Homework 2

- 1. Three neighbors make a fruit salad for a summer picnic. One person uses three pounds of strawberries plus five pounds of grapes plus one pound of melon at a cost of \$20. A second person uses three pounds of strawberries plus two pounds of grapes plus two pounds of melon at a cost of \$21. The last neighbor uses four pounds of strawberries plus three pounds of grapes plus three pounds of melon at a cost of \$30. Write a linear system of equations and find how much each fruit costs. You must use Gauss-Jordan elimination to solve this system.
- 2. Consider the problem of maximizing P = 2x + 4y under the constraints

$$x + 5y \le 10,$$

$$4x + y \le 8,$$

$$x, y \ge 0.$$

- (a) Solve the problem by graphical method.
- (b) Solve the problem by the simplex method.
- 3. Solve the following linear programming problem using the simplex method: maximize $z = 3x_1 + 6x_2 + 2x_3$ subject to

$$3x_1 + 4x_2 + 2x_3 \le 20,$$

$$x_1 + 3x_2 + 2x_3 \le 10,$$

$$x_1, x_2, x_3 \ge 0.$$

4. Solve the following linear programming problem using the simplex method:

minimize
$$z = 3x_1 + 5x_2 + 7x_3$$

subject to

$$-3x_1 + 2x_2 \le 5,$$

$$2x_1 + 3x_2 + 4x_3 \ge 5,$$

$$2x_1 + 5x_3 \le 7,$$

$$x_1, x_2, x_3 \ge 0.$$

5. A contractor rents dirt-removal machines of two different types. A machine of the first type costs \$25 per day to rent, needs one worker to operate it, and moves 30 tons of dirt per day. A machine of the second type costs \$10 per day to rent, needs four workers to operate it, and moves 70 tons of dirt per day. The contractor can spend up to \$500 per day, has a labor force of 64 workers available, and can use a maximum of 25 machines on the site. Formulate the problem of finding the maximum weight of dirt that the contractor can move in one day as a linear programming problem. Then use the simplex method to solve it.

Note: You don't need to worry if the number of rented machines turns out to be noninteger. Renting 2.4 machines for 1 day can practically be viewed as renting 24 machines for 10 days.