① Total 8 pages

8/3/21 DSIP ISE

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Q1

1.1 b) $x(n-4)$.

1.2 Causal

1.3 linear, time invariant.

1.4 b 81920 ∴ 128×128×5

1.5 a Planes 4,5,6,7 has Maximum value.

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Q3. as the image is 3 ~~BB~~ BPP. $L = 2^3 = 8$.

a) Thresholding.

$$S = \begin{cases} 0 & r < T \\ L-1 & r \geq T \end{cases}$$

Here $T = 4$

r	S
4	7
2	0
3	0
0	0
1	0
3	0
5	7
7	7
5	7
3	0
2	0
1	0
2	0
4	7
6	7
7	7.

∴ image after thresholding is

7	0	0	0
0	0	7	7
7	0	0	0
0	7	7	7

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Q3 contd...

b) Bit plane slicing with MSB & LSB.

as image is 3BPP we represent pixel values in 3 bit binary.

4	2	3	0
1	3	5	7
5	3	2	1
2	4	6	7

4 2 1

100	010	011	000
001	011	101	111
101	011	010	001
010	100	110	111

MSB plane.

1	0	0	0
0	0	1	1
1	0	0	0
0	1	1	1

LSB plane.

0	0	1	0
1	1	1	1
1	1	0	1
0	0	0	1

c) Negation since image is 3BPP. $L = 2^8 = 8$.

$\therefore s = (L-1-r)$.

S

7-4	7-2	7-3	7-0
7-1	7-3	7-5	7-7
7-5	7-~~4~~3	7-2	7-1
7-2	7-4	7-6	7-7

Negative image is $\rightarrow$

3	5	4	7
6	4	2	0
2	4	5	6
5	3	1	0.

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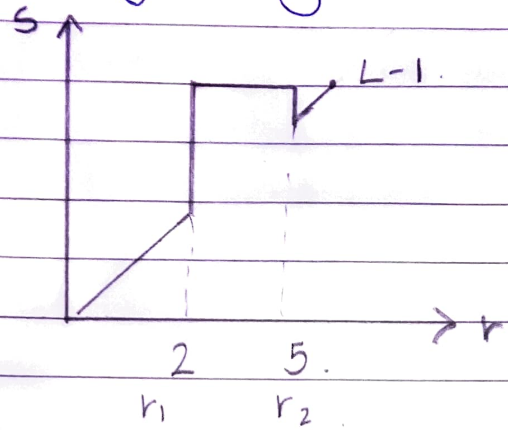
Q3 contd...

d) intensity slicing with background.



$$s = \begin{cases} L-1 & r_1 \le r \le r_2 \\ r & \text{otherwise} \end{cases}$$

So intensity sliced image with background is.

4	2	3	0
1	3	5	7
5	3	2	1
2	4	6	7

Considering $L = 2^3 = 8$ $r_1 = 2$
$r_2 = 5$.

circled will change to $L-1 = 7$.

7	7	7	0
1	7	7	7
7	7	7	1
7	7	6	7

—x—

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~~Q3 contd~~ ...

Q 2a. to find if system is periodic.

Solution.

given = $y(n) = \sin\left(\frac{\pi}{3} n^2\right)$ — (A).

$$y(n+N) = \sin\left(\frac{\pi}{3}(n+N)^2\right)$$

$$= \sin\left(\frac{\pi}{3}\left[n^2 + 2Nn + N^2\right]\right)$$

$$= \sin\left(\frac{n^2\pi}{3} + \frac{2Nn\pi}{3} + \frac{\pi N^2}{3}\right) \quad -(1).$$

Let, $\frac{\pi N^2}{3} = 2\pi M_1$

$\therefore N = \sqrt{6M_i}$

N is integer finite for powers of 6 as M_1

Let, $\frac{\pi N}{3} = 2\pi M_2$.

$N = 3M_2$.

~~N~~ N is integer for $M_2 = 1, 2, 3, \ldots$

When. $M_1 = 6$ & $M_2 = 2$. we get common value of N as. $N = 6$.

