MATH 428 Exam I **Spring Semester, 2009**

Name:_____ Any 4 digits PIN:_____ Score:_____

1(15pts) The Medequip Company produces precision medical diagnostic equipment at two factories. Three medical centers have placed orders for this month's production outputs. The table below shows that what the cost would be for shipping each unit from each factory to each of these customers. Also shown are the number of units that will be produced at each factory and the number of units ordered by each customer.

To	**Unit Shipping Cost**			
From	**Customer 1**	**Customer 2**	**Customer 3**	**Out put**
Factory 1	\$600	\$800	\$700	400 units
Factory 2	\$400	\$900	\$600	500 units
Order size	300 units	200 units	400 units	

A decision needs to be made about the shipping plan for how many units to ship from each factory to each customer. (Hint: let x_{ij} denote the units shipped from factory i to customer j.) Formulate a linear programming model for this problem. **Do not solve for the optimal solution.**

2(40pts) Consider the linear programming model

$$\begin{aligned} \text{Maximize} \quad & Z = x_1 + 3x_2 \\ \text{subject to} \quad & \\ & x_2 \le 3 \\ & x_1 + x_2 \le 4 \\ & x_1 + 5x_2 \ge 5 \\ & x_1 \ge 0,\ x_2 \ge 0. \end{aligned}$$

(a) Use the graphical method to solve the problem. Make sure to demonstrate graphically why the optimal solution is so.

(b) Use the Big-M method to set up a linear programming problem and to initialize the first simplex tableau for the simplex method. **Do not work through the remaining steps to solve the problem.**

(c) From the graphical method you can see that the third constraint $x_1 + 5x_2 \ge 5$ plays no role in the optimal solution. Use this information to set up a linear programming problem and then work through the simplex method in its tableau form to find the optimal solution. (Hint: $z^* = 10$)

3(45pts) Life is not fair. Your mom asks you to play Rock-Paper-Scissors with your little brother and demands that you must play scissors half of the time. You play for pennies: no penny is exchanged for a tie, but one penny is exchanged for a win and a loss.

(a) Make up a pay-off table for yourself, and write down your expected pay-off function.

(b) You know you will lose some pennies because your little brother is a clever brat. Use the graphical method to find out your optimal strategy for the best outcome of the bad situation, given that you must obey your mom to play scissors half of the time. (Hint: $v = -1/6$.)

(c) Your little brother probably will play paper for awhile, but will soon realize that he is needlessly helping you out. From your graphical method, explain why he will quit playing paper for good.

(d) Find out your brother's optimal strategy.

(e) If you start the game with 100 pennies, how many will be likely to remain after a long, torturous play?

End