ASSIGNMENT 9

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Download all python codes from

https://github.com/Gayathri1729/SRFP/tree/main/Assignment9

and latex-tikz codes from

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1 Matrices 2.67

Express the matrix $\mathbf{B} = \begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix}$ as the sum of a symmetric and a skew symmetric matrix.

2 Solution

Given

$$\mathbf{B} = \begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix} \tag{1}$$

and

$$\mathbf{B}^\top = \begin{pmatrix} 2 & -1 & 1 \\ -2 & 3 & -2 \\ -4 & 4 & -3 \end{pmatrix} \tag{2}$$

Let

$$\mathbf{C} = \frac{\mathbf{B} + \mathbf{B}^\top}{2} \tag{3}$$

and

$$\mathbf{D} = \frac{\mathbf{B} - \mathbf{B}^\top}{2} \tag{4}$$

. Then,

$$\mathbf{C} = \frac{\mathbf{B} + \mathbf{B}^\top}{2} = \begin{pmatrix} 2 & -\frac{3}{2} & -\frac{3}{2} \\ -\frac{3}{2} & 3 & 1 \\ -\frac{3}{2} & 1 & -3 \end{pmatrix} \tag{5}$$

$$= \mathbf{C}^\top \tag{6}$$

Also,

$$\mathbf{D} = \frac{\mathbf{B} - \mathbf{B}^\top}{2} = \begin{pmatrix} 0 & -\frac{1}{2} & -\frac{5}{2} \\ \frac{1}{2} & 0 & 3 \\ \frac{5}{2} & -3 & 0 \end{pmatrix} \tag{7}$$

$$= -\mathbf{D}^\top \tag{8}$$

Hence, $\mathbf{C}$ is a symmetric matrix and $\mathbf{D}$ is skew symmetric.

Also, $\mathbf{C} + \mathbf{D} = \mathbf{B}$.

Thus $\mathbf{B}$ is expressed as the sum of a symmetric and a skew symmetric matrix.