

MAT 114 – 001
Fall 2008
Test One
Show all work.

1. The quantity demanded each month of Russo Espresso Makers is 250 when the unit price is \$140. The quantity demanded each month is 1000 when the unit price is \$110. The suppliers will market 750 espresso makers if the unit price is \$60. At a unit price of \$80 they are willing to make available 2250 units.

- 1a. The demand equation is known to be linear. Write the demand equation.
- 1b. The supply equation is known to be linear. Write the supply equation.
- 1c. Determine the equilibrium price.

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

$$\begin{array}{rclcl} 3x & -2y & +8z & = & 9 \\ -2x & +2y & +z & = & 3 \\ x & +2y & -3z & = & 8 \end{array}$$

3. For each of the following augmented matrices of systems of linear equations (with unknowns x , y , and z), determine whether the system has a unique solution, no solution, or infinitely many solutions. Explain.

$$3a. \begin{bmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

$$3b. \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -1 \end{bmatrix}$$

$$3c. \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & -1 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

4a. Graph the feasible set of the following set of linear inequalities.

$$\begin{aligned} 2x + y &\leq 180 \\ x + 3y &\leq 300 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

4b. Find the corner points of the feasible set.

4c. Is the feasible set bounded?

4d. By evaluating $p = x + 1.2y$ at the corners (and, if necessary, a new corner) determine the maximum value of P that satisfies the constraints.

5a. Write the initial tableau for the following standard maximum problem. You need not solve the problem.

$$\text{Maximize } p = 3x + 3y + 4z$$

subject to the following structural constraints and nonnegativity.

$$x + 1y + 3z \leq 15$$

$$4x + 4y + 3z \leq 65$$

5b. Determine the first pivot. You do not need to do the pivot – just determine the row and column of the first pivot.

6. 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.)

	x	y	z	s	t	u	p		
s	0	0	0	1	0	1	0	4	0
y	0	6	3	0	1	4	0	240	
x	6	0	3	0	-1	-10	0	120	
p	0	0	6	0	4	4	3	1680	

7. Formulate the following linear programming problem; i.e., write the objective function and structural constraints. Let p equal profit, x equal the number of model A hibachis, and y equal the number of model B hibachis. You need not solve the problem.

Kane manufacturing has a division that produces two models of hibachis, model A and model B. To produce each model A hibachi requires 3 pounds of cast iron and 6 minutes of labor. To produce each model B hibachi requires 4 pounds of cast iron and 3 minutes of labor. The profit for each model A hibachi is \$2, and the profit for each model B hibachi is \$1.50. If 1000 pounds of cast iron and 1200 minutes of labor are available for production of hibachis each day, how many hibachis of each model should the division produce to maximize Kane's profits?