SC 627 – Assignment 1

E 1.6 :

① Compute line through 2 pts

$$P_1 \equiv (x_1, y_1) \quad ; \quad P_2 \equiv (x_2 - y_2)$$

This gives, $\begin{vmatrix} x_2 - x_1 & x - x_1 \\ y_2 - y_1 & y - y_1 \end{vmatrix} = 0$

$$\Rightarrow (y_1 - y_2)x + (x_2 - x_1)y + (x_1 y_2 - x_2 y_1) = 0$$

We scale this by $[(y_1 - y_2)^2 + (x_2 - x_1)^2]^{-1}$ for $A^2 + B^2 = 1$

② Compute dist. of pt. to line

If 'P_1' & 'P_2' pass through line $ax + by + c = 0$

dist of 'q' from this line is

$$d = \left| \frac{a q_x + b q_y + c}{a^2 + b^2} \right|$$

③ Compute dist. of pt. from segment

$\overrightarrow{vec1}$ ≡ vector from start of line segment to end of line segment

$\overrightarrow{vec2}$ ≡ vector from pt to start of line segment

$$\text{rel length} = (\overrightarrow{vec1} \cdot \overrightarrow{vec2}) / |\overrightarrow{vec1}|^2$$

if rel length < 0 : dist = dist (start pt, pt.)
state ≡ left of start pt {1}

if rel length > 1 : dist = dist (end pt, pt.)
state = right of end pt {2}

else dist = ⊥ dist from pt to line
state = on the line segment {0}

E 1.7

① Compute distance pt to polygon

→ Compute the dist of the pt. from every 2 adj vertices of the polygon
→ Return the min dist of the above computed

② Compute tangent vector to polygon

→ Find the segment closest to the pt. by looping through every 2 adj vertices as edge

→ Depending on its state i.e. on the left, on the right or projection on this closest segment;

- if state = 0 { on the segment }

  tangent has slope equivalent to closest segment.

- if state = 1/2 :
  Let the closer pt of the segment be $\hat{p}$ and original pt. be $\hat{q}$

$$\overline{vec} = (\bar{q} - \bar{p}) \quad \text{from } p \text{ to } q$$

$$\text{tangent} = \hat{k} \times \overline{vec}$$

↳ ensures anticlockwise