When $N = 6$. from (1).

$$y(n+N) = \sin\left(\frac{n^2\pi}{3} + 4n\pi + 4\times3\pi\right).$$

$$= \sin\left(\frac{n^2\pi}{3} + 4n\pi\right). \quad \text{sin is periodic in } N\pi.$$

$$= \sin\left(\frac{\pi n^2}{3}\right). \quad —(B)$$

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~~Sing~~ Since $y(n) = y(n+N)$
from (A) & (B).

The given signal is periodic.

Q2b.

$$x(n) = \{1, -2, \underset{\uparrow}{3}, 4, -1, 2, 2, 3, -2\}$$

-2 -1 0 1 2 3 4 5 6.

$x(0) = 3$. $\quad x(5) = 3$

$x(1) = 4$. $\quad x(6) = -2$.

$x(2) = -1$. $\quad x(-1) = -2$.

$x(3) = 2$. $\quad x(-2) = 1$.

$x(4) = 2$

$$x(-n) = \{-2, 3, 2, 2, -1, 4, \underset{\uparrow}{3}, -2, 1\}.$$

-6 -5 -4 -3 -2 -1 0 . 1 2

even component $= \dfrac{x(n) + x(-n)}{2}$.

Odd component $= \dfrac{x(n) - x(-n)}{2}$.

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(7).

$$x(n) + x(-n) = \{-1, 1, 5, 6, -2, 6, 5, 1, -1\}$$

$$\frac{x(n)+x(-n)}{2} = \{-0.5, 0.5, 2.5, 3, -1, 3, 2.5, 0.5, 0.5\}$$

$$x(n) - x(-n) = \{3, -5, 1, 2, 0, -2, -1, 5, -3\}$$

$\cancel{x(n)}$

$$\frac{x(n)-x(-n)}{2} = \{1.5, -2.5, 0.5, 1, 0, -1, -0.5, 2.5, -1.5\}$$

$\therefore$ Even signal is $\dfrac{x(n)+x(-n)}{2}$.

$$x(n)+x(-n) = \{-2, 3, 2, 2, 0, 2, \underset{\uparrow}{6}, 2, 0, 2, 2, 3, -2\}$$

$$\frac{x(n)+x(-n)}{2} = \{-1, 1.5, 1, 1, 0, 1, \underset{\uparrow}{3}, 1, 0, 1, 1, 1.5, -1\}.$$

-6 -5 -4 -3 -2 -1 ↑ 1 2 3 4 5 6

$\therefore$ Odd signal is $\dfrac{x(n)-x(-n)}{2}$.

$$x(n) - x(-n) = \{2, -3, -2, -2, 2, -6, \underset{\uparrow}{0}, 6, -2, 2, 2, 3, -2\}.$$

$$\frac{x(n)-x(-n)}{2} = \{1, -1.5, -1, -1, 1, -3, \underset{\uparrow}{0}, 3, -1, 1, 1, 1.5, -1\}.$$

