Homework 1 - Math 381 A - Dr. Matthew Conroy

1. (a) Solve the following LP graphically by hand. Include figures and a detailed description of your method. Minimize $x + y$ subject to

$$10x + 3y \leq 60$$
$$5x + 6y \geq 50$$
$$x - y \leq 5$$
$$x, y \geq 0$$

   (b) Maximize $x + y$ subject to the same constraints. (Feel free to recycle figures).

2. You own a company that produces Widgets and Doohickies.

   You have two factories.

   Factory A produces 100 Widgets and 90 Doohickies per day.

   Factory B produces 45 Widgets and 95 Doohickies per day.

   It costs $10000 per day to run Factory A and $7000 per day to run Factory B.

   You have an order for 3000 Widgets and 2000 Doohickies. For how many days (fractions are okay) should each factory be run to minimize the cost to fulfill this order? Solve the appropriate LP by hand, as you did in problem 1.

3. Consider the salsa-and-guacamole scenario from this weeks's lecture. Suppose we sell salsa for $1 per unit, and guacamole for $ z per unit. Depending on the value of z, we would maximize revenue by making all salsa, all guacamole, or some of each. Describe the range of z values corresponding to each type of solution, and give plenty of justification.

4. Suppose you have the following objects, each with a weight, a volume and a value, as shown.

object	weight	volume	value
1	10	5	72
2	11	6	80
3	7	10	66
4	12	4	75
5	3	9	68
6	4	8	50
7	9	12	85
8	2	10	55
9	8	8	82

Which objects should you put in a knapsack with weight capacity 40 and volume capacity 45 such that the total value is maximized?

Define an IP for this problem. Then solve it with lpsolve. Include all input and output to lpsolve, and comment on the solution (i.e., dont just post the output of lpsolve). Are the constraints binding or not?