DHARMSINH DESAI UNIVERSITY, NADIAD.
FACULTY OF TECHNOLOGY
ONLINE SESSIONAL EXAMINATION.

B.Tech (CE) Sem → 7
SUBJECT → Image Processing

ROLL NO → 142
Signature → Prakruti

Date : 25/8/2020
Time : 10:00 to 11:15
Total pages : 12

Q.1

(a) 255 = 11111111 ∴ MSB = 1 LSB = 1
128 = 10000000 1 0
64 = 01000000 0 0
127 = 01111111 0 1

1. MSB Plane

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

LSB Plane

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

(b) Yes, 2 images being different may have same histogram.

Although its probability is less but it is not impossible.

→ because to have same histogram distribution of numbers of specific intensities should be same not the configuration of them.

→ example. image i & its transpose iT have same histogram inspite of being visually different.

(any operation that changes place of pixels not values end up having same histogram of result & original)

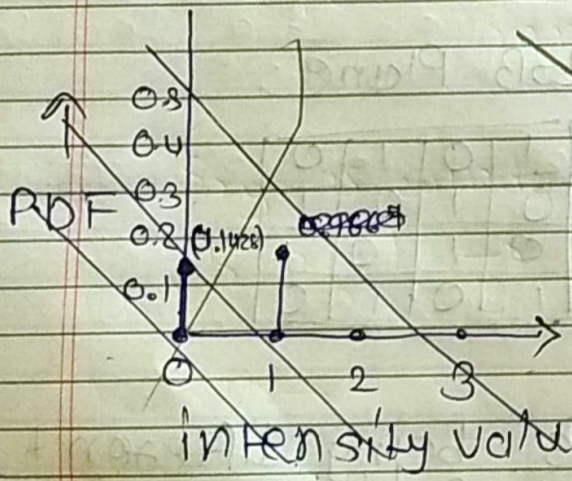
(c) n = 25

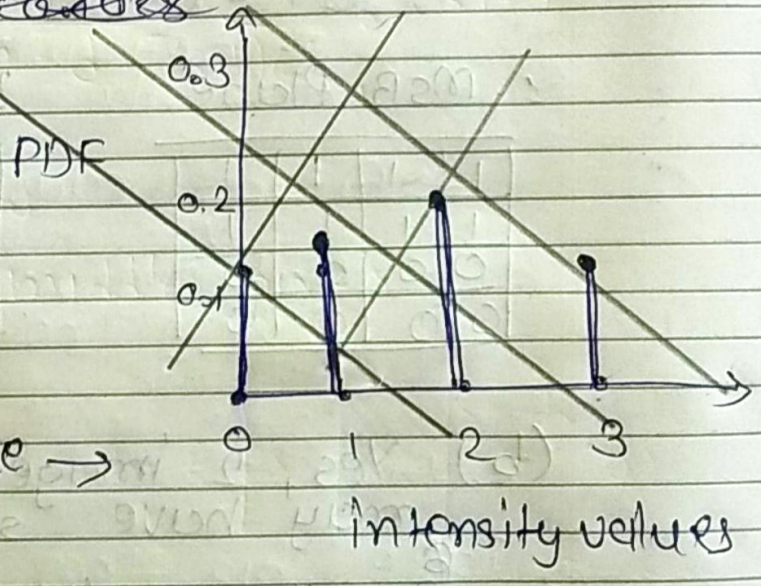
$\therefore P(0) = 7/25$ $P(1) = 6/25$ $P(2) = 5/25$