-6 -5 -4 -3 -2 -1 ↑. 1 2 3 4 5 6

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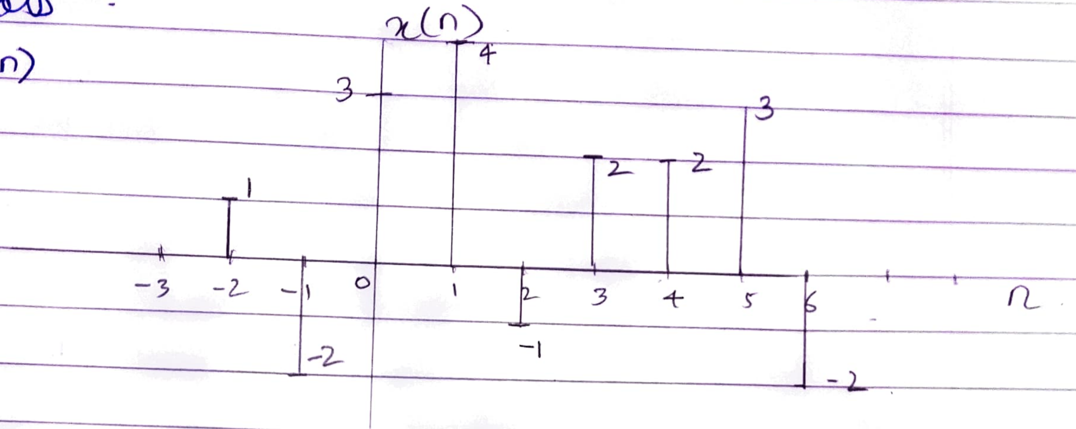
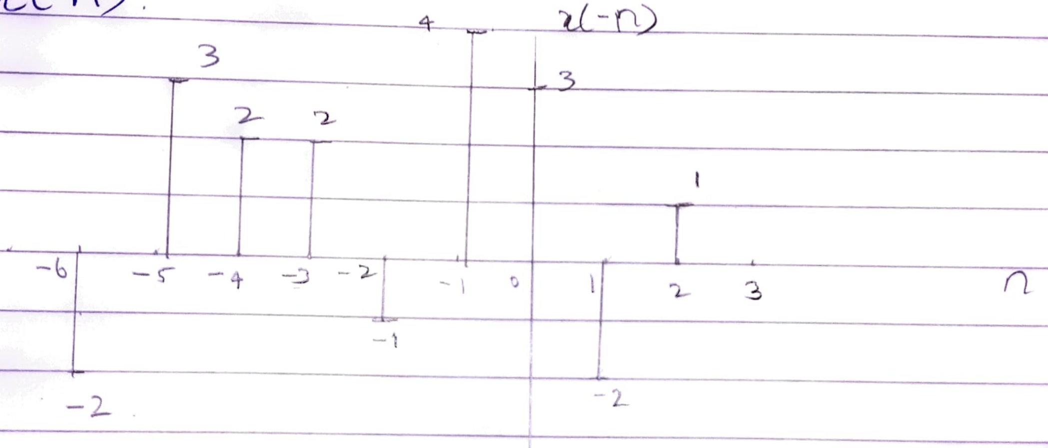
~~Ro~~ Q 2B contd...

Plots

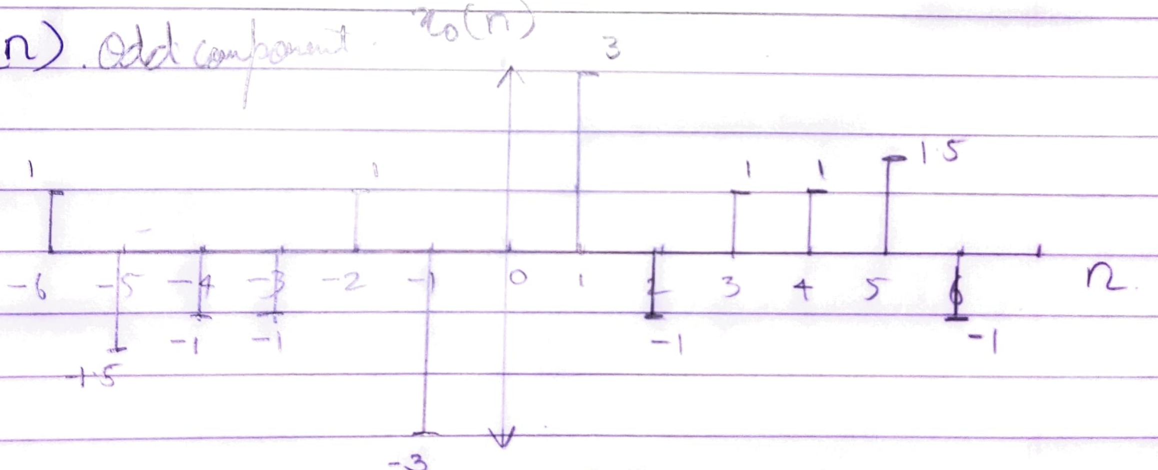
$x(n)$



$x(-n)$.



$x_o(n)$. Odd component



$x_e(n)$ even component.