CS 132 Assignment3

Gordon Ng

TOTAL POINTS

41 / 42

QUESTION 1

1 3 / 3

✓ **- 0 pts Correct**

- 1 pts Not showing T (u + v) = T (u) + T (v)

- 1 pts Not showing T(cu) = cT(u)

- 1 pts Lacking of explanation in proof

- 3 pts Wrong or Missing answer

QUESTION 2

10 pts

2.1 5 / 5

✓ **- 0 pts Correct**

- 1 pts Part1: Incorrect Answer

- 1 pts Part1: Incorrect Justification

- 1 pts Part2: Incorrect Answer (Yes or No)

- 2 pts Part2: Incorrect Justification

- 1 pts Not Selected Correct Pages

- 5 pts Missing

2.2 5 / 5

✓ **- 0 pts Correct**

- 1 pts Part1: Incorrect Answer

- 1 pts Part1: Incorrect Justification

- 1 pts Part2: Incorrect (Yes or No)

- 2 pts Part2: Incorrect Justification

- 1 pts Not Selected Correct Pages

- 5 pts Missing

QUESTION 3

3 4 / 4

✓ **- 0 pts Correct**

- 2 pts Incorrect Explanation

- 2 pts Incorrect Figure

QUESTION 4

4 3 / 3

✓ **- 0 pts Correct**

- 3 pts Incorrect

QUESTION 5

8 pts

5.1 2 / 2

✓ **- 0 pts Correct**

- 1 pts Some Correct, Some Incorrect

- 2 pts Incorrect/Missing

5.2 5 / 6

- 0 pts All Parts Correct

- 1 pts Part i Slightly Incorrect

✓ **- 1 pts Part ii Slightly Incorrect**

- 1 pts Part iii Slightly Incorrect

- 2 pts Part i Incorrect

- 2 pts Part ii Incorrect

- 2 pts Part iii Incorrect

QUESTION 6

6 3 / 3

✓ **- 0 pts Correct**

- 1 pts Used same non-zero columns for b1, b2

- 1.5 pts Incorrect answer, correct explanation / working

- 2 pts Correct answer, no working

- 3 pts Incorrect answer

- 3 pts No solution

QUESTION 7

7 3 / 3

✓ **- 0 pts Correct**

- 1 pts wrong answer

- 2 pts wrong justification

- **3 pts** missing or wrong answer

QUESTION 8

8 pts

8.1 8 / 8

✓ **- 0 pts** Correct

- **8 pts** No Solution

Gordon Ng Assignment 3

1. (i) $T(0,0,0) \Rightarrow T(0) = 0$

(ii) $T(dv + cu) = cT(u) + dT(v)$

$u = x_1, 0, x_3$

$T(x_1, 0, x_3)) + T(x_1, 0, x_3))$

$cx_1, 0, cx_3 \quad dx_1, 0, dx_3$

$T(cx_1 + dx_1, 0+0, cx_3 + dx_3)$

$cx_1, 0, cx_3 \quad dx_1, 0, dx_3$

$cT(x_1) + dT(u)$

2a)

$$A = \begin{bmatrix} 4 & -2 & 5 & -5 \\ -9 & 7 & -8 & 0 \\ -6 & 4 & 5 & 3 \\ 5 & -3 & 8 & -4 \end{bmatrix}$$

$$rref(A) = \begin{bmatrix} 1 & 0 & 0 & -3.5 \\ 0 & 1 & 0 & -4.5 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$x_1 + -3.5x_4 = 0$

$x_2 +$

f.v

$x = (7/2, 9/2, 0, 1)$ (x_1, x_2, x_3, x_4)

$x_1 \quad x_2 \quad x_3 \quad x_4$

$x_1 + \quad -3.5x_4 = 0$

$x_2 + \quad -4.5x_4 = 0$

$x_3 \quad = 0$

$0 \quad = 0$

9i) ii)

$x_1 + -3.5x_4 = 7$

$x_2 + -4.5x_4 = 5$

$x_3 = 9$

$0 = 7$

$x_1 = 7 + 3.5x_4$

$x_2 = 5 + 4.5x_4$

$x_3 = 9$

$x_4 = x_4$

$x_1 = 10.5$

$x_2 = 9.5$

$x_3 = 9$

$x_4 = 1$

$$\begin{bmatrix} 1.000 & 0 & 0 & -3.5 & 4 \\ 0 & 1 & 0 & -4.5 & 7 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$x_1 + x_4(-3.5) = 4$

