ASSIGNMENT 1

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Download all python codes from

https://github.com/vaibhavchhabra25/EE3900−course/blob/main/Assignment−2/codes

and latex-tikz codes from

https://github.com/vaibhavchhabra25/EE3900−course/blob/main/Assignment−2/main.tex

1 Problem

(Matrices-2.50)
If $\mathbf{A} = \begin{pmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}$, $\mathbf{C} = \begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix}$, calculate $\mathbf{AC}$, $\mathbf{BC}$ and verify $(\mathbf{A}+\mathbf{B})\mathbf{C} = \mathbf{AC}+\mathbf{BC}$.

2 Solution

$$\mathbf{AC} = \begin{pmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{pmatrix}\begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix} \tag{2.0.1}$$

$$\implies \mathbf{AC} = \begin{pmatrix} 0\times 2 + 6\times -2 + 7\times 3 \\ -6\times 2 + 0\times -2 + 8\times 3 \\ 7\times 2 + -8\times -2 + 0\times 3 \end{pmatrix} = \begin{pmatrix} 9 \\ 12 \\ 30 \end{pmatrix} \tag{2.0.2}$$

$$\mathbf{BC} = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}\begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix} \tag{2.0.3}$$

$$\implies \mathbf{BC} = \begin{pmatrix} 0\times 2 + 1\times -2 + 1\times 3 \\ 1\times 2 + 0\times -2 + 2\times 3 \\ 1\times 2 + 2\times -2 + 0\times 3 \end{pmatrix} = \begin{pmatrix} 1 \\ 8 \\ -2 \end{pmatrix} \tag{2.0.4}$$

Now,

$$\mathbf{AC}+\mathbf{BC} = \begin{pmatrix} 9 \\ 12 \\ 30 \end{pmatrix} + \begin{pmatrix} 1 \\ 8 \\ -2 \end{pmatrix} = \begin{pmatrix} 9+1 \\ 12+8 \\ 30-2 \end{pmatrix} \tag{2.0.5}$$

$$\implies \mathbf{AC}+\mathbf{BC} = \begin{pmatrix} 10 \\ 20 \\ 28 \end{pmatrix} \tag{2.0.6}$$

And,

$$(\mathbf{A}+\mathbf{B})\mathbf{C} = \left(\begin{pmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}\right)\begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix} \tag{2.0.7}$$

$$\implies (\mathbf{A}+\mathbf{B})\mathbf{C} = \begin{pmatrix} 0+0 & 6+1 & 7+1 \\ -6+1 & 0+0 & 8+2 \\ 7+1 & -8+2 & 0+0 \end{pmatrix}\begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix} \tag{2.0.8}$$

$$\implies (\mathbf{A}+\mathbf{B})\mathbf{C} = \begin{pmatrix} 0 & 7 & 8 \\ -5 & 0 & 10 \\ 8 & -6 & 0 \end{pmatrix}\begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix} \tag{2.0.9}$$

$$\implies (\mathbf{A}+\mathbf{B})\mathbf{C} = \begin{pmatrix} 0\times 2 + 7\times -2 + 8\times 3 \\ -5\times 2 + 0\times -2 + 10\times 3 \\ 8\times 2 + -6\times -2 + 0\times 3 \end{pmatrix} \tag{2.0.10}$$

$$\implies (\mathbf{A}+\mathbf{B})\mathbf{C} = \begin{pmatrix} 10 \\ 20 \\ 28 \end{pmatrix} \tag{2.0.11}$$

From (2.0.11) and (2.0.6),

$$(\mathbf{A}+\mathbf{B})\mathbf{C} = \mathbf{AC}+\mathbf{BC} \tag{2.0.12}$$