nalysis – Deggeller/Gleason/Tantod State your Identity: Alan Lee D° +27/27

Matrix Quiz 1 2019/20 (27 pts)

NO CALCULATORS

1. For this problem, consider the 3 matrices below.

$$A=\begin{bmatrix} 3 & 1 & -4 \\ -2 & 2 & 1 \\ 1 & 0 & 2 \end{bmatrix} \qquad B=\begin{bmatrix} 1 & 0 & -1 \\ 3 & -2 & 5 \end{bmatrix} \qquad C=\begin{bmatrix} 7 & 2 \\ 6 & -4 \end{bmatrix}$$

a) Of the 6 potential products AB, BA, BC, CB, ~~AC~~ and ~~CA~~ only 2 are possible. State which 2, and then do the actual multiplication. [4 each]

#1 BA

$$\begin{bmatrix} 1 & 0 & -1 \\ 3 & -2 & 5 \end{bmatrix}\begin{bmatrix} 3 & 1 & -4 \\ -2 & 2 & 1 \\ 1 & 0 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 1 & -6 \\ 18 & -1 & -4 \end{bmatrix}$$

#2 CB

$$\begin{bmatrix} 7 & 2 \\ 6 & -4 \end{bmatrix}\begin{bmatrix} 1 & 0 & -1 \\ 3 & -2 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 13 & -4 & 3 \\ -6 & 8 & -26 \end{bmatrix}$$

c) Can any of the 3 matrices A,B or C be added together? no Explain your answer below. [2]

they do not have the same dimensions

b) if you were allowed to transpose exactly ONE of the matrices above, state a different product that would be possible, using ***proper notation***. No need to actually do the multiplication. [2]

answer: $B^T C$

2. Represent the following system of equations ***using matrices***. Then solve the system using matrices, clearly showing your use of an inverse matrix. [5]

$7x + 2y = 3$
$6x - 4y = 14$

$$\begin{bmatrix} 7 & 2 \\ 6 & -4 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 14 \end{bmatrix}$$

A

$\det(A) = -40$

$$\text{inv}(A) = \begin{bmatrix} \frac{1}{10} & \frac{1}{20} \\ \frac{3}{20} & -\frac{7}{40} \end{bmatrix}$$

$$\begin{bmatrix} \frac{1}{10} & \frac{1}{20} \\ \frac{3}{20} & -\frac{7}{40} \end{bmatrix}\begin{bmatrix} 3 \\ 14 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$\Downarrow$$

$$\begin{bmatrix} 1 \\ -2 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$$

Answer: (1, -2)

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3. Insureco has three traveling insurance salespeople: Ally, Bob and Carlos. They sell 3 different types insurance, Travel, Life, and Home. Travel insurance costs $100, Life insurance costs $500 and Health insurance costs $600. Ally sold 5 Travel, 4 Life, and 4 Health last week. Bob sold 3/3/3 respectively. Carlos sold 6/0/2 respectively. Create two matrices, one of which is a 3x3, that when multiplied together (show order), would yield a 3 x 1 matrix consisting of each salesperson's total sales in $ last week. [4]

$$\begin{bmatrix} 5 & 4 & 4 \\ 3 & 3 & 3 \\ 6 & 0 & 2 \end{bmatrix} \begin{bmatrix} 100 \\ 500 \\ 600 \end{bmatrix} = \begin{bmatrix} 4900 \\ 3600 \\ 1800 \end{bmatrix}$$

4. Solve the system using Gauss-Jordan Elimination clearly showing and labeling each step. (6 pts)

$$\begin{cases} x+y-z=6 \\ x \quad +z=1 \\ -2y-3z=4 \end{cases}$$

$$\left[\begin{array}{ccc|c} 1 & 1 & -1 & 6 \\ 1 & 0 & 1 & 1 \\ 0 & -2 & -3 & 4 \end{array}\right]$$

$R_1 \Rightarrow R_1 - R_2$

$$\left[\begin{array}{ccc|c} 0 & 1 & -2 & 5 \\ 1 & 0 & 1 & 1 \\ 0 & -2 & -3 & 4 \end{array}\right]$$

$R_1 \Rightarrow 2 \cdot R_1$

$$\left[\begin{array}{ccc|c} 0 & 2 & -4 & 10 \\ 1 & 0 & 1 & 1 \\ 0 & -2 & -3 & 4 \end{array}\right]$$

$R_3 \Rightarrow R_1 + R_3$

$$\left[\begin{array}{ccc|c} 0 & 2 & -4 & 10 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & -7 & 14 \end{array}\right]$$

$R_3 \Rightarrow \frac{R_3}{-7}$

$$\left[\begin{array}{ccc|c} 0 & 2 & -4 & 10 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & -2 \end{array}\right]$$

$R_1 \Rightarrow R_1 + 4R_3$

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

$R_1 \Rightarrow \frac{R_1}{2}$

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

$R_2 \Rightarrow R_2 - R_3$

$$\left[\begin{array}{ccc|c} 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 3 \\ 0 & 0 & 1 & -2 \end{array}\right]$$

$R_1 \Leftrightarrow R_2$

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -2 \end{array}\right]$$

$((x, y, z)$

$= \boxed{(3, 1, -2)}$ /10