$x_2 + x_4(-4.5) = 7$

$x_3 = 1$

$x_4 = x_4$

$x_1 = 4 + 3.5x_4$

$x_2 = 7 + 4.5x_4$

$x_3 = 1$

$x_4 = x_4$

iff $x_4 = 1$

$x_1 = 7.5$

$x_2 = 11.5$

$x_3 = 1$

$x_4 = 1$

1 3 / 3

✓ **- 0 pts Correct**

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$x_1 + -3.5x_4 = 0$

$x_2 +$

f.v

$x = (7/2, 9/2, 0, 1)$ (x_1, x_2, x_3, x_4)

$x_1 \quad x_2 \quad x_3 \quad x_4$

$x_1 + \quad -3.5x_4 = 0$

$x_2 + \quad -4.5x_4 = 0$

$x_3 \quad = 0$

$0 \quad = 0$

9i) ii)

$x_1 + -3.5x_4 = 7$

$x_2 + -4.5x_4 = 5$

$x_3 = 9$

$0 = 7$

$x_1 = 7 + 3.5x_4$

$x_2 = 5 + 4.5x_4$

$x_3 = 9$

$x_4 = x_4$

$x_1 = 10.5$

$x_2 = 9.5$

$x_3 = 9$

$x_4 = 1$

$$\begin{bmatrix} 1.000 & 0 & 0 & -3.5 & 4 \\ 0 & 1 & 0 & -4.5 & 7 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$x_1 + x_4(-3.5) = 4$

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$x_3 = 1$

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$x_2 = 7 + 4.5x_4$

$x_3 = 1$

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iff $x_4 = 1$

$x_1 = 7.5$

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$x_4 = 1$

2.1 5 / 5

✓ **- 0 pts** **Correct**

- 1 pts Part1: Incorrect Answer

- 1 pts Part1: Incorrect Justification

- 1 pts Part2: Incorrect Answer (Yes or No)

- 2 pts Part2: Incorrect Justification

- 1 pts Not Selected Correct Pages

- 5 pts Missing

b.i)

$$A = \begin{bmatrix} -9 & -4 & -9 & 4 \\ 5 & -8 & -7 & 6 \\ 7 & 11 & 16 & -9 \\ 9 & -7 & -4 & 5 \end{bmatrix} \quad \text{rref}(A) = \left[\begin{array}{cccc|c} 1 & 0 & 0 & 0 & 3/4 \\ 0 & 1 & 0 & 0 & 1\,1/4 \\ 0 & 0 & 1 & 0 & -1\,3/4 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$x_1 = 3/4$
$x_2 = 1\,1/4$
$x_3 = -1\,3/4$
$x_4 = x_4$

$x = (x_1 \quad x_2 \quad x_3 \quad x_4) = (3/4 \quad 1\,1/4 \quad -1\,3/4 \quad 1)$

b.ii)

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

$x_1 + 3/4\,x_4 = -1\,1/4$
$x_2 + 1\,1/4\,x_4 = -2\,3/4$
$x_3 + -1\,3/4\,x_4 = 3\,1/4$
$x_4 = x_4$

$x_1 = -1\,1/4 - 3/4\,x_4$
$x_2 = -2\,3/4 - 1\,1/4\,x_4$
$x_3 = 3\,1/4 + 1\,3/4\,x_4$
$x_4 = x_4$

iff $x_4 = 1$

$x_1 = -2$
$x_2 = -4$
$x_3 = 5$
$x_4 = 1$

2.2 5 / 5

✓ **- 0 pts** **Correct**

- 1 pts Part1: Incorrect Answer

- 1 pts Part1: Incorrect Justification

- 1 pts Part2: Incorrect (Yes or No)

- 2 pts Part2: Incorrect Justification

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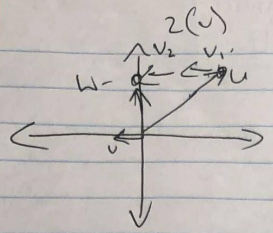
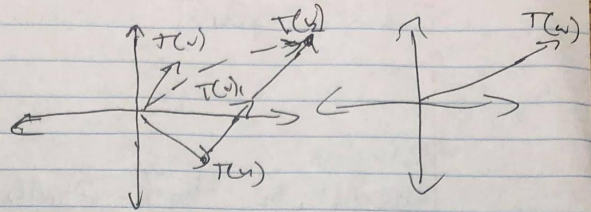
3.



