CS 132 Quiz 4B (Individual)

Gordon Ng

TOTAL POINTS

9 / 10

QUESTION 1

1 2 / 2

✓ **- 0 pts** Correct

- 2 pts Incorrect

QUESTION 2

2 4 / 5

- 0 pts Correct

- 1 pts Part 1 Incorrect

- 1 pts Part 2 Incorrect

✓ **- 1 pts Part 3 Incorrect**

- 1 pts Part 4 Incorrect

- 1 pts Part 5 Incorrect

- 1 pts Didn't justify some answers

- 0.5 pts Didn't justify some answers

- 1.5 pts Didn't justify some answers

QUESTION 3

3 3 / 3

✓ **- 0 pts** Correct

- 1 pts Incorrect P(C<-B)

- 1 pts Incorrect [x]B

- 1 pts Incorrect [x]C

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Answer the questions in the spaces provided.
If you run out of room for an answer, continue on the back of the page.

(First Name, Last Name): Gordon Ng BU ID: U82744816

1. (2 points) If the null space of a 5×6 matrix **A** is 4-dimensional, what is the dimension of the column space of **A**?

The column space would be 2.

$$5 \left[\begin{matrix} fv & 1 & & & & \\ fv & 0 & 0 & 0 & 0 & 0 \\ fv & & & & & \\ fv & & & & & \end{matrix}\right]^{6} \quad \begin{bmatrix} x_1 \\ x_2 \\ x_3 = fv \\ x_4 = fv \\ x_5 = fv \\ x_6 = fv \end{bmatrix}$$

2. (5 points) **A** is an $m \times n$ matrix. Mark each statement True or False. Justify each answer.

   1. The row space of **A** is the same as the column space of $\mathbf{A}^T$. True, rank is unchanged
   2. If **B** is any echelon form of **A**, and if **B** has three nonzero rows, then the first three rows of **A** form a basis for Row **A**. False, there could be no solution.
   3. The dimensions of the row space and the column space of **A** are the same, even if **A** is not a square. False, there could be a matrix that isn't equal
   4. The sum of the dimensions of the row space and the null space **A** equals the number of rows in **A**. False, null space is free variables
   5. On a computer, row operations can change the apparaent rank of a matrix.

False ~~FALSE~~, the rank is unchanged with row operations, because it is the rank at the end that determines it.

3. (3 points) Let $\mathcal{B} = \{\mathbf{b}_1, \mathbf{b}_2\}$ and $\mathcal{C} = \{\mathbf{c}_1, \mathbf{c}_2\}$ be bases for a vector space $\mathcal{V}$, and suppose $\mathbf{b}_1 = 6\mathbf{c}_1 - 2\mathbf{c}_2$ and $\mathbf{b}_2 = 9\mathbf{c}_1 - 4\mathbf{c}_2$.

   1. Find the change of coordinates matrix from $\mathcal{B}$ to $\mathcal{C}$.
   2. Find $[\mathbf{x}]_c$ for $\mathbf{x} = -3\mathbf{b}_1 + 2\mathbf{b}_2$. Use part (1).

a)

$$b_1 = \begin{bmatrix} 6 \\ -2 \end{bmatrix} \quad b_2 = \begin{bmatrix} 9 \\ -4 \end{bmatrix} \quad \underset{C \leftarrow B}{P} = \begin{bmatrix} 6 & 9 \\ -2 & -4 \end{bmatrix}$$

$$\begin{array}{r} +18 \\ 27 \\ \hline 45 \end{array}$$

b)

$$\begin{matrix} -18 - 27 \\ 4 + 8 \end{matrix} \begin{bmatrix} 45 \\ 12 \end{bmatrix} = [x]_c \quad \underset{2\times 2}{\begin{bmatrix} 6 & 9 \\ -2 & -4 \end{bmatrix}} \cdot \underset{2\times 1}{\begin{bmatrix} -3 \\ -2 \end{bmatrix}} = [x]_c \quad \begin{matrix} -18 + \cancel{18} & 6 \\ \cancel{+18} & +8 \end{matrix} = \begin{bmatrix} 12 \\ -10 \end{bmatrix}$$

$[x]_c$

$$\begin{bmatrix} 45 \\ 12 \end{bmatrix}$$

2×1

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Print Name, Last Name: Gordon Ng .... BU ID: U8 2744...

(2 points) If the null space of a [illegible] matrix A is [illegible]-dimensional, what is the dimension of the column space of A?

The column space would be [illegible]

[illegible]

(? points) Let $\mathcal{B} = \{b_1, b_2\}$ and $\mathcal{C} = \{c_1, c_2\}$ be bases for a vector space V, and suppose $b_1 = 6c_1 - 2c_2$ and $b_2 = 9c_1 - 4c_2$.

a. Find the change of coordinates matrix from $\mathcal{B}$ to $\mathcal{C}$.

b. Find $[x]_\mathcal{C}$ for $x = -3b_1 + 2b_2$. Use part (a).

$b_1 = \begin{bmatrix} 6 \\ -2 \end{bmatrix} \quad b_2 = \begin{bmatrix} 9 \\ -4 \end{bmatrix}$

[illegible]