HOMEWORK- 3

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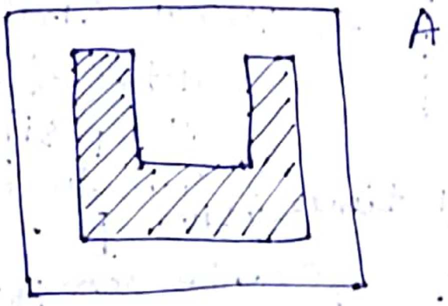
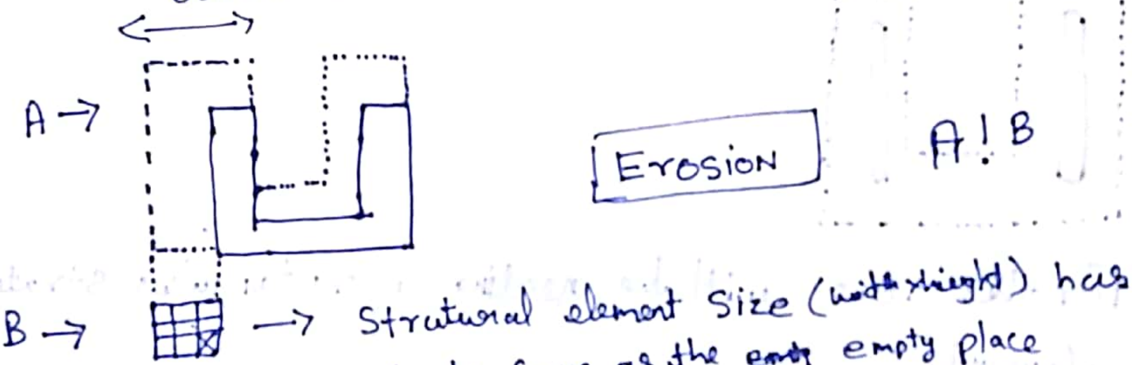
Problem 1.

org img.



6units. (assuming).

(a)

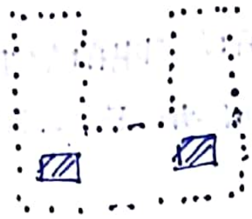


→ Structural element Size (width×height) has to be Same as the ~~emty~~ empty place

→ ~~ach~~ anchor element has to be at the bottom right corner.

assuming. it is of width 6units as shown in image we will need 3×3.

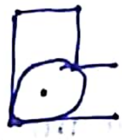
(b)



B

C

I could achieve this using ~~two approach~~. a circle as big as the erosion using this structural element



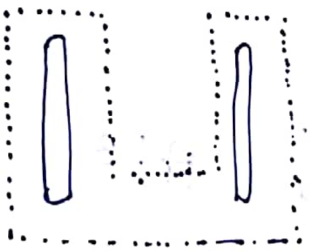
will result in

→ very small points at the centre of the circle near the position, rest all will be blank.

Hence after that we dilate n times using  rectangle of needed size.

$\boxed{(A \ominus B) \oplus C}$ .. (C can be done in dilation)

(C)



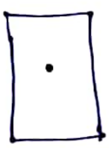
For this we will be needing a retangular structural element.

Approach

① First aim to disconnect the two region.

→ hence we need height of struct element greater than this.

②  width we should lose info about the pillars. ~~because~~ hence same width as pillar.

Struct element →  centre as the anchor point.

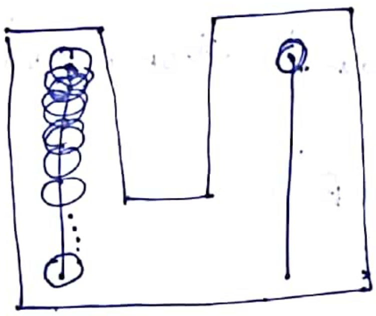
B

$A ! B$ will result in.

now we will use a circle to dialate.

⊙ $\Rightarrow C$ (Struct element).

If the circle is small we need to dialate multiple time.



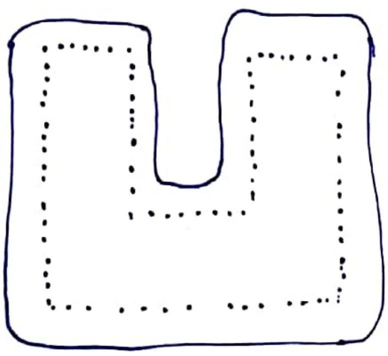
$A \oplus C$

if C is very small.