$u + 2(v) = u$



$T(u) + 2T(v) = T(w)$

4. $x_1\begin{bmatrix}-2\\5\end{bmatrix} + x_2\begin{bmatrix}7\\-3\end{bmatrix}$

T is a linear transformation:
$x_1T(v) + x_2T(u) = T(x_1v + x_2u)$

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

5a) $\begin{bmatrix}1/6 & 1/2 & 1/3\\1/2 & 1/4 & 1/4\\1/3 & 1/4 & 5/12\end{bmatrix}$ Markov's Theory, each row sums to 1.
Even at A^{30}, each row sums to 1.
They all reach to 0.3333 when the matrix is towards higher numbers/limits for ~~ignore~~ exponents. They get closer and closer to 0.3333

b)i) All the matrixes return zero matrixes when $(A+I)(A-I)-(A^2)-I)$

bii) All the matrixes return zero matrixes when $((A+B)(A-B)) - ((A^2)-B^2))$

5 biii) $S^2 = \begin{bmatrix}0&0&1&0&0\\0&0&0&1&0\\0&0&0&0&1\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^3 = \begin{bmatrix}0&0&0&1&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^4 = \begin{bmatrix}0&0&0&0&1\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^5 S^6 = \begin{bmatrix}0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$

6. $\left[\begin{array}{cc|c}3&-6&0\\-2&4&0\end{array}\right]\frac{1}{3}\left[\begin{array}{cc|c}1&-2&0\\-2&4&0\end{array}\right]\times 2+1\left[\begin{array}{cc|c}1&-2&0\\0&0&0\end{array}\right]$ $x_1 + -2x_2 = 0$

$x_1 = 2x_2$

$\begin{bmatrix}3&-6\\-2&4\end{bmatrix}\begin{bmatrix}a&b\\c&d\end{bmatrix}$ $3a - 6c = 0$ $3b - 6d = 0$

$-2a + 6c = 0$ $-2b + 6d = 0$

$a = 2c$ $b = 2d$

$x_2\begin{bmatrix}2\\1\end{bmatrix}$

$B = \begin{bmatrix}4&2\\2&1\end{bmatrix}$

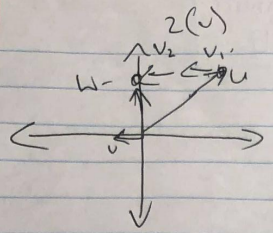
3 **4 / 4**

✓ **- 0 pts** **Correct**

- 2 pts Incorrect Explanation

- 2 pts Incorrect Figure

3.



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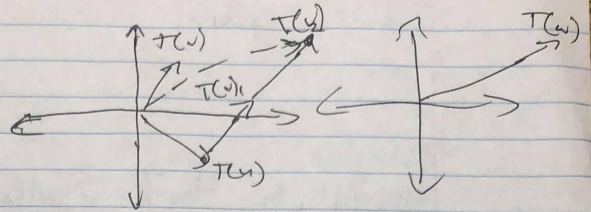

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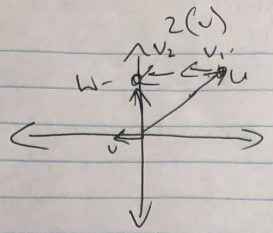
4 3 / 3

✓ **- 0 pts** **Correct**

- 3 pts Incorrect

3.



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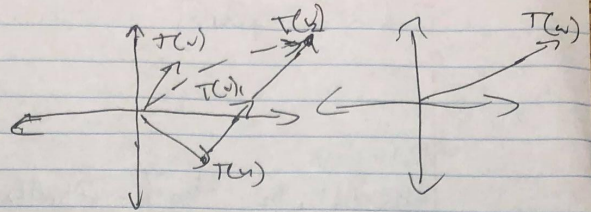

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$B = \begin{bmatrix}4&2\\2&1\end{bmatrix}$

5.1 **2 / 2**

✓ **- 0 pts** **Correct**

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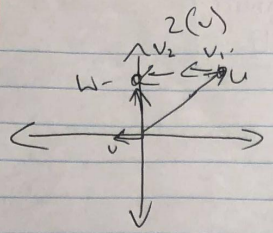
3.



