

Name: _____

Date: _____

Math 151 – Linear Mathematics

Final Exam – Spring 2010

Show your works. No works, no credits.

Your Score	
Total	100

No.1 A manufacturer has a monthly fixed cost of \$ 40,000 and a production cost of \$8 for each unit produced. The product sells for \$ 12/unit.

(a) Indicate the unknown clearly and assign a variable for the unknown. (1 pt)

(b) What is the cost function? (3 pts)

(b) What is the revenue function? (2 pts)

(c) Find the break-even point algebraically. (Note: **Find both the break-even quantity and break-even revenue for full credits**) (6 pts)

(d) What is the profit function? (4 pts)

(e) Compute the profit/loss corresponding to production levels of 8000 and 12,000 units and **state it clearly whether it is a profit or loss.** (6 pts)

No.2 Let $A = \begin{bmatrix} 3 & -5 \\ 4 & -7 \end{bmatrix}$.

(a) Find A^{-1} . (6 pts)

(b) Find $(A^{-1})^{-1}$. (6 pts)

Hint: Let $B = A^{-1}$ from part (a) and find B^{-1} . And $B^{-1} = (A^{-1})^{-1}$.

(c) Can you conclude that $(A^{-1})^{-1} = A$. **Justify your answer carefully by using part(a) and (b).**

(2 pts)

No.3 Find the inverse of the matrix, if it exists. (10 pts)

$$A = \begin{bmatrix} 2 & -3 & -4 \\ 0 & 0 & -1 \\ 1 & -2 & 1 \end{bmatrix}$$

No.4 Solve for u, x, y, and z in the matrix equation:

(10 pts)

$$\begin{bmatrix} 3x & -2 \\ -3 & y \end{bmatrix} - 4 \begin{bmatrix} -3 & 2 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 15 & -2z \\ -u & 4 \end{bmatrix}$$

No.5 A company manufactures two products, A and B, on two machines, I and II. It has been determined that the company will realize a profit of \$5 on each unit of product A and a profit of \$3 on each unit of product B. To manufacture a unit of product A requires 6 min on machine I and 4 min on machine II. To manufacture a unit of product B requires 9 min on machine I and 2 min on machine II. There are 4 hour of machine time available on machine I and 2 hr of machine time available on machine II in each work shift. Determine how many units of each product should be produced in each shift to maximize the company's profit by answering the following questions.

Fill in the details for the following table.

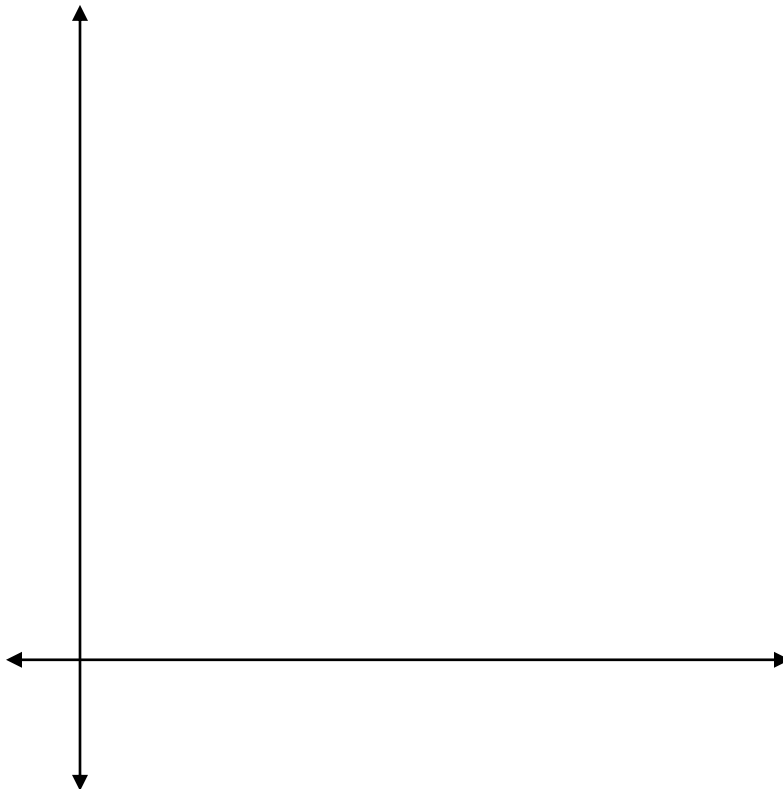
	Type A	Type B	Time Available
Machine I			
Machine II			
Profit/Unit			

(a) Indicate the unknowns clearly and assign the variable for the unknowns. (2 pts)

(b) Formulate the objective function (ie, profit equation) that you want to maximize. (2 pts)

(c) Formulate the system of inequalities that the objective function is subjected. (6 pts)

(d) Determine graphically the solution set for the system of inequalities from part (c).
Indicate clearly the coordinates of all corner points (vertices) of the solution set.
(12 pts)



(e) Determine how many units of each product should be produced in each shift to maximize the company's profit? (6 pts)

(f) What is the optimal profit? (2 pts)

No.6 For the following system of linear equations

$$2x - 3y - 4z = 4$$

$$-z = 3$$

$$x - 2y + z = -8$$

(a) Write a matrix equation that is equivalent to the above system of linear equations. (6 pts)

(b) Solve the system of equations by using the inverse of the coefficient matrix. (8 pts)
(Note: 0 credit for using augmented matrix and not using the matrix equations. Express your answer clearly for full credits.)

Hint: You may use No.3 for the inverse of the coefficient matrix.