$= 0.28$ $= 0.24$

$P(3) = 7/25$

$= 0.28$



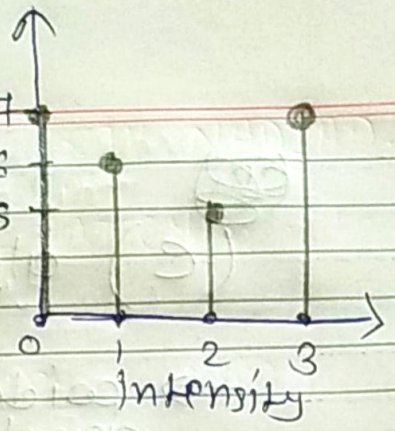


average = $P(0)(0) + P(1)(1) + P(2)(2) + P(3)(3)$

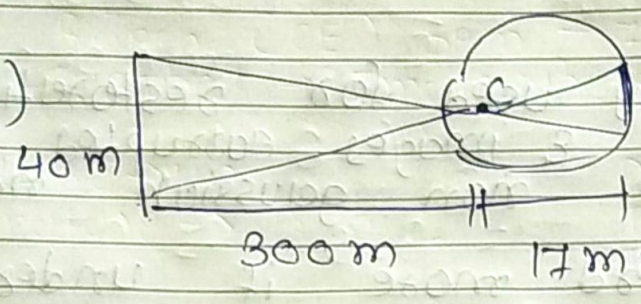
$= 0(7/25) + 6/25(1)(0.24) + 2(0.2) + 3(7/25)(0.28)$

∴ average = 1.48

≈ 1



(d)



$\frac{40}{300} = \frac{h}{17}$ ∴ $h = \frac{40(17)}{300}$

$= 2.26667$ mm

(f) photopic vision

→ it is cone vision. Also called bright light vision.

→ it includes brightly colored vision of objects. i.e. daylight vision.

scotopic vision.

→ it is rod vision also called dimlight vision

→ it includes colorless vision like moonlight vision.

→ doesnt involve color vision

→ sensitive to low level illumination

(e) alpha trimmed mean filter.

→ widely used for restoration of signals & images corrupted by additive non gaussian noise.

→ preffered more if underlying noise deviates from gaussian with impulsive components or any other combination of multiple noise
→ deletes $d/2$ lowest & $d/2$ highest gray pixels

$$\text{output} = \frac{1}{mn-d} \sum_{(s,t)\in S_{xy}} g_r(s,t)$$

S_{xy} is window.
$g_r(s,t)$ → middle pixels.

Q.2

(a)

1. arithematic mean $\left(\frac{1}{mn}\sum g(s,t)\right)$

output $= \frac{1+7+5+6+2+3+1+4+2}{9}$

$= 3.44$

≈ 3

2. geomatric mean

output $= (18.7 \cdot 5 \cdot 6 \cdot 2 \cdot 3 \cdot 1 \cdot 4 \cdot 2)^{1/9}$

$= (10,080)^{1/9}$

$= 2.785 \approx 3$

3. Harmonic mean

output $= 9/\left(\frac{1}{1}+\frac{1}{7}+\frac{1}{5}+\frac{1}{6}+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{2}\right)$

$= 9/4.092857$

$= 2.1989$

≈ 2

4. midpoint filter

$$\text{output} = \frac{1}{2}(\text{max of window} + \text{min of window})$$

$$= \frac{1}{2}(6+1)$$

$$= 3.5 \approx 3$$

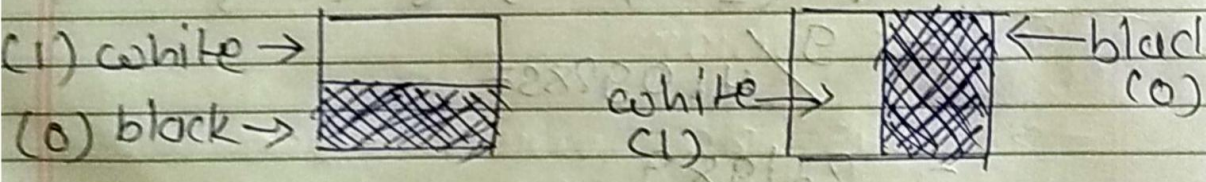
5. median filter.

output = median of window

= 5th value

= 2

(b) image 1 image 2

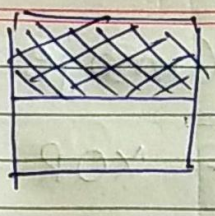


for ease of calculation lets consider 4 major parts of image as

1	2
3	4

so that explanation can be simply done.

NOT (image)



for image 1

value in part 1 = 1 } white
part 2 = 1
part 3 = 0 } black
part 4 = 0

and NOT(0) = 1
NOT(1) = 0

∴ in result part 1 & 2 are 0 (black)
3 & 4 are 1 (white)

AND (image1, image2)

1	1
0	0

1	0
1	0

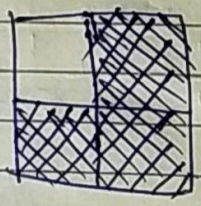
part 1 → 1 · 1 = 1
2 → 1 · 0 = 0
3 → 0 · 1 = 0
4 → 0 · 0 = 0

(· taken to denote AND)

∴ result =

1	0
0	0

i.e.



