

Math 17B  
 Vogler  
 Discussion Sheet 8

1.) Consider the following matrices of various dimensions. Perform the indicated operations.

$$A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 0 \\ 0 & -2 & 3 \end{pmatrix}, \quad B = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 1 & 2 \\ 1 & 0 & -2 \end{pmatrix}, \quad C = \begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix}, \quad D = \begin{pmatrix} 1 & -2 & 3 \\ 2 & 0 & -1 \end{pmatrix}$$

$$E = (1 \quad -1 \quad 0 \quad 4), \quad F = \begin{pmatrix} 2 \\ -2 \\ 3 \\ -1 \end{pmatrix}$$

- a.)  $3C$    b.)  $A - B$    c.)  $B'$ , the transpose of  $B$   
 d.)  $CD$    e.)  $AB$    f.)  $BA$    g.)  $EF$    h.)  $FE$   
 i.) Compute  $C^{-1}$ , the inverse of  $C$    j.) Compute  $A^{-1}$ , the inverse of  $A$ .

2.) Consider the system  $\begin{cases} x - y = 3 \\ 2x + 3y = 26 \end{cases}$

- a.) Solve the system using matrix reduction.  
 b.) Rewrite the system in the form  $AX = B$  and solve it using  $A^{-1}$ .

3.) Compute the determinant of each of the following matrices to determine which matrices are invertible. If the matrix is invertible, determine its inverse matrix.

a.)  $A = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$    b.)  $A = \begin{pmatrix} 2 & 4 \\ -3 & -6 \end{pmatrix}$    c.)  $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$    d.)  $A = \begin{pmatrix} 0 & 0 \\ 3 & 5 \end{pmatrix}$

4.) Determine the inverse for each  $3 \times 3$  matrix.

a.)  $A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & -1 & 1 \\ 0 & 1 & -2 \end{pmatrix}$    b.)  $A = \begin{pmatrix} 2 & -1 & 3 \\ 1 & 1 & -1 \\ 3 & -2 & 1 \end{pmatrix}$    c.)  $A = \begin{pmatrix} 3 & 1 & 4 \\ 4 & 1 & 6 \\ 1 & 0 & 1 \end{pmatrix}$

5.) Use your answer in part 4.)a.) to solve the system  $\begin{cases} x + 3z = 2 \\ 2x - y + z = -3 \\ y - 2z = 0 \end{cases}$

6.) Let  $A = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix}$  and  $B = \begin{pmatrix} 5 & 0 \\ -1 & 4 \end{pmatrix}$ . Show that  $AB$  is not equal to  $BA$ .

7.) Let  $A = \begin{pmatrix} 2 & 3 \\ 0 & 0 \end{pmatrix}$ .

a.) Find a 2x2 matrix  $B$  so that  $AB = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ , or explain why it is impossible.

b.) Find a 2x2 matrix  $B$ , where NOT ALL of the entries are zero, so that  $AB = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ , or explain why it is impossible.

8.) Consider the Leslie matrix  $L = \begin{pmatrix} 0 & 1.4 & 1.8 & 2.7 & 0.9 \\ 0.9 & 0 & 0 & 0 & 0 \\ 0 & 0.75 & 0 & 0 & 0 \\ 0 & 0 & 0.6 & 0 & 0 \\ 0 & 0 & 0 & 0.4 & 0 \end{pmatrix}$

a.) How many age classes are in this population ?

b.) What percent of 2-year old females survive to the end of the following breeding season ?

c.) What percent of 4-year old females survive to the end of the following breeding season ?

d.) What is an average number of female offspring for a 0-year old female ?

e.) What is an average number of female offspring for a 1-year old female ?

f.) What is an average number of female offspring for a 3-year old female ?

g.) If  $N(0) = \begin{pmatrix} 1000 \\ 650 \\ 450 \\ 550 \\ 300 \end{pmatrix}$ , determine  $N(1)$ .

“ I hear and I forget. I see and I remember. I do and I understand.” – Chinese Proverb