

20 minutes

Math 584

Quiz 1 Spring 2019

Name \_\_\_\_\_

YOU ARE BEING GRADED FOR WORK, NOT JUST THE FINAL ANSWER.

1) Let  $B = \begin{bmatrix} 1 & 4 \\ 1 & 4 \end{bmatrix}$ .

a) Find  $\text{rank}(B)$ .

$$= \boxed{1}$$

b) Find a basis for  $C(B)$ .

$$\left\{ \begin{pmatrix} 1 \\ 1 \end{pmatrix} \right\}$$

c) Find  $[C(B)]^\perp = \text{nullspace of } B^T$ .  $B^T = \begin{bmatrix} 1 & 1 \\ 4 & 4 \end{bmatrix}$

$$B^T \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{matrix} y_1 + y_2 = 0 & \text{or } y_1 = -y_2 \\ 4y_1 + 4y_2 = 0 & \text{or } y_1 = -y_2 \end{matrix}$$

$$[C(B)]^\perp = \left\{ \alpha \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \alpha \in \mathbb{R} \right\} = \left\{ \alpha \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \alpha \in \mathbb{R} \right\}$$

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$$\text{note } B^T \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 4 & 4 \end{pmatrix} \begin{pmatrix} -1 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} = B^T \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

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2.17

2) Let  $A = \begin{bmatrix} 1 & 2 & 4 & 3 \\ 3 & -1 & 2 & -2 \\ 5 & -4 & 0 & -7 \end{bmatrix}$  and show that  $A^{-} = \frac{1}{7} \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$  is a generalized

inverse of  $A$ .

Show  $AA^{-}A = A$ .

easier

$$(AA^{-})A = \frac{1}{7} \begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ -7 & 14 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 & 4 & 3 \\ 3 & -1 & 2 & -2 \\ 5 & -4 & 0 & -7 \end{bmatrix} =$$

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

OR harder

$$A(A^{-}A) = \frac{1}{7} \begin{bmatrix} 1 & 2 & 4 & 3 \\ 3 & -1 & 2 & -2 \\ 5 & -4 & 0 & 7 \end{bmatrix} \begin{bmatrix} 7 & 0 & 8 & -1 \\ 0 & 7 & 10 & 11 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} = A$$

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