Math 4553, Homework 1, Due on 1/27/2012

1. (4 points) A company can produce three different types of concrete blocks, identified as A, B, and C. The production process is constrained by facilities available for mixing, vibration, and inspection/drying. Using the data given in the following table, formulate the production problem in order to maximize the profit.

	A	B	C	available
Mixing (hours/batch)	1	3	9	900
Vibration (hours/batch)	2	3	6	1,200
Inspection/drying (hours/batch)	0.7	0.8	1	400
Profit ($/batch)	7	17	30	

2. (4 points) A company requires open-top rectangular containers to transport material. Using the following data, formulate an optimum design problem to determine the container dimensions for minimum cost.

Construction costs	Sides = $\$65/m^2$, Bottom = $\$120/m^2$
Can be used for	10 years
Yearly maintenance cost	$\$12/m^2$ of the outside surface area
Minimum volume of the container	$1200\,m^3$

3. (6 points) Use graphical methods to solve the following optimization problem:

$$\text{Maximize } f(x,\, y) = -6x + 9y$$
$$\text{Subject to } \begin{pmatrix} x - y \geq 2 \\ 3x + y \geq 1 \\ 2x - 3y \geq 3 \end{pmatrix}$$

(Notice that x, y are not necessarily positive in this problem.)

4. (6 points) Rewrite the linear programming problem

$$\begin{aligned} \max \quad & f = 2x_1 - x_2 + 2x_3 \\ \text{subject to} \quad & 2x_1 - x_2 + x_3 = 5 \\ & x_1 + x_2 \geq 10 \\ & x_1 \geq 0,\ x_2 \geq 0,\ 0 \leq x_3 \leq 6 \end{aligned}$$

into the standard form

$$\begin{aligned} \min \quad & f = \mathbf{p}^t\mathbf{x} \\ \text{subject to} \quad & A\mathbf{x} \geq \mathbf{b} \\ & \mathbf{x} \geq \mathbf{0} \end{aligned}$$

Identify matrix A and vectors $\mathbf{p}$, $\mathbf{b}$.