ASSIGNMENT 4

Vojeswitha Gopireddy
AI20BTECH11024

Download all python codes from

```
https://github.com/V−Gopireddy/EE3900/blob/
    main/Assignment4/codes/Assignment−4.py
```

and latex-tikz codes from

```
https://github.com/V−gopireddy/EE3900/blob/main
    /Assignment4/Assignment−4.tex
```

1 Linear forms 2.28

Find the equation of the plane through the intersection of the planes $\begin{pmatrix}1 & 1 & 1\end{pmatrix}\mathbf{x} = 1$ and $\begin{pmatrix}2 & 3 & 4\end{pmatrix}\mathbf{x} = 5$ which is perpendicular to the plane $\begin{pmatrix}1 & -1 & 1\end{pmatrix}\mathbf{x} = 0$

2 Solution

The equations of the given planes are,

$$P_1 : \begin{pmatrix}1 & 1 & 1\end{pmatrix}\mathbf{x} - 1 = 0 \tag{2.0.1}$$

$$P_2 : \begin{pmatrix}2 & 3 & 4\end{pmatrix}\mathbf{x} - 5 = 0 \tag{2.0.2}$$

The equation of a plane P passing through the line of intersection of the planes can be represented as

$$P : P_1 + \lambda P_2 = 0 \tag{2.0.3}$$

Therefore, P can be represented as

$$\mathbf{n}^T\mathbf{x} = c \tag{2.0.4}$$

Where

$$\mathbf{n} = \begin{pmatrix}1 + 2\lambda \\ 1 + 3\lambda \\ 1 + 4\lambda\end{pmatrix} \tag{2.0.5}$$

$$c = 1 + 5\lambda \tag{2.0.6}$$

Given the plane is perpendicular to

$$P_3 : \begin{pmatrix}1 & -1 & 1\end{pmatrix}\mathbf{x} = 0 \tag{2.0.7}$$

whose normal $\mathbf{n_1} = \begin{pmatrix}1 \\ -1 \\ 1\end{pmatrix}$

Therefore,

$$\mathbf{n}^T\mathbf{n_1} = 0 \tag{2.0.8}$$

$$\implies \begin{pmatrix}1 + 2\lambda \\ 1 + 3\lambda \\ 1 + 4\lambda\end{pmatrix}^T \begin{pmatrix}1 \\ -1 \\ 1\end{pmatrix} = 0 \tag{2.0.9}$$

Solving the above we get

$$\lambda = \frac{-1}{3} \tag{2.0.10}$$

Substituting the value of λ we have

$$\mathbf{n} = \begin{pmatrix}\frac{1}{3} \\ 0 \\ \frac{-1}{3}\end{pmatrix} \tag{2.0.11}$$

$$c = \frac{-2}{3} \tag{2.0.12}$$

Equation of the plane is,

$$\begin{pmatrix}\frac{1}{3} & 0 & \frac{-1}{3}\end{pmatrix}\mathbf{x} = \frac{-2}{3} \tag{2.0.13}$$

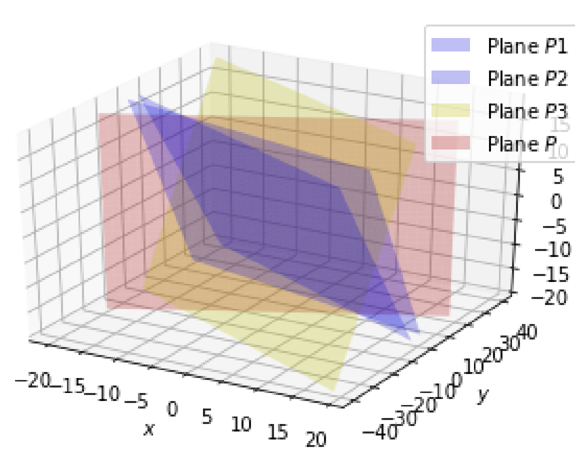

Fig. 0: Plane P passing through intersection of P_1 and P_2 and perpendicular to P_3