$(A \oplus C)$ n time.

$$\boxed{\begin{array}{l} A!B \rightarrow A \oplus C \\ \text{if } c \text{ small } (A \oplus C) \text{ n times} \end{array}}$$

(d).

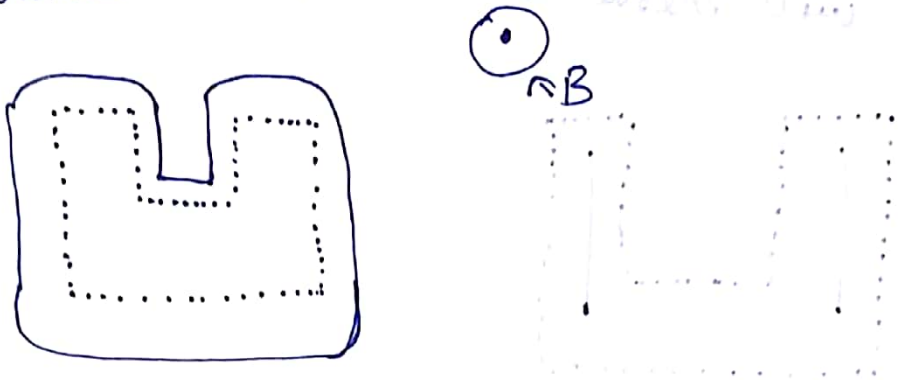


AS we know if we dialate with a circle will be curve the outer edges. and errosion will ~~ea~~ curve or smooth the inner edges.

circle structural element

Scanned by CamScanner

First dilate. $A \oplus B$



now we can see that we haven't got the curve in the middle. for with we will have erode but if we erode now it will cancel out our dilation.

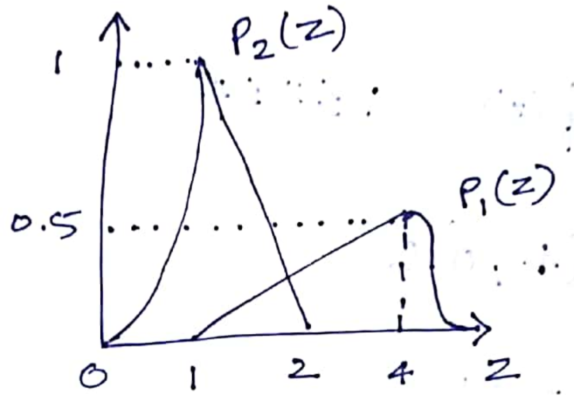
Hence we dilate again and then erode.

$$((A \oplus B) \oplus B) \ominus B)$$

→ Dilation → Dilation → erosion.

→ Dilation → closing

roblem 2



$P_2(z)$ can be represented using two function, in the time period of 0-1 & 1-2.

$$P_2(z) = \begin{cases} f_1(z) & 0 \le z \le 1 \\ f_2(z) & 1 \le z \le 2. \end{cases}$$

as $f_1(z)$ does not involve in the intersection, does not play any role here.

$f_2(z)$ can be found using two point form.

$(1,1)$ $(2,0)$

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y-1}{0-1} = \frac{x-1}{2-1}$$

$y-1 = -x+1$

$f(y) = -x+2$

$$\boxed{f_2(z) = -z+2}$$

Similary for $P_1(z)$ we do not considers its (f_2).

hence.

$$P_1(z) = \begin{cases} f(z) & 1 \leq z \leq 4 \end{cases}$$

$(1,0)$ $(4, 0.5)$

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y-0}{0.5-0} = \frac{x-1}{4-1}$$

$$3y = 0.5x - 0.5$$

$$y = \frac{0.5x}{3} - \frac{0.5}{3}$$

$$y = \frac{1}{6}x - \frac{1}{6}$$

$$P_1(z) = \frac{1}{6}z - \frac{1}{6} \quad 1 \leq z \leq 4.$$

As we know that probability is the area under the curve of probability distribution function.

$$P_1 = \frac{1}{2} \times b \times h = \frac{1}{2} \times 3 \times \frac{1}{2} = 3/4$$

$$P_2 = \frac{1}{2} \times 1 \times 1 = \frac{1}{2}$$

To find the optimal threshold.

