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 20 liters.

   Each bag of X has a weight of 2 kg, volume of 0.2 L, and value of 300 thousand USD.

   Each bag of Y has a weight of 0.4 kg, volume of 0.5 L, and value of 100 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 7.61 bags of X and 36.96 bags of Y. We can use linear programming to see this.

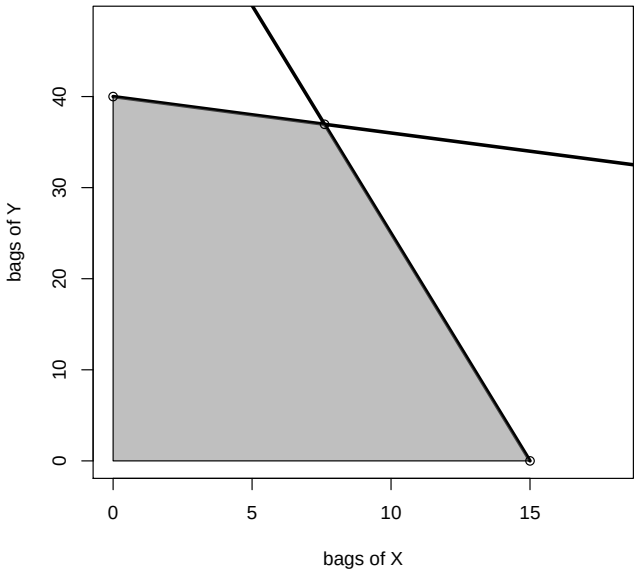
   We write a weight inequality.

   $$2x + 0.4y \leq 30$$

   We write a volume inequality.

   $$0.2x + 0.5y \leq 20$$

   We graph the two inequalities, shading the feasible region.



   There are three vertices of interest.

   $$(0, 40)$$

   $$(7.61, 36.96)$$

   $$(15, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 300x + 100y$$

   We determine the profits.

   $$P(0, 40) = 4000$$

   $$P(7.61, 36.96) = 5978.26$$

   $$P(15, 0) = 4500$$

   Thus, the thief should take 7.61 bags of X and 36.96 bags of Y.