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2017152

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Assignment-2.

Ans. 1)

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$ (zero padding.)

$$w = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$w(-x, -y) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$I * w = \sum_{s=-\infty}^{\infty} \sum_{k=-\infty}^{\infty} I(s, k) \cdot w(x-s, y-k) \Rightarrow Y_0(x, y)$$

Step 1.

-1	0	0	
0 0	0 0	0	0
0 0	1 1	0	0
0	0	1	0
0	0	0	0

$a_{11} = (0\cdot 0) + (0\cdot 0) + (0\cdot 0) + (1\cdot 1)$

$\boxed{a_{11} = 1}$

Step 2.

-1	0	0	
0 0	0 0	0 0	0
0 0	1 0	0 1	0
0	0	1	0
0	0	0	0

$a_{12} = 0$

P.T.O.

Step-3.

-1	0	0	
0	00	00	00
0	10	00	+10
0	0	1	0
0	0	0	0

$a_{13} = 0$

Similarly, $a_{14} = 0$

Step-4.

-1	00	00	0	0
0	00	10	0	0
0	00	10	1	0
	0	0	0	0

$a_{21} = 0$

Step-5.

0-1	00	00	0
00	01	00	0
00	00	11	0
0	0	0	0

0 0 1-

0 0 0

$\boxed{a_{22} = 1 \quad 0}$ 0

Step-6.

0	-10	00	00
0	01	00	00
0	00	01	01
0	0	0	0

0 . 0 1-

$a_{23} = 0$

1 0 0

Similarly, $a_{24} = 0$.

Step - 7.

	0	0	0	0
-1	00	10	0	0
0	00	00	1	0
0	00	10	0	0

$a_{31} = 0$

0 0 0

1 0 0

Step - 8.

0	0	0	0
-10	01	00	0
00	00	01	0
00	00	10	0

$a_{32} = 0$

0 0 0

1 0 0

Step - 9.

0	0	0	0
0	-11	00	00
0	00	01	00
0	00	00	10

$\boxed{a_{33} = -1}$

0 0

0 0 0

1 0 0

Step -10.

0	0	0	0	
0	1	-10	00	0
0	0	0 0	000	01
0	0	000	00	10

$a_{34} = 0$

1 0 0

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Step -11.

	0	0	0	0
	0	1	0	0
-1	00	00	1	0
0	00	00	0	0

0 0 1

$a_{41} = 0$

0 0
0 0 0
1 0 0

Step -12.

0	0	0	0
0	1	0	0
-10	00	01	0
00	00	00	0

0 0 1

0 $a_{42} = 1 0$
0 0 0
1 0 0

Step -13.

0	0	0	0
0	1	0	0
0	-10	01	00
0	00	00	00

0 0 1

0 0 1
0 0 0 $a_{43} = 0$
1 0 0

Step -14.

0	0	0	0
0	1	0	00
0	0	-10	00
0	0	00	00

0 0
0 0

0 0 1

$\boxed{a_{44} = -1}$

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Finally, $I * w = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$

Ans. 3) (B)

$$\text{Blurr Image} \rightarrow I'(x, y) = I(x, y) * w(x, y) \quad (1)$$

$$\text{Box Filter} = w(x, y)$$

$$G_{mask}(x, y) = I(x, y) - I'(x, y)$$

$$G_{mask}(x, y) = I(x, y) - [I(x, y) * w(x, y)] \quad (2)$$

$$\text{Sharped Image} \Rightarrow I(x, y) + G_{mask}(x, y) = I(x, y) + I(x, y) - [I(x, y) * w(x, y)]$$

$$\text{Sharped Image} \Rightarrow 2 \cdot I(x, y) - [I(x, y) * w(x, y)]$$

$$I(x, y) * [2 \cdot \delta(x, y) - w(x, y)]$$

$$\boxed{w'(x, y) = 2 \cdot \delta(x, y) - w(x, y)}$$

$\downarrow$

Net Filter.

P.T.O.

For the given question,

$$2 \cdot \delta(x, y) = \begin{bmatrix} 0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0 \\ 0&0&0&2&0&0&0 \\ 0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0 \end{bmatrix}$$

and, Box filter $\Rightarrow w(x, y) = \frac{1}{(7 \times 7)} \begin{bmatrix} 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \end{bmatrix}$

and, $w'(x, y) = 2 \cdot \delta(x, y) - w(x, y) = \frac{-1}{49} \begin{bmatrix} 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1.97&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \\ 1&1&1&1&1&1&1 \end{bmatrix}$

Ans. 4) Given $\Rightarrow F(\omega) = \delta(\omega - k\omega_0) + \delta(\omega + k\omega_0)$

Now, Inverse fourier transform, $f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega) \cdot (e)^{j\omega t} \, d\omega$

$$F(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \delta(\omega - k\omega_0) \cdot e^{j\omega t} \, d\omega + \frac{1}{2\pi} \int_{-\infty}^{\infty} \delta(\omega + k\omega_0) \cdot e^{j\omega t} \, d\omega$$

$$F(t) = \frac{1}{\pi} \left[\frac{(e)^{jk\omega_0 t} + (e)^{-jk\omega_0 t}}{2} \right]$$

Ans $\Rightarrow$ $\boxed{f(t) = \frac{\cos(k\omega_0 t)}{\pi}}$