$$P_1 \; P_1(T) = P_2 \; P_2(T).$$

$$P_1(T) = \frac{1}{6}T - \frac{1}{6} \qquad P_1 = 3/4$$

$$P_2(T) = -T + 2 \qquad P_2 = 1/2.$$

$$\frac{3}{4} \times \left(\frac{1}{6}T - \frac{1}{6}\right) = \frac{1}{2}(-T+2)$$

$$\frac{\cancel{3}^{1}}{\cancel{24}_{8}}T - \frac{\cancel{3}^{1}}{\cancel{24}_{8}} = -T\frac{1}{2} + \frac{\cancel{2}^{1}}{\cancel{2}}$$

$$\frac{1}{8}T - \frac{1}{8} = -\frac{1}{2}T + 1$$

$$\frac{1}{8}T + \frac{1}{2}T = \frac{8+1}{8}$$

$$\cancel{\frac{T}{2}\left(\frac{1}{8} + 1\right) = \frac{3}{2}}$$

$$T\left(\frac{5}{4}\right) = \cancel{8}$$

$$\frac{1T + 4T}{8} = \frac{9}{8}$$

$$\frac{5T}{\cancel{8}} = \frac{9}{\cancel{8}}$$

$$\boxed{T = \frac{9}{5}} = \boxed{T = 1.80}$$

is the optimal Thres.

Problem 3

(a) $y = x - 2 \quad -①$

As we know:

$$y = r\sin\theta \quad ; \quad x = r\cos\theta$$

in ①

$$r\sin\theta = r\cos\theta - 2$$

$$r(\sin\theta - \cos\theta) = -2$$

$$\boxed{r = -\frac{2}{\sin\theta - \cos\theta} = \frac{2}{\cos\theta - \sin\theta}}$$

$$y = 1 - x/2$$

$$y = r\sin\theta ; \quad x = r\cos\theta .$$

$$2r\sin\theta = \frac{2 - r\cos\theta}{\cancel{2}}$$

$$2r\sin\theta + r\cos\theta = 2$$

$$r(2\sin\theta + \cos\theta) = 2$$

$$\boxed{r = \frac{2}{2\sin\theta + \cos\theta}}$$

linear equation.

$$\cancel{x = \cos\theta + y\sin\theta =}$$

$$x\cos\theta + y\sin\theta = e \quad -(1)$$

as we already know that function of the form $A\cos\theta + B\sin\theta = f(x)$

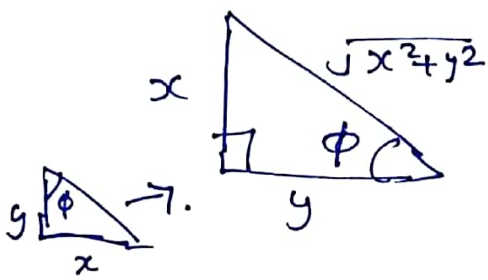
will result in $f(x)$ as a sine function this can be proven using Algebra or Geometry.

Let us solve it using Geometry.

$$(1) \times \frac{1}{\sqrt{x^2+y^2}}$$

$$\sqrt{x^2+y^2}\left(\frac{x\cos\theta}{\sqrt{x^2+y^2}} + \frac{y\sin\theta}{\sqrt{x^2+y^2}}\right) = e$$

$$\frac{x\cos\theta}{\sqrt{x^2+y^2}} + \frac{y\sin\theta}{\sqrt{x^2+y^2}} = \frac{e}{\sqrt{x^2+y^2}}$$



$$\sin\phi = \frac{x}{\sqrt{x^2+y^2}}$$

$$\cos\phi = \frac{y}{\sqrt{x^2+y^2}}.$$

$$\sin\phi\cos\theta + \cos\phi\sin\theta = \frac{e}{\sqrt{x^2+y^2}} = f(x).$$

$$\boxed{\sin(\phi+\theta) = f(x)}$$ hence sinusoidal wave.

Relating ~~to~~ the amplitude and phase of the sinusoid to the point (x, y).

$$\sin(\phi + \theta) = \frac{\rho}{\sqrt{x^2+y^2}}$$

as we know that Amplitude is $\sqrt{x^2+y^2}$.

Amplitude is directly proportion to x, y (far from origin ↑)

Hence Amplitude will change.

Also phase will also change with (x, y)

hence will shift / change phase.. (for far from origin) ↑ increase phase.

Period / Frequency is independent of the value of (x, y) of the image.