the feasible region bounded? Does your answer change if you remove the constraint $x \geq 0$?
2. Solve the following linear programming model graphically:

$$\text{Minimize: } Z = 10x + 2y$$

$$\text{Subject to: } 4x + 2y \geq 20$$

$$-6x + 4y \leq 12$$

$$\frac{6}{7}x + y \geq 6$$

$$x, y \geq 0$$

3. Starbright Coffee Shop at the Galleria Mall serves two coffee blends it brews on a daily basis, Pomona and Coastal. Each is a blend of three high-quality coffees from Colombia, Kenya, and Indonesia. The coffee shop has 6 pounds of each of these coffees available each day. Each pound of coffee will produce sixteen 16-ounce cups of coffee. The shop has enough brewing capacity to collectively brew 30 gallons of these two coffee blends each day. Pomona is a blend of 20% Colombian, 35% Kenyan, and 45% Indonesian, whereas Coastal is a blend of 60% Colombian, 10% Kenyan, and 30% Indonesian. The shop sells at least 1.5 times more Pomona than Coastal each day. Pomona sells for \$2.05 per cup, and Coastal sells for \$1.85 per cup. The manager wants to know how many cups of each blend to sell each day to maximize sales.
- (a) Formulate a linear programming model for this problem.
- (b) Solve this model by using graphical analysis.
- (c) Solve this model using Excel Solver (include a printout of the spreadsheet).
4. In the previous problem:
- (a) If Starbright Coffee Shop could get 1 more pound of coffee, which one should it be? What would be the effect on sales of getting 1 more pound of this coffee?

- (b) If the costs associated with increasing brewing capacity from 30 gallons to 40 gallons per day come out to roughly \$15 per day, would such a change be profitable?
- (c) If the shop spent \$20 per day on advertising that would increase the relative demand for Pomona to twice that of Coastal, should it be done?