EE3900 Assignment-2

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Download all python codes from

https://github.com/vrahul02/EE3900/tree/main/Assignment−2/Codes

and latex-tikz codes from

https://github.com/vrahul02/EE3900/tree/main/Assignment−2/Assignment−2.tex

Problem Matrix Q.2.49

If $\mathbf{A} = \begin{pmatrix} 1 & 1 & -1 \\ 2 & 0 & 3 \\ 3 & -1 & 2 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 & 3 \\ 0 & 2 \\ -1 & 4 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 1 & 2 & 3 & -4 \\ 2 & 0 & -2 & 1 \end{pmatrix}$, find $(\mathbf{AB})\mathbf{C}$, $\mathbf{A}(\mathbf{BC})$ and show that $(\mathbf{AB})\mathbf{C} = \mathbf{A}(\mathbf{BC})$.

Solution

We know matrix multiplication is a row-by-column multiplication. Thus,

AB

$$= \begin{pmatrix} 1 & 1 & -1 \\ 2 & 0 & 3 \\ 3 & -1 & 2 \end{pmatrix} \begin{pmatrix} 1 & 3 \\ 0 & 2 \\ -1 & 4 \end{pmatrix} \tag{0.0.1}$$

$$= \begin{pmatrix} 2 & 1 \\ -1 & 18 \\ 1 & 15 \end{pmatrix} \tag{0.0.2}$$

(AB)C

$$= \begin{pmatrix} 2 & 1 \\ -1 & 18 \\ 1 & 15 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 & -4 \\ 2 & 0 & -2 & 1 \end{pmatrix} \tag{0.0.3}$$

$$= \begin{pmatrix} 4 & 4 & 4 & -7 \\ 35 & -2 & -39 & 22 \\ 31 & 2 & -27 & 11 \end{pmatrix} \tag{0.0.4}$$

BC

$$= \begin{pmatrix} 1 & 3 \\ 0 & 2 \\ -1 & 4 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 & -4 \\ 2 & 0 & -2 & 1 \end{pmatrix} \tag{0.0.5}$$

$$= \begin{pmatrix} 7 & 2 & -3 & -1 \\ 4 & 0 & -4 & 2 \\ 7 & -2 & -11 & 8 \end{pmatrix} \tag{0.0.6}$$

A(BC)

$$= \begin{pmatrix} 1 & 1 & -1 \\ 2 & 0 & 3 \\ 3 & -1 & 2 \end{pmatrix} \begin{pmatrix} 7 & 2 & -3 & -1 \\ 4 & 0 & -4 & 2 \\ 7 & -2 & -11 & 8 \end{pmatrix} \tag{0.0.7}$$

$$= \begin{pmatrix} 4 & 4 & 4 & -7 \\ 35 & -2 & -39 & 22 \\ 31 & 2 & -27 & 11 \end{pmatrix} \tag{0.0.8}$$

From (0.0.4) and (0.0.8),

$$(\mathbf{AB})\mathbf{C} = \mathbf{A}(\mathbf{BC}) \tag{0.0.9}$$