OR (image1, image2)

part 1 → 1 OR 1 = 1
2 → 1 OR 0 = 1
3 → 0 OR 1 = 1
4 → 0 OR 0 = 0

∴ result =

1	1
1	0

i.e.

XOR (image 1, image 2)

1	1
0	0

XOR

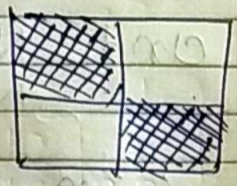
1	0
1	0

Pixel 1 → 1 XOR 1 = 0
2 → 1 XOR 0 = 1
3 → 0 XOR 1 = 1
4 → 0 XOR 0 = 0

∴ result =

0	1
1	0

i.e.



Q.3

(a) 4 bit image $\therefore L = 16$
$L-1 = 15$
intensities 0 to 15
in given image.

$r_{min} = 2$ $S_{min} = 0$
$r_{max} = 11$ $S_{max} = 15$

$$S = \frac{r - r_{min}}{r_{max} - r_{min}} * (S_{max} - S_{min})$$

$$= \frac{r-2}{11-2}(15)$$

$$= (r-2)\left(\frac{15}{9}\right)$$

r input intensity	output intensity
2	$(2-2)(\frac{15}{9}) = 0$
3	$(3-2)(\frac{15}{9}) = 1.667 \approx 2$
4	$(4-2)(15/9) = 3.333 \approx 3$
8	$(8-2)(15/9) = 10$

9	$(9-2)\left(\frac{15}{9}\right) = 11.667$ ≈ 12
10	$(10-2)\left(\frac{15}{9}\right) = 13.333$ ≈ 13
11	$(11-2)\left(\frac{15}{9}\right) = 15$

output =>

2	10	0	0	12	3
10	15	3	15	15	28
2	13	12	13	2	3
0	15	12	12	2	0
3	12	2	10	12	3
3	10	2	0	15	0

(b)

1. smallest possible n (i.e. no. of bits)
for this L should be minimum
as values are 1 to 5
we can have $\boxed{L=8}$
∴ according to $L = 2^n$
$\boxed{n=3}$

