

Assignment 1

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Download all python codes from

<https://github.com/Gayathri1729/SRFP/tree/main/Assignment3>

and latex-tikz codes from

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1 CONSTR-2.33

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

2 EXPLANATION

Given, $LI = 4, IF = 3, TL = 2.5, LF = 4.5, IT = 4$.

Consider $\triangle LIF$,

$$\|L - I\| + \|I - F\| = 7 > \|L - F\| \quad (2.0.1)$$

$$\|I - F\| + \|L - F\| = 7.5 > \|L - I\| \quad (2.0.2)$$

$$\|L - I\| + \|L - F\| = 8.5 > \|I - F\| \quad (2.0.3)$$

thus triangle inequality is satisfied.

Similarly in $\triangle LIT$,

$$\|L - I\| + \|I - T\| = 8 > \|L - T\| \quad (2.0.4)$$

$$\|L - T\| + \|I - T\| = 6.5 > \|L - I\| \quad (2.0.5)$$

$$\|L - I\| + \|L - T\| = 6.5 > \|I - T\| \quad (2.0.6)$$

and triangle inequality is satisfied.

\therefore the given sides form a quadrilateral. And let the sides of the triangles be denoted by $LI = f, IF = l, TL = t, LF = i, IT = g$ Then,

$$f = 4, l = 3, t = 2.5, i = 4.5, g = 4 \quad (2.0.7)$$

Suppose $\angle FLI = N$ and $\angle TLI = M$ Now, let

$$\mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (2.0.8)$$

$$\mathbf{I} = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (2.0.9)$$

$$\mathbf{F} = \begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} i \cos N \\ i \sin N \end{pmatrix} \quad (2.0.10)$$

$$\mathbf{T} = \begin{pmatrix} r \\ s \end{pmatrix} = \begin{pmatrix} t \cos M \\ t \sin M \end{pmatrix} \quad (2.0.11)$$

Then we know that,

$$\cos N = \frac{f^2 + i^2 - l^2}{2fi} \quad (2.0.12)$$

$$p = i \cos N = \frac{f^2 + i^2 - l^2}{2f} \quad (2.0.13)$$

$$= \frac{4^2 + 4.5^2 - 3^2}{2 \times 4} = 3.406 \quad (2.0.14)$$

$$\sin N = \pm \sqrt{1 - \cos^2 N} \quad (2.0.15)$$

$$q = i \sin N = \pm \sqrt{i^2 - i^2 \cos^2 N} \quad (2.0.16)$$

$$= \pm \sqrt{4.5^2 - 3.406^2} = \pm 2.94 \quad (2.0.17)$$

$$\cos M = \frac{t^2 + f^2 - g^2}{2ft} \quad (2.0.18)$$

$$r = t \cos M = \frac{t^2 + f^2 - g^2}{2f} \quad (2.0.19)$$

$$= \frac{2.5^2 + 4^2 - 4^2}{2 \times 4} = 0.781 \quad (2.0.20)$$

$$\sin M = \pm \sqrt{1 - \cos^2 M} \quad (2.0.21)$$

$$s = t \sin M = \pm \sqrt{t^2 - t^2 \cos^2 M} \quad (2.0.22)$$

$$= \pm \sqrt{2.5^2 - 0.781^2} = \pm 2.374 \quad (2.0.23)$$

Consider q and s to be positive. Then the coordinates of the quadrilateral can be obtained from 2.0.8, 2.0.9, 2.0.10 and 2.0.11.

$$\mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}, \mathbf{F} = \begin{pmatrix} 3.406 \\ 2.94 \end{pmatrix}, \mathbf{T} = \begin{pmatrix} 0.781 \\ 2.374 \end{pmatrix} \quad (2.0.24)$$

Knowing all the coordinates we can now construct the quadrilateral.

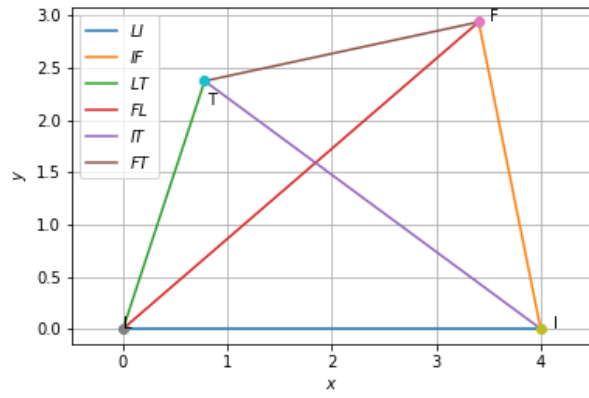


Fig. 2.1: Quadrilateral $LIFT$