532 Activity 3 DEVIN BRESSER

1.)

a.) $\underline{X} =$

	Bao	Julia	Vivek	Jamal	
	36	72	90	54	CS 760
	40	80	100	60	ECE 533
	20	40	50	30	MATH 521

b.) $\underset{3\times4}{\underline{X}} = \underset{3\times1}{\underline{t}}\ \underset{1\times4}{\underline{w}^T}$, $\underline{t} = \underset{3\times1}{\begin{bmatrix} 9 \\ 10 \\ 5 \end{bmatrix}}$, $\underline{w}^T =$

Bao	Julia	Vivek	Jamal
4	8	10	6

Brianna → $5\times \underline{t}$

c.)

?	760
50	533
?	521

→ 760 → 45

521 → 25

2.) $\underset{4\times5}{\underline{X}} \rightarrow \underline{T} = \underset{4\times2}{\begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -1 & -1 \\ -1 & 1 \end{bmatrix}}$, $\underline{W} = \underset{2\times5}{\begin{bmatrix} 8 & 6 & 4 & 5 & 4 \\ 2 & 3 & 3 & -2 & -1 \end{bmatrix}}$

a.) $\underline{X} = \begin{bmatrix} 10 & 9 & 7 & 3 & 3 \\ 6 & 3 & 1 & 7 & 5 \\ 6 & 3 & 1 & 7 & 5 \\ 10 & 9 & 7 & 3 & 3 \end{bmatrix}$

b.) $\underline{X} = \underline{t}_1 \underline{w}_1^T + \underline{t}_2 \underline{w}_2^T$, $[\underline{t}_1]_1 = [\underline{t}_2]_1 = 1$

$\underline{t}_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$, $\underline{w}_1^T = [8\ 6\ 4\ 5\ 4]$, $\underline{t}_2 = \begin{bmatrix} 1 \\ -1 \\ -1 \\ 1 \end{bmatrix}$, $\underline{w}_2^T = [2\ 3\ 3\ -2\ -1]$

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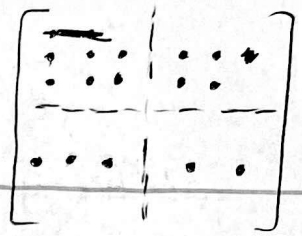
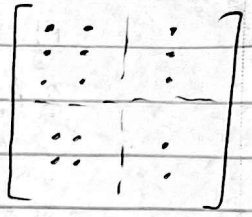


3.) $\underset{2\times 5}{X} = \begin{bmatrix} \underset{2\times 3}{A} & \underset{2\times 2}{B} \\ \underset{1\times 3}{c^T} & \underset{1\times 2}{d^T} \end{bmatrix}$



$$\underset{2\times 2}{R} = \begin{bmatrix} A & B \\ c^T & d^T \end{bmatrix} \begin{bmatrix} A^T & \overset{2\times 2}{c^*} \\ B^T & d^* \end{bmatrix}$$

$$(A^TA + B^TB) \;\#\; (A\,c^* + B\,d^*) \;\#\; (c^TA^T + d^TB^T) \;\#\; (c^Tc^* + d^Td^*)$$

a.)

$$\underset{2\times 5}{R} = \begin{bmatrix} A^TA + B^TB & Ac^* + Bd^* \\ c^TA^T + d^TB^T & c^Tc^* + d^Td^* \end{bmatrix}$$

, ~~2x2 matrix~~

b.)

$$\underset{1\times 5}{X^*} = \left[\begin{array}{c|c} \underset{2\times 3}{} & \underset{2\times 2}{} \\ \hline \underset{1\times 3}{} & \underset{1\times 2}{} \end{array}\right]$$

3x5

$$X^T = \left[\begin{array}{c|c} \underset{3\times 2}{} & \underset{3\times 1}{} \\ \hline \underset{2\times 2}{} & \underset{2\times 1}{} \end{array}\right]$$

5x3

→ R is 3x3 matrix

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4.) a.) $\underline{y} = \underline{A}\,\underline{x}$

$$\underline{A} = [\underline{a}_1, \underline{a}_2, \underline{a}_3 \cdots \underline{a}_N]$$

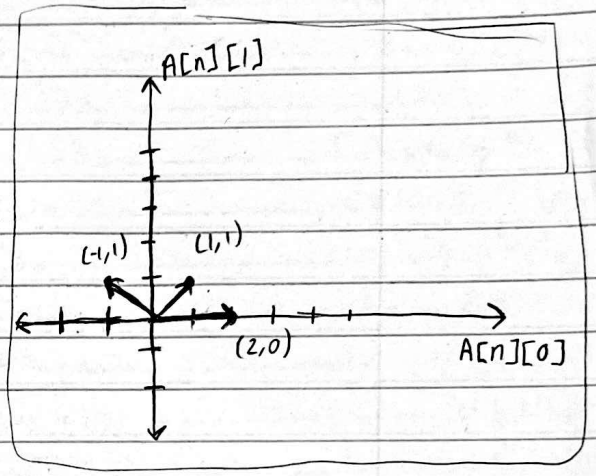
$$\underline{y} = \underline{A}\,\underline{x} = \underset{m \times N}{[\underline{a}_1, \underline{a}_2 \cdots \underline{a}_N]} \quad \underset{N \times 1}{\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_N \end{bmatrix}}$$

$$\rightarrow y = \underline{a}_1 x_1 + \underline{a}_2 x_2 + \cdots \underline{a}_N x_N$$

$$y = \sum_{n=1}^{N} \underline{a}_n x_n$$

b.) $\underline{A} = \underset{2 \times 3}{\begin{bmatrix} 1 & -1 & 2 \\ 1 & 1 & 0 \end{bmatrix}} \rightarrow$

$(1,1) \quad (-1,1) \quad (2,0)$



c.) $\underset{2 \times 1}{\underline{y}} = \underset{2 \times 3}{\underline{A}}\,\underset{3 \times 1}{\underline{x}}$, $\underline{x} = \underset{3 \times 1}{\begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}}$

Thus $\underline{y} = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$