Math 4553, Exam I, Feb. 24, 2012 Name: _____

1. (15 points) A university has 3 parking lots, shared by 3 buildings, A, B, and C. The available parking spaces of each lot, the number of employees who need to park their car, and the distances between the buildings and parking lots are given below. Formulate an optimization problem to assign parking permits which minimizes the total walking distances of employees. You may set A_1, A_2, A_3 to be the number of parking permits for lot 1, 2 and 3, respectively, assigned to employees in building A. Similarly, define B_1, B_2, B_3, C_1, C_2, C_3, and use these nine variables as optimization variables. (You do not need to solve the optimization problem.)

		distances from parking lot (meters)		
lot	available parking spaces	Building A	Building B	Building C
1	35	260	380	220
2	120	410	340	370
3	80	350	390	440
# of employees		70	90	50

2. (15 points) Solve the following problem using graphical optimization:

$$\begin{aligned} \min \quad & f = 6x + y \\ \text{subject to} \quad & x + y \geq 3 \\ & 2x - y \geq 2 \\ & x, y \geq 0 \end{aligned}$$

3. (20 points) Solve the following problem using the Simplex method. If the problem has no solution, unbounded solution, or multiple solutions, you must state so and justify your answer.

$$\begin{aligned} \min \quad & f = x_1 + 2x_2 + 3x_3 \\ \text{subject to} \quad & x_1 - x_2 + 3x_3 = 3 \\ & 4x_1 + x_2 \geq 1 \\ & x_1,\ x_3 \geq 0 \\ & x_2 \text{ is a free variable} \end{aligned}$$