MAT 114 – 008
Fall 2007
Test One
Show all work.

1. A certified public accountant wants to help a client figure out how much the client has invested in four municipal bonds, call them A, B, C, and D. The bonds A, B, C, and D pay annual interest rates of 8%, 10%, 12%, and 14%, respectively. The accountant knows that the client invested $120,000 in the four bonds and that the client was paid $12,900 in interest. The accountant also knows that the client received $4,800 in interest from the investment in bond C and that the amount invested in bond C was $20,000 less than the amount invested in bonds A and B combined. Write a system of linear equations that determines the amount invested in each bond. You need not solve the system.

2. For the following system of linear equations, set up the augmented matrix and use Gauss-Jordan reduction to solve the system.

$$\begin{aligned} x \quad +y \quad +z \quad &= \quad 22 \\ \quad -y \quad +z \quad &= \quad 4 \\ x \quad +y \quad -z \quad &= \quad 0 \end{aligned}$$

3a. Graph the feasible set of the following set of linear inequalities.

$$\begin{aligned} 3x + 8y &\le 24 \\ 6x + 4y &\le 30 \\ x &\ge 0 \\ y &\ge 0 \end{aligned}$$

3b. Find the corner points of the feasible set.

3c. Is the feasible set bounded?

3d. By evaluating $p = 2x + 3y$ at the corners determine the maximum value of p that satisfies the constraints.

4. Write the initial tableau for the following standard maximum problem. You need not solve the problem.

Maximize $p = 5x + 5y + 6z$

subject to the following structural constraints and nonnegativity.

$$\begin{aligned} 4y + z &\le 40 \\ 3x + 7y + 7z &\le 45 \end{aligned}$$

5. Write the initial tableau for the following minimum problem. You need not solve the problem.

Minimize $c = 40x + 60y + 50z$

subject to the following structural constraints and nonnegativity.

$$\begin{array}{rcl} 100x + 100y + 50z & \geq & 1500 \\ 50x + 100y + 100z & \leq & 1500 \end{array}$$

6. Formulate the following linear programming problem; i.e., write the objective function and structural constraints. Let p equal profit, x equal the number of economy rocks, y equal the number of regular rocks, and z equal the number of deluxe rocks that are produced. You need not solve the problem.

A company produces three types of high quality pet rocks: the economy rock, the regular rocks, and the deluxe rock. Each rock must be polished and painted. The regular and deluxe rocks must also be decorated. The time for each of these activities is shown in the table below:

	Economy rock	Regular rock	Deluxe rock
Polish	1	1	1
Paint	1	2	3
Decorate	0	3	4

Each economy rock yields a profit of $4, each regular rock a profit of $7, and each deluxe rock a profit of $8. Suppose that the company has 20 hours of polishing time, 36 hours of painting time, and 36 of decorating time available each week. How many economy rocks, regular rocks, and deluxe rocks should be produced each week to maximize profits?

7. The following is an initial tableau.

	x	y	z					
s	1	1	–1	1	0	0	0	3
t	1	2	1	0	1	0	0	8
u	1	1	0	0	0	1	0	5
	–7	–5	–6	0	0	0	1	0

7a. Is this tableau in phase I or phase II?

7b. Determine the pivot.

7c. Do this one pivot operation.

8. The following is an initial tableau.

	x	y	z	w					
s	1	1	1	1	1	0	0	0	40
t	2	1	–1	–1	0	–1	0	0	10
u	1	1	1	1	0	0	–1	0	10
	–2	–3	–1	–4	0	0	0	1	0

8a. Is this tableau in phase I or phase II?

8b. Determine the pivot.

8c. Do this one pivot operation.

9. The following tableau is neither an initial tableau nor a final tableau.

		y	z			u		
s	0	5	5	1	0	–1	0	50
t	0	5	–5	0	1	0	0	50
x	5	–5	0	0	0	1	0	50
	0	–1	–3	0	0	1	1	50

9a. Is this tableau in phase I or phase II?

9b. Determine the pivot.

9c. Do this one pivot operation.

10. The following is a final tableau. Determine the maximum value of p and the values of x, y, and z. (Show the values of x, y, z, and p as fractions.)

			z	s		u		
x	2	0	12	4	0	–1	0	2000
t	0		–8	0	1	–2	0	2000
y	0	4	–4	–4	0	2	0	2000
	0	0	25	4	0	1	1	10000