

Q33) Gray Level

	0	2
→	1	1
	2	2
	3	3
	4	1

When threshold is 1, the calculation of background

$$\text{Weight } W_b = \frac{2}{7} = 0.2222$$

$$\text{Mean } \mu_b = \frac{(0 \times 2)}{2} = 0$$

$$\text{Variance } \sigma_b^2 = \frac{((0-0)^2 \times 2)}{2} = 0$$

When threshold is 1, the calculation of foreground

$$\text{Weight } W_f = \frac{1+2+3+1}{7} = 0.7778$$

$$\text{Mean } \mu_f = \frac{(1 \times 1) + (2 \times 2) + (3 \times 3) + (4 \times 1)}{7} = 2.5714$$

$$\text{Variance } \sigma_f^2 = \frac{((1-2.5714)^2 \times 1) + ((2-2.5714)^2 \times 2) + ((3-2.5714)^2 \times 3) + ((4-2.5714)^2 \times 1)}{7}$$

$$= \frac{2.46929796 + 0.65299592 + 0.55109388 + 2.04089796}{7}$$

$$= 0.8163$$

$$\text{Within-Class Variance: } \sigma_w^2 = (0.2222)(0) + (0.7778)(0.8163) = 0.6351$$

$$\text{Between-Class Variance: } \sigma_b^2 = (0.2222)(0 - 2.5714)^2 + (0.7778)(2.5714 - 2.5714)^2 = 1.1428$$

- 25) a)
- | | | | |
|---|---|---|----------------------------------------------------------------|
| 1 | → | A | The spectrum is rotated |
| 2 | → | B | High frequencies correspond to small image detail, sharp edges |
| 3 | → | D | The spectrum is rotated |
| 4 | → | C | High frequencies correspond to small image detail, sharp edges |

- b)
- | | | | |
|---|---|---|--------------------|
| a | → | 3 | -45° degree |
| b | → | 6 | 45° degree |
| c | → | 1 | Horizontal filter |
| d | → | 2 | Vertical filter |
| e | → | 5 | Line detection |
| f | → | 4 | Enhance the image |

Q26)

i	x	y
→ A	1	1
B	2	0
C	0	1
→ D	2	2
E	1	5
G	3	4

$i=1$

i	1	2	cluster
A	0	1.4	1
B	1.4	2	1
C	1	2.2	1
D	1.4	0	2
E	4	3.2	2
G	3.6	2.2	2

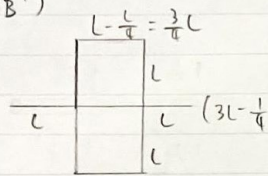
New point
(1, 0.7)
(2, 3.7)

$i=2$

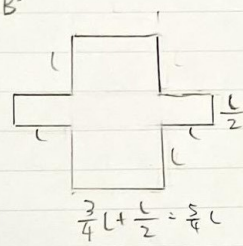
i	1	2	cluster
A	0.3	2.9	1
B	1.2	3.7	1
C	1	3.4	1
D	1.7	1.7	1
E	4.3	1.7	2
G	3.9	1.1	2

New point
(1.3, 1)
(2, 4.5)

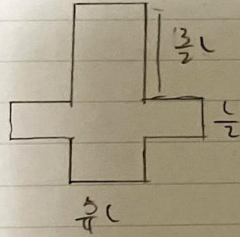
Q27) a) $(A \ominus B')$



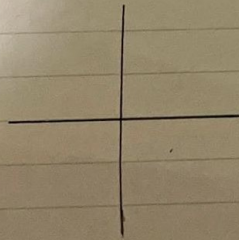
$(A \ominus B') \ominus B^3$



b) $(A \ominus B') \ominus B^4$



c) $(A \ominus B') \ominus B^2$



$$2L + \left(\frac{L}{4} + \frac{L}{8}\right) \times 2$$

$$= 2\frac{3}{4}L$$

Q28) a)

$$\begin{array}{cccccc} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 1 & 3 & 6 \\ 0 & 1 & 2 & 2 & 4 & 0 \\ 0 & 1 & 0 & 2 & 5 & 0 \\ 0 & 0 & 2 & 3 & 6 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{array}$$

\Rightarrow

$$\begin{array}{cccc} 0 & 1 & 2 & 0 \\ 1 & 1 & 2 & 2 \\ 0 & 2 & 2 & 2 \\ 0 & 0 & 2 & 0 \end{array}$$

b)

$$\Rightarrow \begin{array}{cccc} -1 & -4 & 3 & -7 \\ 0 & -3 & 1 & -6 \\ -3 & 2 & 2 & -8 \\ 3 & -5 & -2 & -16 \end{array}$$

c)

129) a) Salt & Pepper noise

Median filter

Alpha-trimmed mean filter

b) Periodic noise

Bandreject filter

Butterworth notch filter

c) Motion blur noise

Wiener filter

Inverse filter

230) $y = -2x + 1$
slope = -2

$$-2 \times m_2 = -1$$

$$m_2 = \frac{1}{2}$$

$$\Rightarrow y = \frac{1}{2}x$$

$$\Rightarrow y = -2x + 1 \quad - \textcircled{1}$$

$$y = \frac{1}{2}x \quad - \textcircled{2}$$

$$\Rightarrow \frac{1}{2}x = -2x + 1$$

$$\frac{5}{2}x = 1$$

$$x = \frac{2}{5} \quad \Rightarrow y = \frac{1}{5}$$

$$\Rightarrow P = \sqrt{\left(\frac{2}{5} - 1\right)^2 + \left(\frac{1}{5} - 0\right)^2}$$
$$= 0.6325$$

$$\tan \theta = \frac{\frac{1}{5}}{\frac{2}{5}}$$

$$\theta = 26.5651^\circ$$