Name:

Date:

1. A thief is filling her backpack with two types of valuable substances. She can carry up to 35 kg, and her backpack can fit up to 20 liters.

   Each bag of X has a weight of 0.6 kg, volume of 0.6 L, and value of 40 thousand USD.

   Each bag of Y has a weight of 10 kg, volume of 1 L, and value of 400 thousand USD.

   There is no requirement to take full bags, so the thief can opt for a fraction of a bag.

   How many bags of each should the thief take to maximize her profit?

1. The thief should take 30.56 bags of X and 1.67 bags of Y. We can use linear programming to see this.
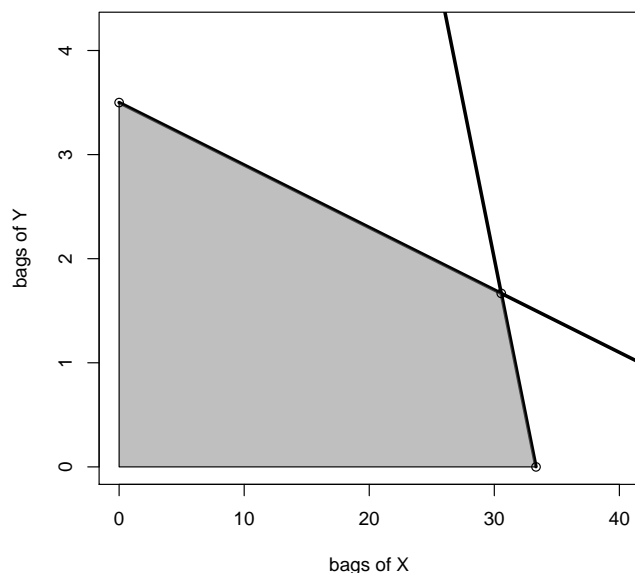
   We write a weight inequality.
   $$0.6x + 10y \leq 35$$

   We write a volume inequality.
   $$0.6x + 1y \leq 20$$

   We graph the two inequalities, shading the feasible region.

   There are three vertices of interest.

   $$(0, 3.5)$$

   $$(30.56, 1.67)$$

   $$(33.33, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 40x + 400y$$

   We determine the profits.
   $$P(0, 3.5) = 1400$$
   $$P(30.56, 1.67) = 1888.89$$
   $$P(33.33, 0) = 1333.33$$

   Thus, the thief should take 30.56 bags of X and 1.67 bags of Y.