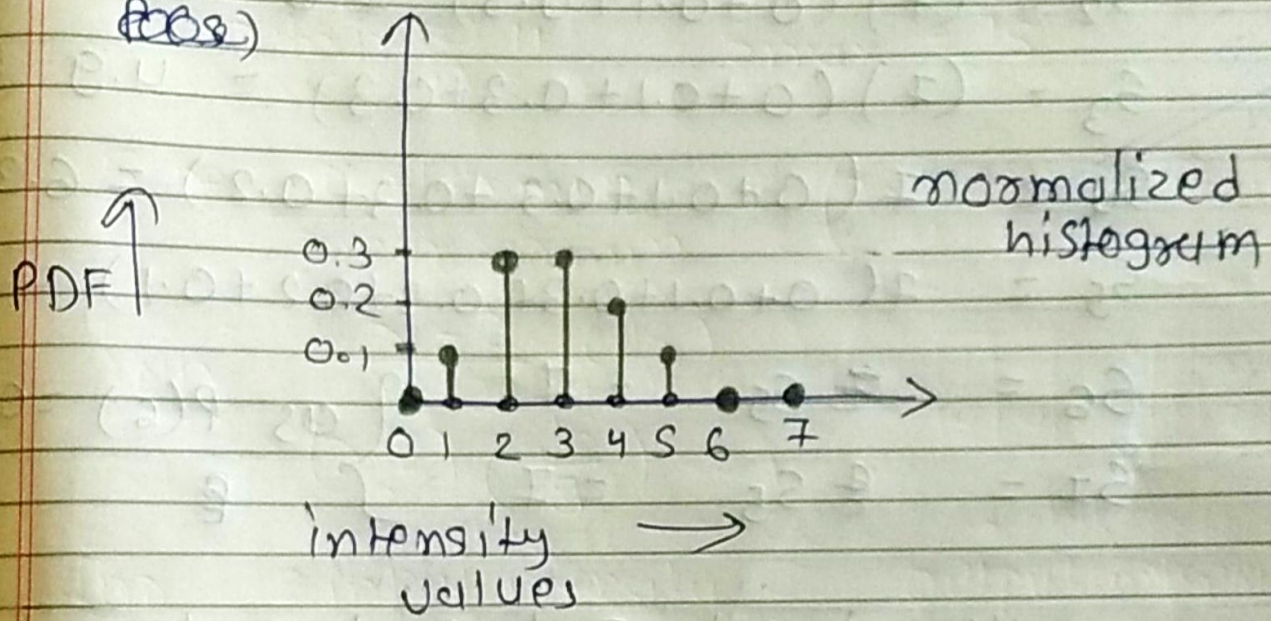
2. $P(0) = 0$ $P(5) = 1/10$

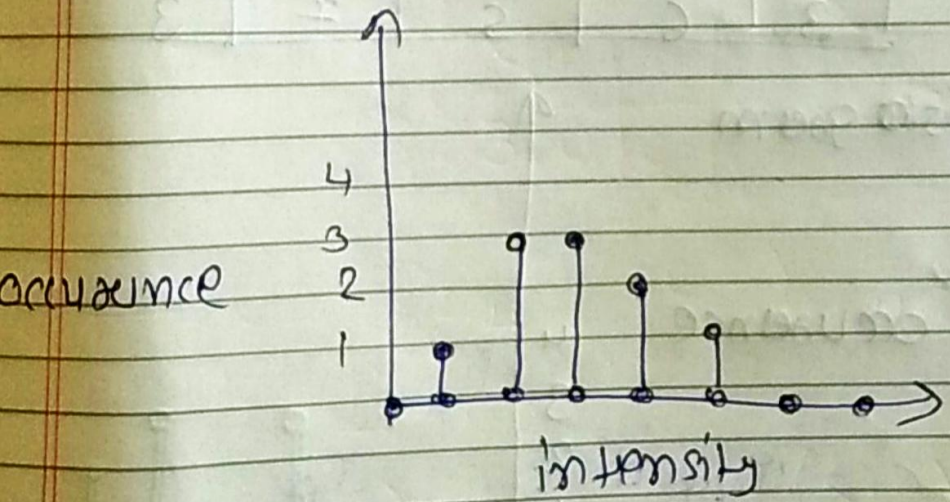
$P(1) = 1/10$ $P(6) = 0$

$P(2) = 3/10$ $P(7) = 0$

$P(3) = 3/10$

$P(4) = 2/10$





equalization.

$$S_k = (L-1) \sum_{j=0}^{k} P_r(x_j)$$

$S_0 = (7)(0) = 0$

$S_1 = (7)(0+0.1) = 0.7 \approx 1$

$S_2 = (7)(0+0.1+0.3) = 2.8 \approx 3$

$S_3 = (7)(0+0.1+0.3+0.3) = 4.9 \approx 5$

$S_4 = 7(0+0.1+0.3+0.3+0.2) = 6.3 \approx 6$

$S_5 = 7(0+0.1+0.3+0.3+0.2+0.1) = 7$

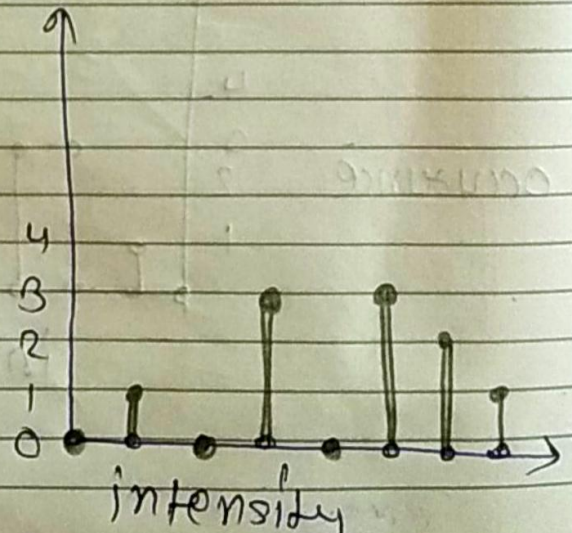
$S_6 = S_5 = 7$

$S_7 = S_5 = 7$

} as $P(6) = 0$ & $P(7) = 0$

result	1	3	5	6	5
	3	6	5	7	3

result histogram



end of answer sheet