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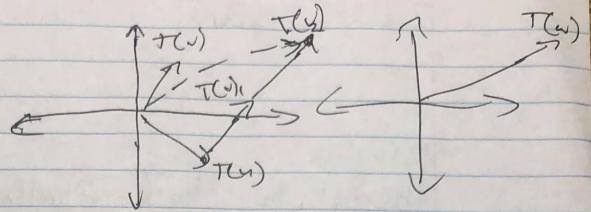

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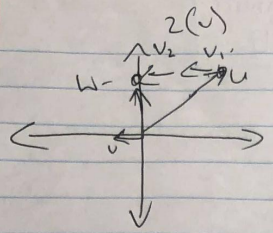
5.2 5 / 6

- **0 pts** All Parts Correct
- **1 pts** Part i Slightly Incorrect
✓ - **1 pts** **Part ii Slightly Incorrect**
- **1 pts** Part iii Slightly Incorrect
- **2 pts** Part i Incorrect
- **2 pts** Part ii Incorrect
- **2 pts** Part iii Incorrect

3.



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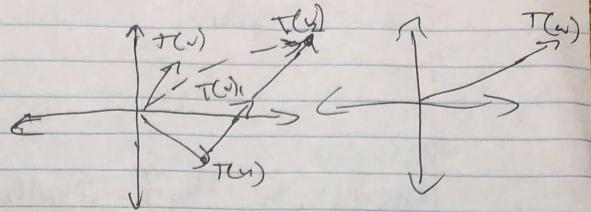

$T(u) + 2T(v) = T(w)$

4. $x_1\begin{bmatrix}-2\\5\end{bmatrix} + x_2\begin{bmatrix}7\\-3\end{bmatrix}$

T is a linear transformation:
$x_1T(v) + x_2T(u) = T(x_1v + x_2u)$

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

5a) $\begin{bmatrix}1/6 & 1/2 & 1/3\\1/2 & 1/4 & 1/4\\1/3 & 1/4 & 5/12\end{bmatrix}$ Markov's Theory, each row sums to 1.
Even at A^{30}, each row sums to 1.
They all reach to 0.3333 when the matrix is towards higher numbers/limits for ~~ignore~~ exponents. They get closer and closer to 0.3333

b)i) All the matrixes return zero matrixes when $(A+I)(A-I)-(A^2)-I)$

bii) All the matrixes return zero matrixes when $((A+B)(A-B)) - ((A^2)-B^2))$

5 biii) $S^2 = \begin{bmatrix}0&0&1&0&0\\0&0&0&1&0\\0&0&0&0&1\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^3 = \begin{bmatrix}0&0&0&1&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^4 = \begin{bmatrix}0&0&0&0&1\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ $S^5 S^6 = \begin{bmatrix}0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$

6. $\left[\begin{array}{cc|c}3&-6&0\\-2&4&0\end{array}\right]\frac{1}{3}\left[\begin{array}{cc|c}1&-2&0\\-2&4&0\end{array}\right]\times 2+1\left[\begin{array}{cc|c}1&-2&0\\0&0&0\end{array}\right]$ $x_1 + -2x_2 = 0$

$x_1 = 2x_2$

$\begin{bmatrix}3&-6\\-2&4\end{bmatrix}\begin{bmatrix}a&b\\c&d\end{bmatrix}$ $3a - 6c = 0$ $3b - 6d = 0$

$-2a + 6c = 0$ $-2b + 6d = 0$

$a = 2c$ $b = 2d$

$x_2\begin{bmatrix}2\\1\end{bmatrix}$

$B = \begin{bmatrix}4&2\\2&1\end{bmatrix}$

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✓ - **0 pts** **Correct**

- **1 pts** Used same non-zero columns for b1, b2
- **1.5 pts** Incorrect answer, correct explanation / working
- **2 pts** Correct answer, no working
- **3 pts** Incorrect answer
- **3 pts** No solution

Question:

7. $[Qr_1, \ldots, Br_p] = Q[r_1, r_2 \ldots, r_p] =$ Answer: QB

Definition:

$AB = A[b_1, b_2 \ldots b_p] = [Ab_1, Ab_2 \ldots Ab_p]$

i) b_1 and b_2, b_3 are the columns of B matrix.

ii) : in the row or column it represents any value for the whole row/column.

iii) The algorithm below to calculate $c1, c2, c3$ is the column picture as they take the first element of a^1 and multiply it with B^1, 2nd element and multiply it with $b1$ and 3rd element with $b1$ again. Therefore it is going down the column for every value in said column.

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✓ **- 0 pts** **Correct**

- 1 pts wrong answer

- 2 pts wrong justification

- 3 pts missing or wrong answer

Question:

7. $[Qr_1, \ldots, Br_p] = Q[r_1, r_2 \ldots, r_p] =$ Answer: QB

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$AB = A[b_1, b_2 \ldots b_p] = [Ab_1, Ab_2 \ldots Ab_p]$

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✓ - 0 pts Correct

- 8 pts No Solution