Assignment 1 (part2)

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Download Latex codes from here

https://github.com/EE20RESCH14003/Assignment-1(part2)

1 Matrix 3.9

Question No. 73:

Find X so that $X\begin{pmatrix}1 & 2 & 3\\ 1 & 4 & 5\end{pmatrix} = \begin{pmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{pmatrix}$

1.1 Solution

Let $A = \begin{pmatrix}1 & 2 & 3\\ 1 & 4 & 5\end{pmatrix}$ and $B = \begin{pmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{pmatrix}$

Matrix A is 2x3 and B is 2x3 so matrix X must be 2x2

Assume matrix $X = \begin{pmatrix}a & b\\ c & d\end{pmatrix}$

$\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}1 & 2 & 3\\ 1 & 4 & 5\end{pmatrix}=\begin{pmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{pmatrix}$

Multiplying the matrix X and A and comparing with matrix B

$$a + 4b = -7 \quad (1.1.1)$$
$$2a + 5b = -8 \quad (1.1.2)$$
$$3a + 6b = -9 \quad (1.1.3)$$

$$c + 4d = 2 \quad (1.1.4)$$
$$2c + 5d = 4 \quad (1.1.5)$$
$$3c + 6d = 6 \quad (1.1.6)$$

Solving set of equations for variables a and b

$\begin{pmatrix}1 & 4 & -7\\ 2 & 5 & -8\\ 3 & 6 & -9\end{pmatrix} \xleftrightarrow[R_3\to 3R_1-R_3]{R_2\to 2R_1-R_2} \begin{pmatrix}1 & 4 & -7\\ 0 & 3 & -6\\ 0 & 6 & -12\end{pmatrix}$

$\begin{pmatrix}1 & 4 & -7\\ 0 & 3 & -6\\ 0 & 6 & -12\end{pmatrix} \xleftrightarrow{R_3\to 2R_2-R_3} \begin{pmatrix}1 & 4 & -7\\ 0 & 3 & -6\\ 0 & 0 & 0\end{pmatrix}$

The system is consistent and no free variables. Hence unique solution.

$3b = -6 \therefore b = -2$ and a=1

Similarly, for variables c and d

$\begin{pmatrix}1 & 4 & 2\\ 2 & 5 & 4\\ 3 & 6 & 6\end{pmatrix} \xleftrightarrow[R_3\to 3R_1-R_3]{R_2\to 2R_1-R_2} \begin{pmatrix}1 & 4 & 2\\ 0 & 3 & 0\\ 0 & 6 & 0\end{pmatrix}$

$\begin{pmatrix}1 & 4 & 2\\ 0 & 3 & 0\\ 0 & 6 & 0\end{pmatrix} \xleftrightarrow{R_3\to 2R_2-R_3} \begin{pmatrix}1 & 4 & 2\\ 0 & 3 & 0\\ 0 & 0 & 0\end{pmatrix}$

System is consistent and no free variables. 3d=0 $\therefore d = 0$ and $c = 2$

Hence, Matrix $X = \begin{pmatrix}1 & -2\\ 2 & 0\end{pmatrix}$