1) $A' = \{(x_1, 0.8), (x_2, 0.7), (x_3, 0.6), (x_4, 0.3), (x_5, 0.9)\}$

$x_1 = 0.8 \geq 0.7$

$x_2 = 0.7 \geq 0.7$

$x_3 = 0.6 < 0.7$

$x_4 = 0.3 < 0.7$

$x_5 = 0.9 > 0.7$

$\{x_1, x_2, x_5\}$

2) $x = 0$, $\mu(x) = 0$

$x = 2$, $\mu(x) = 0.7$

$x = 4$, $\mu(x) = 0.7$

$x = 6$, $\mu(x) = 0$

$= \dfrac{(2 \cdot 0.7) + (4 \cdot 0.7)}{0.7 + 0.7} = \dfrac{1.4 + 2.8}{1.4} = \dfrac{4.2}{1.4} = 3.176$

→ Inputs : $[1, 2, 5]$

weights : $[4, 5, 6]$

weighted sum $= (1 \cdot 4) + (2 \cdot 5) + (3 \cdot 6)$

$= 4 + 10 + 8 = 32$

output $= 32 \times 3 = 96.$

Q)

i/p size $= 28\times28$, kernel size $= 7\times7$ strid $=1$.

$$o/p \text{ size} : \frac{i/p \text{ size} - kernel \text{ size}}{stridre}$$

$$= 28 - 7 + 1 = 22,$$

$$22\times22$$

Q) Heigh & width.

$$Mension = \frac{Input \text{ dimension} - filter \text{ size} + 2\times Padd.}{Stride + 2}$$

$$Output \text{ weight} = \frac{(63 - 7 + 2\times0)}{2} + 1 = 29,$$

$$29\times29\times32$$

Q) i/p player $= 6$ neurons

o/p layer $= 2$ neurons

weight b/w i/p & hidden layer

Rows × no. of neurons − neuron in i/p

$$= 5\times6$$

$$= [2\times5] , [5\times6]$$

8) output size $= \left(\frac{n+2p}{3}(+1)\right) \times \left(\frac{n+2p-f}{3}+1\right)$

$n=5$ $f=7$

$P=1$ $s=1$

$= \left(\frac{3+2(1)-7}{1}+1\right) \times \left(\frac{5+2(1)-7}{1}+1\right)$

$= \left(\frac{5+2-7}{1}+1\right) \times \left(\frac{5+2(1)-7}{1}+1\right)$

$= 1 \times 1$

Section-3

$\underline{Q)}$

S_1	S_2	S_3	S_4
1	0		
1	0	0	

Hebb rule :- $W = \sum\limits_{t=1}^{n} t \cdot s$

for Pattern 1 : $S_1 : [1,0,1,0]$ $t=[1,0]$

$w_1 = t_1 \times s_1 = \begin{bmatrix} 1.0 & 1.1 & 0.1 & 1.0 \\ 0.1 & 0.0 & 0.0 & 0.0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

for Pattern 2 : $S_2 = [1,0,0,1]$ $t=[1,0]$

$w_2 = t_2 \times s_2 = \begin{bmatrix} 1.1 & 1.0 & 1.0 & 1.1 \\ 0.1 & 0.0 & 0.0 & 0.1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

for Pattern 3 : $S_3 = [1,1,0,0]$ $t_3 = [0,1]$

$w_3 = t_3 \times s_3 = \begin{bmatrix} 0.1 & 0.1 & 0.0 & 0.0 \\ 1.1 & 1.1 & 1.0 & 1.0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$

Pattern 4 : S_4 = $[0, 0, 1, 1]$, $t_4 = [0, 1]$

$$\omega_4 = t_4 \times S_4 = \begin{bmatrix} 0.0 & 0.0 & 0.1 & 1.0 \\ 1.0 & 1.0 & 14 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$W = \omega_1 + \omega_2 + \omega_3 + \omega_4$

$$= \begin{bmatrix} 2 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

outer Product rule.

$$= \hat{W} = \sum_{t=1}^{\hat{n}} t \times s$$

$$W = \begin{bmatrix} 2 & 0 & 1 & 1 \\ 1 & 1 & 1 & 11 \end{bmatrix}$$

Q) Centre gravity Method

to a triangle Points Me $(1,0)$ $(3,1)$ $(5,10)$

area $= \frac{1}{2}$ 2.4 , 2.5

Centroid $= 3.33$

$$CoG = \frac{\int x \cdot \mu(x) \, dx}{\int \mu(x) \, dx} = \frac{(A_1 x_1) + (A_2 \cdot x_2)}{A_1 + A_2} = 3.17.$$

$$COS = \frac{\sum (a_i A_i) f(6 A_i)}{\sum A_1 + A_2} = \frac{(3.2) + (3.33 + 2.55)}{2 + 2.25} = 3.17$$

Centra of target area Method :–

$$C_2 \cdot (area = 2.5)$$

$$\frac{2}{2} = x_{c_2} = 3.33$$

$CoG \approx 3.17$

$COS \approx 3.13$

$CLA \approx 3.33$

Q) Given

$A = \{(x_1, 0), (x_2, 0.3), (x_3, 0.4), (x_4, 0.5), (x_5, 0.8), (x_6, 1), (x_7, 1), (x_8, 1), (x_9, 1), (x_{10}, 0.7), (x_{11}, 0.5), (x_{13}, 0.8)\}$

Support :- $\{x \in A \mid \mu(x) > 0\}$

$\mu(x_1) = 0$, $\mu(x_{13}) = 0$

$(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12})$

core : $\{x \in A \mid \mu(x) = 1\}$

$\mu(6) = \mu(x_7) = \mu(x_8) = \mu(x_9) = 1$

$= (x_6, x_7, x_8, x_9)$

Crossover Points :- $\{x \in A \mid \mu(x) = 0.5\}$

$\mu(x_4) = 0.5$ & $\mu(x_{11}) = 0.5$

(x_4, x_{11}).

Alpha cut for $= 0.3$ $\{x \in A \mid \mu(x) = \alpha\}$

$(x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11})$

Strong Alphacut for $\alpha = 0.4$: $\{x \in A \mid \mu(x) \geq \alpha\}$

$\mu(x) > 0.4$

$(x_4, x_5, x_6, x_7, x_8, x_9, x_{10})$

Boundary: $\{x \in A \mid 0 < \mu(x) < 1\}$

$0 < \mu(x) < 1$

$(x_2, x_3, x_4, x_5, x_{10}, x_{11}, x_{12})$

Normaility : $\mu(x) = 1$

$\mu(x_6) = \mu(x_7) = \mu(x_8) = \mu(x_9) = 1$

Scalar cordinality

$$= 0+0.3+ 0.4+0.5+0.8 + 1+1+1+0.7+0.5$$

$$0.2+0$$

$$= 7.3$$

Relative cordinality $= \dfrac{\text{Scaler Cordinality}}{\text{N.O.f elements}}$

$$= \frac{7.3}{13}$$

$$= 0.5615$$