Name:

Date:

1. A thief is filling her backpack with two types of valuable substances. She can carry up to 40 kg, and her backpack can fit up to 35 liters.

    Each bag of *X* has a weight of 5 kg, volume of 0.7 L, and value of 1000 thousand USD.

    Each bag of *Y* has a weight of 0.06 kg, volume of 0.07 L, and value of 40 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 2.27 bags of X and 477.27 bags of Y. We can use linear pro-
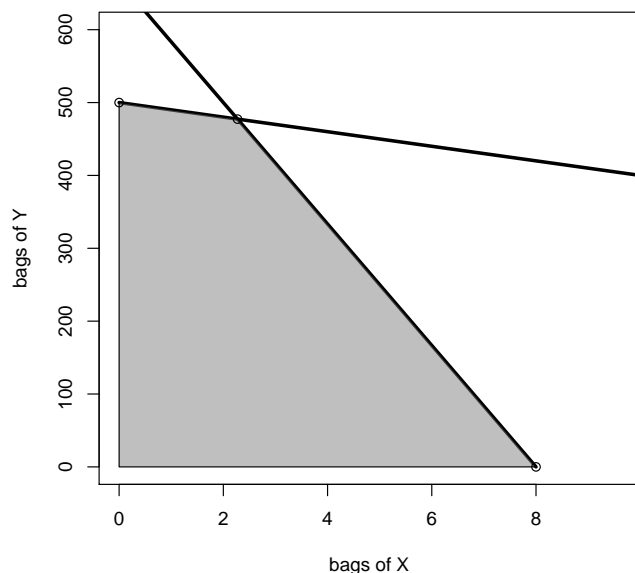   gramming to see this.

   We write a weight inequality.
   $$5x + 0.06y \leq 40$$

   We write a volume inequality.
   $$0.7x + 0.07y \leq 35$$

   We graph the two inequalities, shading the feasible region.

   There are three vertices of interest.

   $$(0, 500)$$

   $$(2.27, 477.27)$$
   $$(8, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 1000x + 40y$$

   We determine the profits.
   $$P(0, 500) = 20000$$
   $$P(2.27, 477.27) = 21363.64$$
   $$P(8, 0) = 8000$$

   Thus, the thief should take 2.27 bags of X and 477.27 bags of Y.