Homework

1. A company specializes in making 5 types of auto parts. Each part is first cast from iron and then sent to a finishing shop. The required worker-hours (per 100 units) for each of the parts of the two shops are:

| Part | 1 | 2 | 3 | 4 | 5 |
|------|---|---|---|---|---|
| Casting | 2 | 1 | 3 | 3 | 1 |
| Finishing | 3 | 2 | 2 | 1 | 1 |
| Profits | $30 | 20 | 40 | 25 | 10 | ← (per 100 units) |

The work capacities of the casting & finishing shops (per month are 700 and 1000 ~~hours~~ worker-hours, resp. Formulate the LP to determine the numbers of parts of each type to be made so as to maximize profits.

2. Explore the computational complexity of the Simplex algorithm and an interior point algorithm for solving Linear Programs. Feel free to begin with the Matlab code posted on the class web page.

Practice/Test Questions

1. Convert the following LPs to standard form

a. Min $\quad x + 2y + 3z$

    s.t. $\quad 2 \le x + y \le 3$

            $4 \le x + z \le 5$

            $x \ge 0, \; y \ge 0, \; z \ge 0$

b. max $\quad -x - y + z$

    s.t. $\quad x + 2y + 3z = 10$

            $x \ge 1, \; y \ge 2, \; z \ge 1$

2. Convert the following problem to a linear program in standard form

    min $\quad |x| + |y| + |z|$

    s.t. $\quad x + y \le 1$

          $2x + z = 3$

3. A class of piecewise linear functions can be represented as $f(x) = \max(c_1^T x + d_1, c_2^T x + d_2, \ldots, c_p^T x + d_p)$. For such a function, show how to convert the following into a linear programming problem

$$\min \ f(x)$$
$$\text{s.t.} \ Ax = b$$
$$x \geq 0$$

4. Discuss the situation of a linear program that has one or more columns of $A$ equal to zero. Consider both the case where the corresponding variables are required to be non-negative and the case where some are free.