Assignment No.3

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Download latex-tikz codes from

https://github.com/Panisha707/ASSIGNMENT03/blob/main/main.tex

Download python codes from

https://github.com/Panisha707/ASSIGNMENT03/blob/main/untitled21.py

Question taken from

Construction, Excercise 2.5

1 Question No 1

Construct LIFT such that LI=4, IF=3, TL=2.5, LF=4.5, IT=4

2 Solution

Let,there are two triangles $\triangle FLI$ and $\triangle TLI$
In $\triangle FLI$

$$\|\mathbf{L}-\mathbf{I}\|+\|\mathbf{I}-\mathbf{F}\| = 7 > \|\mathbf{L}-\mathbf{F}\| \tag{2.0.1}$$

$$\|\mathbf{L}-\mathbf{F}\|+\|\mathbf{I}-\mathbf{F}\| = 7.5 > \|\mathbf{L}-\mathbf{I}\| \tag{2.0.2}$$

$$\|\mathbf{L}-\mathbf{F}\|+\|\mathbf{L}-\mathbf{I}\| = 8.5 > \|\mathbf{I}-\mathbf{F}\| \tag{2.0.3}$$

triangle inequality is satisfied. Similarly
In $\triangle TLI$

$$\|\mathbf{L}-\mathbf{I}\|+\|\mathbf{I}-\mathbf{T}\| = 8 > \|\mathbf{T}-\mathbf{L}\| \tag{2.0.4}$$

$$\|\mathbf{L}-\mathbf{I}\|+\|\mathbf{T}-\mathbf{L}\| = 6.5 > \|\mathbf{I}-\mathbf{T}\| \tag{2.0.5}$$

$$\|\mathbf{I}-\mathbf{T}\|+\|\mathbf{T}-\mathbf{L}\| = 6.5 > \|\mathbf{L}-\mathbf{I}\| \tag{2.0.6}$$

and triangle inequaliity is satisfied. $\therefore$ the given sides form a quadrilateral.

The vertices of the quadrilateral are calculated by taking $\triangle FLI$ and $\triangle TLI$

From $\triangle FLI$,let the side of the triangle are

a=4, b=3, c=4.5

Let the vertices of the triangle

$$\mathbf{F} = \begin{pmatrix} p \\ q \end{pmatrix}, \mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} a \\ 0 \end{pmatrix}$$

$$\mathbf{F} = c\begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{2.0.7}$$

we use law of cosines

$$\cos\theta = \frac{a^2+c^2-b^2}{2ac} \tag{2.0.8}$$

$$= \frac{4^2+4.5^2-3^2}{2\times4\times4.5} \tag{2.0.9}$$

$$= 0.7569 \tag{2.0.10}$$

$$\implies \theta = 40.808 \tag{2.0.11}$$

Thus,

$$\mathbf{F} = 4.5\begin{pmatrix} \cos 40.808 \\ \sin 40.808 \end{pmatrix} \tag{2.0.12}$$

$$\mathbf{F} = 4.5\begin{pmatrix} 0.7569 \\ 0.6535 \end{pmatrix} \tag{2.0.13}$$

$$\mathbf{F} = \begin{pmatrix} 3.406 \\ 2.940 \end{pmatrix} \tag{2.0.14}$$

The vertices of the $\triangle FLI$ are found out to be

$$\mathbf{F} = \begin{pmatrix} 3.406 \\ 2.940 \end{pmatrix}, \mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \tag{2.0.15}$$

From $\triangle TLI$,let the sides of the triangle

a=4, b=4, c=2.5

Let the vertices of the triangle

$$\mathbf{T} = \begin{pmatrix} p \\ q \end{pmatrix}, \mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} a \\ 0 \end{pmatrix}$$

$$\mathbf{T} = c\begin{pmatrix}\cos\theta\\ \sin\theta\end{pmatrix} \tag{2.0.16}$$

we use law of cosines

$$\cos\theta = \frac{a^2+c^2-b^2}{2ac} \tag{2.0.17}$$

$$= \frac{4^2+2.5^2-4^2}{2\times 4\times 2.5} \tag{2.0.18}$$

$$= 0.3125 \tag{2.0.19}$$

$$\implies \theta = 71.790 \tag{2.0.20}$$

Thus

$$\mathbf{T} = 2.5\begin{pmatrix}\cos 71.790\\ \sin 71.790\end{pmatrix} \tag{2.0.21}$$

$$\mathbf{T} = 2.5\begin{pmatrix}0.3125\\ 0.9499\end{pmatrix} \tag{2.0.22}$$

$$\mathbf{T} = \begin{pmatrix}0.781\\ 2.374\end{pmatrix} \tag{2.0.23}$$

The vertices of the $\triangle TLI$ are found out to be

$$\mathbf{T} = \begin{pmatrix}0.781\\ 2.374\end{pmatrix}, \mathbf{L} = \begin{pmatrix}0\\ 0\end{pmatrix}, \mathbf{I} = \begin{pmatrix}4\\ 0\end{pmatrix} \tag{2.0.24}$$

∴The vertices of the quadrilateral LIFT can be written as

$$\mathbf{L} = \begin{pmatrix}0\\ 0\end{pmatrix}, \mathbf{I} = \begin{pmatrix}4\\ 0\end{pmatrix}, \mathbf{F} = \begin{pmatrix}3.406\\ 2.940\end{pmatrix}, \mathbf{T} = \begin{pmatrix}0.781\\ 2.374\end{pmatrix} \tag{2.0.25}$$

∴ Fig.2.1 verifies that the points can form a quadrilateral.

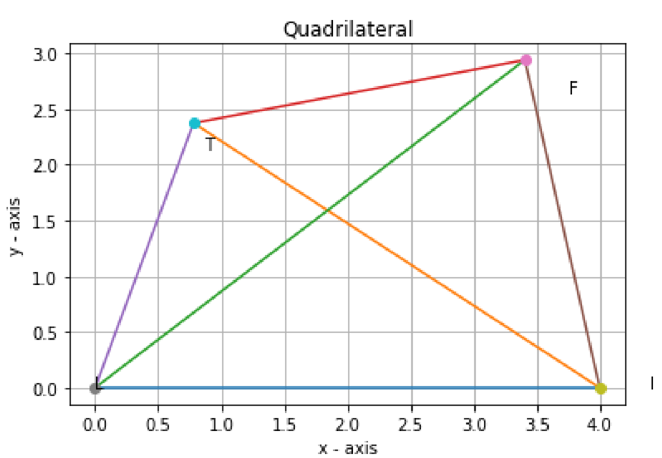

Fig. 2.1: Quadrilateral LIFT