

# Assignment-1

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**Abstract**—This document explain the concept of projection of vector by solving a problem.

Using equation (2.0.1)

Download all python codes from

<https://github.com/vipulmalik8569/MT-EE5609>

and latex-tikz codes from

<https://github.com/vipulmalik8569/MT-EE5609>

$$\mathbf{p} = \frac{\begin{bmatrix} \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}^T \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \end{bmatrix}}{\left\| \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \right\|^2} \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \quad (3.0.1)$$

$$\mathbf{p} = \left[ \frac{(7 - 3 + 56)}{(\sqrt{7^2 + (-1)^2 + 8^2})^2} \right] \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \quad (3.0.2)$$

$$\mathbf{p} = \frac{13}{25} \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} = \begin{pmatrix} \frac{92}{25} \\ -\frac{13}{25} \\ \frac{21}{5} \end{pmatrix} \quad (3.0.3)$$

## 1 PROBLEM

Find the projection of vector  $\begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}$  on vector  $\begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix}$

Hence the projection of  $\mathbf{u}$  on  $\mathbf{v}$  is

$$\mathbf{p} = \begin{pmatrix} \frac{92}{25} \\ -\frac{13}{25} \\ \frac{21}{5} \end{pmatrix}$$

## 2 EXPLANATION

Projection of  $\mathbf{u}$  onto  $\mathbf{v}$  means the component of  $\mathbf{u}$  in the direction of  $\mathbf{v}$ .

This is given by the formula :

$$\mathbf{p} = \left( \frac{\mathbf{u}^T \mathbf{v}}{\|\mathbf{v}\|^2} \right) \mathbf{v} \quad (2.0.1)$$

where

$$\mathbf{u}^T \mathbf{v} = u_1 v_1 + u_2 v_2 + \cdots + u_n v_n \quad (2.0.2)$$

and

$$\|\mathbf{v}\| = \sqrt{v_1^2 + v_2^2 + \cdots + v_n^2} \quad (2.0.3)$$

## 3 SOLUTION

We have,

$$\mathbf{u} = \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}, \mathbf{v} = \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix}$$