Assignment 1

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Download the python code from

https://github.com/jvinaykumar12/EE5609/tree/master/Assignment1

and latex-file codes from

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1 Question No.33

Find the distance of the point $\begin{pmatrix}1\\-1\end{pmatrix}$ from the line $\begin{pmatrix}12 & -5\end{pmatrix}\mathbf{x} = -82$

2 Explanation

First we find the normal vector to the given line and then using the normal vector we can find out the line which is perpendicular to the given line and passes through the point $\begin{pmatrix}1 & -1\end{pmatrix}$.The distance from the point to the line is the distance between point of intersection of two lines and the given point

Given line equation

$$\mathbf{n}^T\mathbf{P} = \mathbf{c} \tag{2.0.1}$$

$$\begin{pmatrix}12 & -5\end{pmatrix}\mathbf{P} = -82 \tag{2.0.2}$$

The equation of the line perpendicular to the given line and passing through the given point can be written as

$$\mathbf{P} = \mathbf{A} + \lambda\mathbf{n} \tag{2.0.3}$$

Since the two lines intersect, the intersection point will lie on both lines. Therefore we substitute the point P from (2.0.3) in (2.0.1)

$$\mathbf{n}^T\mathbf{P} = \mathbf{n}^T\mathbf{A} + \lambda\|n\|^2 = \mathbf{c} \tag{2.0.4}$$

$$\lambda = \frac{\mathbf{c} - \mathbf{n}^T\mathbf{A}}{\|n\|^2} \tag{2.0.5}$$

By substituting lambda in the below line equation

$$\|P - A\| = |\lambda|\,\|n\| \tag{2.0.6}$$

we get

$$\|P - A\| = \frac{|\mathbf{c} - \mathbf{n}^T\mathbf{A}|}{\|n\|} \tag{2.0.7}$$

By substituting the given values

$$\mathbf{A} = \begin{pmatrix}1\\-1\end{pmatrix} \tag{2.0.8}$$

$$\mathbf{n} = \begin{pmatrix}12\\-5\end{pmatrix} \tag{2.0.9}$$

$$c = -82 \tag{2.0.10}$$

we get the distance between the point and the line

$$\|P - A\| = Distance = 7.615 \tag{2.0.11}$$