

UNIVERSITY OF NEW BRUNSWICK
DEPARTMENT OF MATHEMATICS AND STATISTICS

Winter 2004

Math 1833

Finite Mathematics for the Management Sciences

Test #3: Worth 30% of your final mark

Time: 2 hours

Mark: _____/30

Instructions:

- Show all your work. **No work, no marks!**
- Work neatly and in an organized manner.
- If you need to start a question over, put a line through the work you do not want marked.
- If you are using a formula in a problem, state it first!
- Graphing calculators are **not** allowed!
- Good Luck! ☺

1. Let $A = \begin{bmatrix} 1 & -2 \\ 3 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & 5 \\ 1 & 4 & -3 \end{bmatrix}$, $C = \begin{bmatrix} 2 \\ -4 \\ 0 \end{bmatrix}$, $D = \begin{bmatrix} 3 \\ \frac{1}{2} \end{bmatrix}$.

- a) [3 marks] Find $ABC - 2D$
b) [1 mark] Find BA .

2. [2 marks] Indicate whether the matrix is in row-reduced echelon form.
If it is not in RREF state the reason.

a) $\left[\begin{array}{cc|c} 1 & 1 & 3 \\ 0 & 0 & 0 \end{array} \right]$

c) $\left[\begin{array}{ccc|c} 0 & 1 & 2 & 4 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{array} \right]$

b) $\left[\begin{array}{ccc|c} 1 & 0 & 1 & 3 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 6 \end{array} \right]$

d) $\left[\begin{array}{cc|c} 1 & 0 & -10 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{array} \right]$

3. [4 marks] Solve the following system using Gaussian Elimination.

$$3x - 2y + 4z = 16$$

$$2x + y - 2z = -1$$

$$x + 4y - 8z = -18$$

4. a) [3 marks] Find the inverse of $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix}$.

b) [2 marks] Use the answer you found in part a) to solve the following systems.

$$2x + y + z = 1$$

i) $3x + 2y + z = 2$

$$2x + y + 2z = -1$$

$$2x + y + z = 2$$

ii) $3x + 2y + z = -3$

$$2x + y + 2z = 1$$

5. [4 marks] Ace Novelty received an order from Canada's Wonderland for 900 Giant Pandas, 1200 Big Red Dogs and 2000 Big Birds. Ace's management decided that 500 Giant Pandas, 800 Big Red Dogs, and 1300 Big Birds could be manufactured in their Calgary plant and the balance of the order could be filled by their Halifax plant. Each Panda require 1.5 yards of plush, 30 cubic feet of stuffing, and 5 pieces of trim; each Big Red Dog requires 2 square yard of plush, 35 cubic feet of stuffing, and 8 pieces of trim; and each Big Bird requires 2.5 square yards of plush, 25 cubic feet of stuffing, and 15 pieces of trim.

- Write a production matrix representing the quantities of each type of animal to be produced at each plant location.
- Write an activity matrix representing the amount and type of material required to manufacture each type of animal.
- Write a cost matrix representing the unit cost for each type of material.
- Use matrix operations to find how much of each type of material must be purchased for each plant.

6. [3 marks] Determine graphically the Feasible Region for the following system of linear inequalities.

$$4x + 3y > 12$$

$$x - y \leq 0$$

7. [4 marks] Solve the following Linear Programming Problem:

Let x = the number of pencils to be bought

y = the number of pens to be bought

$$\text{Minimize Cost} = 6x + 8y$$

Subject to:

$$40x + 10y \geq 2400$$

$$10x + 15y \geq 2100$$

$$5x + 15y \geq 1500$$

$$x \geq 0, y \geq 0$$

8. [4 marks] Set up the following Linear Programming Problem. DO NOT SOLVE.

A farmer plans to plant two crops, A and B. The cost of cultivating crop A is \$40/acre, whereas that of crop B is \$60/acre. The farmer has a maximum of \$7400 available for land cultivation. Each acre of crop A requires 20 labour-hours, and each acre of crop B requires 25 labour-hours. The farmer has a maximum of 3300 labour-hours available. If he expects to make a profit of \$150/acre on crop A and \$200/acre on crop B, how many acres of each crop should he plant in order to maximize his profit?