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Internal Assesment Test - II

Sub:	Digital Image Processing						Code:	10EC763
Date:	09/ 11 / 2017	Duration:	90 mins	Max Marks:	50	Sem: 7th	Branch:	ECE (B)

Answer Any FIVE FULL Questions

		Marks	OBE CO	OBE RBT
1.	Perform histogram equalization of the 5x5 image whose data is shown in Table.1 and infer the results. Draw the histogram of image before and after equalization	[10]	CO2	L4
2.	With necessary graphs, explain the following: (i) Contrast stretching (ii) Bit plane slicing (iii) Gray level slicing (iv) Power law transformation	[10]	CO2	L4
3.(a)	Briefly discuss (i) RGB color model (ii) CMYK color model	[06]	CO6	L2
(b)	Write a note on full color image processing.	[04]	CO6	L2
4.	Explain the smoothing of images in frequency domain using: (i) ideal low pass filter (ii) Butterworth low pass filter	[10]	CO4	L3

Gray level	0	1	2	3	4	5	6	7
Number of pixels	0	0	0	6	14	5	0	0

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5.	What is pseudo color image processing? Explain intensity slicing and gray to color transformations.	[10]	CO6	L2
6. (a)	Justify the statement "median filter is an effective tool to minimize salt and pepper noise" using the image segment shown below: $\begin{bmatrix} 24 & 22 & 33 & 25 & 32 & 24 \\ 34 & 255 & 24 & 0 & 26 & 23 \\ 23 & 21 & 32 & 31 & 28 & 26 \end{bmatrix}$	[05]	CO4	L5
(b)	Using the second derivative, develop a Laplacian mask for image sharpening	[05]	CO4	L4
7. (a)	What is a histogram? Describe how does histogram of the following image look like: (i) Dark image (ii) Bright image (iii) Low contrast image (iv) High contrast image	[06]	CO2	L2,L4
(b)	Explain the following spatial image enhancement operations: (i) Image negative (ii) AND operation	[04]	CO2	L2
8.	What is HSI color model? Give the expressions for converting RGB to HIS color model.	[10]	CO6	L2

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Solution Scheme (7e)

1. (a) M×N: 1024×1024

$L = 256 = 2^k \Rightarrow k = 8$

b, Total no. of bits = M×N×k = 10485760 bits (2m)

= 1280 kB

Total time reqd to transmit this image over a 56k baud link:

$T = \frac{b}{\text{baud rate}} = \frac{10485760 \text{ bits}}{57000 \text{ bits/sec}} = 184045 \text{ sec}$

= 3.12 min (2m)

(b) V = {2, 3, 4}

4-path

3	4	1	2	0	
0	1	0	4	2	(q)
2	2	3	1	4	
3	0	4	2	1	
1	2	0	3	4	

(p)

No 4-path (2m)

Since there are no 4-neighbours of the final pixel value 4 in the path in V.

8path :

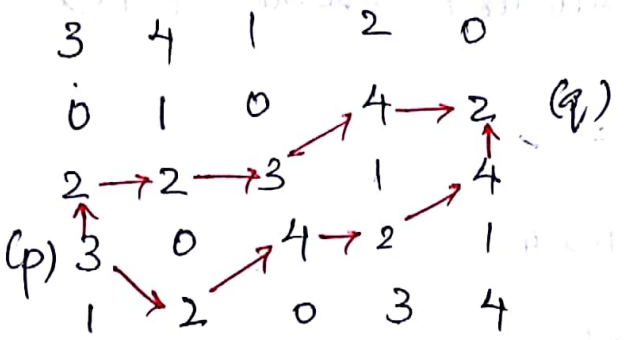
3	4	1	2	0	
0	1	0	4	2	(q)
2	2	3	1	4	
3	0	4	2	1	
1	2	0	3	4	

(p)

---> shortest 8path length = 4

(2m)

m-path :



shortest m-path length = 5

(2m)

2. Concept of spatial filtering (explanation)
(fig - mechanics of spatial filtering - 3x3 mask) : 2m

Expressions of R, g(x,y) : 1m

Smoothing linear filters.

Need / purpose : (1M)

Std avg & weighted avg mask & explanation : (2m)

Expression : (1m)

Order statistics (median) filter :

purpose : (1M)

example with mask : (2M).

