

Assignment 2

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Download all python codes from

https://github.com/Digjoy12/Signal-Processing/tree/main/Assignment_2/Code

and latex codes from

https://github.com/Digjoy12/Signal-Processing/blob/main/Assignment_2/main.tex

PROBLEM

(Matrix - Q2.60) Find the matrix \mathbf{X} so that

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

SOLUTION

Let,

$$\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \quad (0.0.1)$$

$$\mathbf{B} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix} \quad (0.0.2)$$

Now, multiplying \mathbf{A}^\top on both sides,

$$\mathbf{XAA}^\top = \mathbf{BA}^\top \quad (0.0.3)$$

$$\Rightarrow \mathbf{X} = \mathbf{BA}^\top (\mathbf{AA}^\top)^{-1} \quad (0.0.4)$$

Therefore,

$$\mathbf{X} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix} \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix} (\mathbf{AA}^\top)^{-1} \quad (0.0.5)$$

$$= \begin{pmatrix} -50 & -122 \\ 28 & 64 \end{pmatrix} \left[\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix} \right]^{-1} \quad (0.0.6)$$

$$= \begin{pmatrix} -50 & -122 \\ 28 & 64 \end{pmatrix} \left[\begin{pmatrix} 14 & 32 \\ 32 & 77 \end{pmatrix} \right]^{-1} \quad (0.0.7)$$

$$= \begin{pmatrix} -50 & -122 \\ 28 & 64 \end{pmatrix} \begin{pmatrix} \frac{77}{54} & \frac{-16}{27} \\ \frac{-16}{27} & \frac{27}{7} \end{pmatrix} \quad (0.0.8)$$

$$= \begin{pmatrix} 1 & -2 \\ 2 & 0 \end{pmatrix} \quad (0.0.9)$$