Name:

Date:

1. A thief is filling her backpack with two types of valuable substances. She can carry up to 30 kg, and her backpack can fit up to 25 liters.

   Each bag of *X* has a weight of 3 kg, volume of 0.3 L, and value of 5 thousand USD.

   Each bag of *Y* has a weight of 0.1 kg, volume of 0.1 L, and value of 0.2 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 1.85 bags of X and 244.44 bags of Y. We can use linear programming to see this.
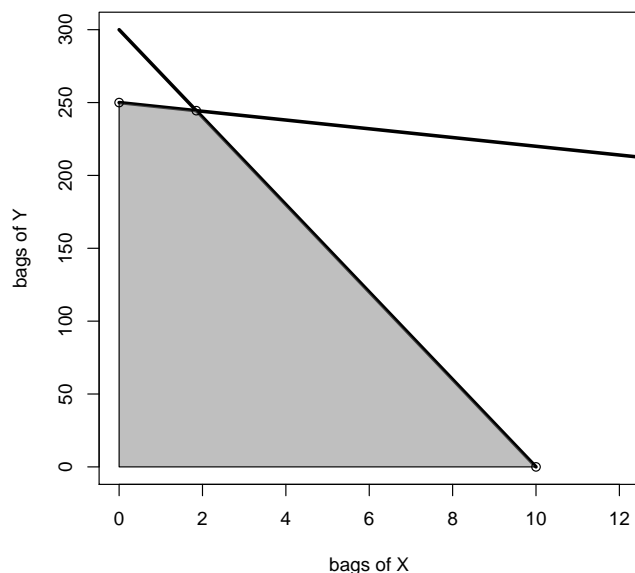
   We write a weight inequality.
   $$3x + 0.1y \leq 30$$

   We write a volume inequality.
   $$0.3x + 0.1y \leq 25$$

   We graph the two inequalities, shading the feasible region.

   bags of X

   There are three vertices of interest.

   $$(0, 250)$$

   $$(1.85, 244.44)$$

   $$(10, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 5x + 0.2y$$

   We determine the profits.
   $$P(0, 250) = 50$$
   $$P(1.85, 244.44) = 58.15$$
   $$P(10, 0) = 50$$

   Thus, the thief should take 1.85 bags of X and 244.44 bags of Y.