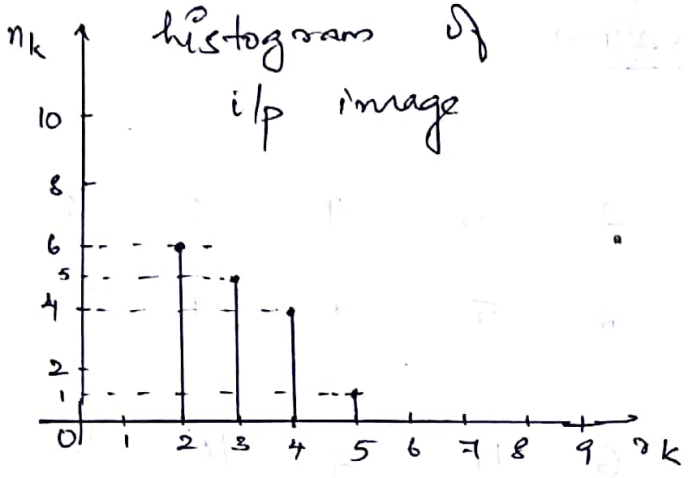
3. Histogram Equalization.

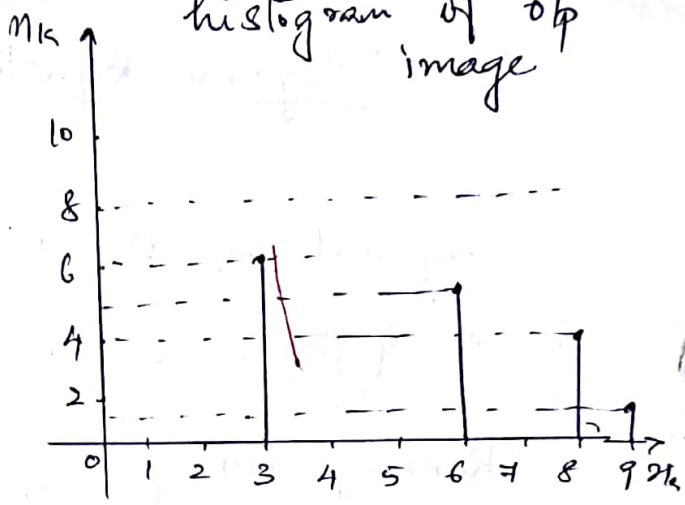
Gray scale r_k	0	1	2	3	4	5	6	7	8	9
no. of pixels n_k	0	0	6	5	4	1	0	0	0	0
Running sum ($\sum_{j=0}^{k} n_j$)	0	0	6	11	15	16	16	16	16	16
$S = \sum_{j=0}^{k} n_j / n$ (÷ by total no. of pixels)	0	0	$\frac{6}{16}$ = 0.375	$\frac{11}{16}$ 0.6875	$\frac{15}{16}$ 0.9375	$\frac{16}{16} = 1$	1	1	1	1
multiply by max. intensity (=9)	0	0	0.375 × 9 = 3.375	0.6875 × 9 = 6.1875	0.9375 × 9 = 8.4375	1 × 9 = 9	9	9	9	9
Round up to nearest integer.	0	0	3	6	8	9	9	9	9	9

Mapping gray level to i/p gray scale: (4m)

Original image	after equalization
0	0
1	0
2	3
3	6
4	8
5	9
6	9
7	9
8	9
9	9

(1m)





(2m)

$$\begin{bmatrix} 2 & 3 & 3 & 2 \\ 4 & 2 & 4 & 3 \\ 3 & 2 & 3 & 5 \\ 2 & 4 & 2 & 4 \end{bmatrix} \xrightarrow[\text{Eqn}]{\text{histogram}} \begin{bmatrix} 3 & 6 & 6 & 3 \\ 8 & 3 & 8 & 6 \\ 6 & 3 & 6 & 9 \\ 3 & 8 & 3 & 8 \end{bmatrix}$$

(2m)

histogram of o/p image:

Gray Scale	0	1	2	3	4	5	6	7	8	9
No. of pixels	0	0	0	6	0	0	5	0	4	1

4. (i) RGB color model.

RGB cube figure: 2m

Explanation: 2m

Safe RBG colors: 1m

(ii) HSI color model:

HSI model cube (rotated RGB): 2m

projection fig. & explanation: 1m

Explanation of computing H, S, I components: 2m

5) Pseudo color image processing

↳ Explanation : 2m

Intensity slicing :

Graphs (2) } 3m
Expressions. }

Explanation :- 1m

Gray to color transformation :

fig : 1m

graph + applns explanation : (2+1.) m

6, (i) Contrast stretching

graph : (1.5m)

explanation of variations in r_1, r_2, s_1, s_2 : (1 m)

(ii) Bit plane slicing

fig : 1m

explanation : 1.5 m

(iii) Gray level slicing :

graphs (2 variations) = 1.5 m

explanation : 1m

(iv) Power law transformation :

graph, expression : 1.5 m

explanation with example : 1m

7. (a) Histogram definition + expression : 2m

Plot for :
Dark image - 1m
Bright " - 1m
low contrast " - 1m
high contrast " - 1m

(b) Image Negative

Graph + expression : 1m
explanation : - 1m

AND operation

explanation with ~~exp~~ example fig : (1+1)m