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1. a)

$$X = \begin{bmatrix} 36 & 72 & 90 & 54 \\ 40 & 80 & 100 & 60 \\ 20 & 40 & 50 & 30 \end{bmatrix}$$

b) find solution of $X = tw^T$

i.e., $\begin{bmatrix} 36 & 72 & 90 & 54 \\ 40 & 80 & 100 & 60 \\ 20 & 40 & 50 & 30 \end{bmatrix} = \begin{bmatrix} 9 \\ 10 \\ 5 \end{bmatrix} w^T$

3×4 $\quad 3\times 1$ $\quad 1\times 4$

Solve the matrix, we get

$w^T = [4 \ 8 \ 10 \ 6]$

$\rightarrow w = \begin{bmatrix} 4 \\ 8 \\ 10 \\ 6 \end{bmatrix}$

c) Followed by same taste profile,

we get cs760 : ece533 : math521 = 9 : 10 : 5 = x : 35 : y

so, cs760 = 27, math521 = 15.

2. a)

$$X = TW = \begin{bmatrix} 10 & 9 & 7 & 3 & 3 \\ 6 & 3 & 1 & 7 & 5 \\ 6 & 3 & 1 & 7 & 5 \\ 10 & 9 & 7 & 3 & 3 \end{bmatrix}$$

b).

$$t_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \quad t_2 = \begin{bmatrix} 1 \\ -1 \\ -1 \\ 1 \end{bmatrix}, \quad w_1 = \begin{bmatrix} 8 \\ 6 \\ 4 \\ 5 \\ 4 \end{bmatrix}, \quad w_2 = \begin{bmatrix} 2 \\ 3 \\ 3 \\ -2 \\ -1 \end{bmatrix}$$

3. a)

$$R = XX^T = \begin{bmatrix} A & B \\ C^T & d^T \end{bmatrix} \begin{bmatrix} A^T & C \\ B^T & d \end{bmatrix} = \begin{bmatrix} AA^T + BB^T & AC + Bd \\ C^TA^T + d^TB^T & C^TC + d^Td \end{bmatrix}$$

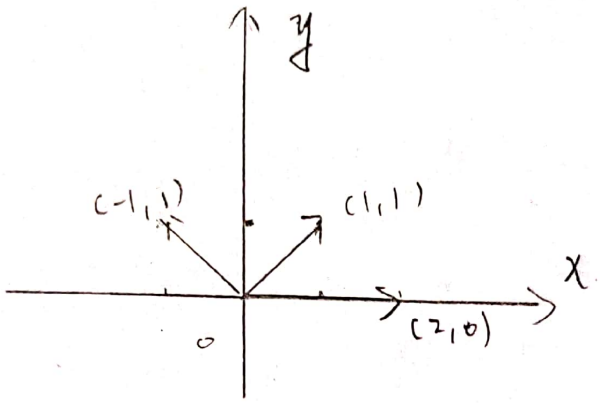
b).

Dim of $X = 3 \times 3$.

4. a) Denote x as row $x_1, x_2 \cdots x_n$

then $y = a_1 x_1 + a_2 x_2 + \cdots + a_n x_n$

b).



c) $y = Ax = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$.