Practice Assignment 5

Due: Thursday, February 26 at 2PM to TEACH

To get credit, each student must submit their own solutions (which need not be typeset) to TEACH by the due date above – no late submissions are allowed. Note that while you must each submit solutions individually, you are free to work through the problem sets in groups. Solutions will be posted shortly after class and may be discussed in class. These will be not be graded on the basis of *completion* alone, not *correctness*.

The following questions are about linear programming. Section 2 (pages 21–24) of `http://web.williams.edu/Mathematics/sjmiller/public_html/416/currentnotes/LinearProgramming.pdf` will be very helpful in solving these problems.

1. Suppose, in a linear program, my goal is to *maximize* a linear function, but I only know how to minimize a function. What do I do?

2. Consider the following problem:

$$\begin{aligned} \max \quad & x - y \\ s.t. \quad & x + y \leq 5 \\ & |x + 2y| \leq 10 \end{aligned}$$

   Can I solve this problem with a linear program? If so, how? What is the solution?

3. Consider the following problem:

$$\min \ \max\{x, y\} \ \ s.t.\ x + 2y \geq 2$$

   Can I solve this problem with a linear program? If so, how? What is the solution?

4. You are given a set of points $(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)$ in the plane. You want to find a line $y = mx + b$ that comes close to each point. You probably learnt the method of least squares to find a line of best fit in your past, but we want to find the line of best fit that minimizes the maximum absolute deviation. That is, you want to find the values of m and b that minimizes:

$$\max_{1 \leq i \leq n} |y_i - mx_i - b|$$

   Model this *general problem* as a linear program. If you have time and the means, use the linear program to find the line of minimum-maximum-absolute-deviation for *the instance* given by the following points:

$$(1, 3), (2, 5), (3, 7), (5, 11), (7, 14), (8, 15), (10, 19)$$

   For full credit, you must show that you thought about how to solve this problem.