BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI,

DUBAI CAMPUS, DUBAI INTERNATIONAL ACADEMIC CITY DUBAI

I SEM 2012-2013

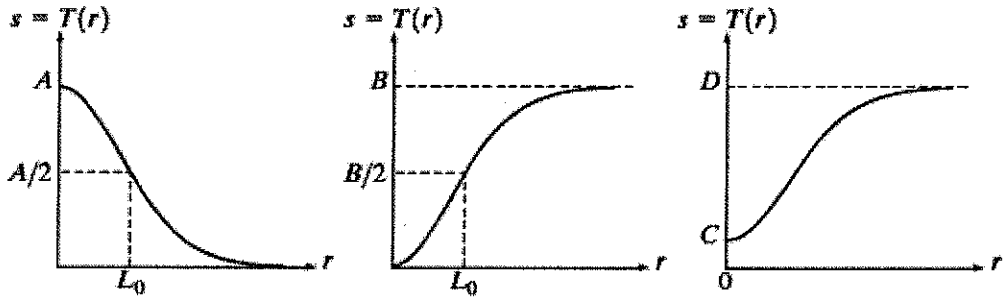
IMAGE PROCESSING EA C443 (ELECTIVE)

COMPREHENSIVE EXAMINATION

WEIGHTAGE 40%, MAX MARKS 40, TIME 3 HOURS, DATE 10-01-2013

Note : Answer all the questions

Q.1 Exponentials of the form e^{-ar^2} , with α positive constant, are useful for constructing smooth intensity transformation functions. Start with this basic function and construct transformations having the general shapes shown in the following figures. The constant shown are input parameters, and your proposed transformation must include them in their specifications. 9M



Q.2 Explain the following 6M

i. Histogram equalization
ii. Contrast stretching

Q.3 Given following 4x4 image , 10M

8	4	4	5
6	8	2	2
8	6	5	4
1	6	5	3

Apply unsharp masking and high boost filtering on the image.

Q.4 Explain following properties of 2D Discrete Fourier Transform 4M

i. Seperability property
ii. Shifting property

Q.5 Apply Harmonic mean filter on the following 3x3 image. 5M

2	2	1
1	25	2
3	2	2

Q.6 What is Fourier slice theorem? Explain 6M

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Q. 1	(a) General form: $s = T(r) = Ae^{-Kr^2}$. For the condition shown in the problem figure, $Ae^{-KL_0^2} = A/2$. Solving for K yields $-KL_0^2 = \ln(0.5)$ $K = 0.693/L_0^2$. Then, $s = T(r) = Ae^{-\frac{0.693r^2}{L_0^2}}$. (b) General form: $s = T(r) = B(1 - e^{-Kr^2})$. For the condition shown in the problem figure, $B(1 - e^{-KL_0^2}) = B/2$. The solution for K is the same as in (a), so $s = T(r) = B(1 - e^{-\frac{0.693r^2}{L_0^2}})$ (c) General form: $s = T(r) = (D - C)(1 - e^{-Kr^2}) + C$.	8
Q. 2	Explain the following i. Histogram equalization	4

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IMAGE PROCESSING EA C443 (ELECTIVE)

TEST 2 (OPEN BOOK)

WEIGHTAGE 20% , MAX MARKS 20, TIME 50 MINUTES, DATE 19-12-2012

Note : Answer all the questions

Q.1 A blur filter is given by 6M

$$h(m,n)=\begin{bmatrix} 0 & 0.05 & 0.05 & 0 \\ 0.15 & 0.1 & 0.1 & 0.15 \\ 0 & 0.1 & 0.1 & 0 \\ 0 & 0.1 & 0.1 & 0 \end{bmatrix}$$

find the deblur filter using Weiner filter approach with $\sigma_x^2=200$ and $\sigma_w^2=100$
Weiner filter is given by

$$G(u,v)=\frac{H^*(u,v)}{|H(u,v)|^2+\frac{\sigma_w^2}{\sigma_x^2}}$$

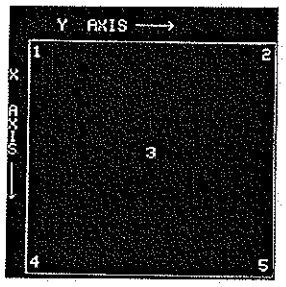
Q.2 Given following 8x8, 3 bit image, 6M

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

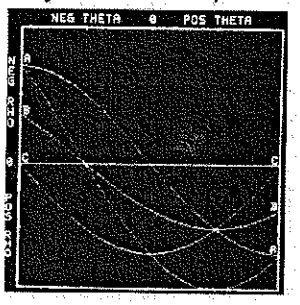
Find

i. Entropy of the image
ii. Compress the image using Huffman coding
iii. Compute the compression achieved and the effectiveness of the Huffman coding

Q.3 Consider following figure 5



a) Explain why the Hough mapping of point 1 in above figure, is a straight line
b) Is this only point that produce that result? Explain
c) Explain the reflective adjacency relationship illustrated in the following figure.



Q.4 What is Radon transform? Explain 3

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IMAGE PROCESSING EA C443 (ELECTIVE)

TEST 1 (CLOSED BOOK)

WEIGHTAGE 25% , MAX MARKS 25, TIME 50 MINUTES, DATE 07-11-2012

Note : Answer all the questions

Q.1 Given following 4x4 image, perform the second derivative on the same 5M

6	8	9	3
5	6	8	2
4	6	7	8
2	3	5	6

Q.2 Explain the following 6M

i. Grey level slicing
ii. Contrast stretching
iii. Bit plane slicing

Q.3 Given following 8x8 image which is having 16 grey levels, draw the histogram of the image and perform histogram equalization. 5M

9	9	9	10	9	7	10	7
7	7	9	7	8	7	10	10
8	8	8	8	10	9	9	9
10	10	8	8	9	9	7	9
7	9	10	9	10	8	7	8
10	9	7	7	10	10	10	7
9	7	10	9	8	9	7	9
8	8	10	7	9	9	8	7

Q.4 Given following 3x3 image 5M

0	8	0
1	8	0
0	8	0

and the filter mask

-1	2	-1
-1	2	-1
-1	2	-1

perform the filter operation

Q.5 Write the equation for 2D DFT and its inverse? Explain its seperability property 4M

qw 3

BITS PILANI DUBAI CAMPUS

MATLAB IMPLEMENTATION 2 OF IMAGE PROCESSING ALGORITHMS
EA C443 IMAGE PROCESSING (ELECTIVE)
MAX MARKS : 7 , PERCENTAGE WEIGHTAGE : 7% ; Time 30 Minutes

Given an image file with hidden text into it,write a MATLAB program to extract the message from the image.
Note: Image file is already available in the share directory of the system

```
clc;
clear all;
close all;
data3=imread('watimage1.bmp');
[row col]=size(data3);
imshow(data3);
alldata=[];
n=1;
for k=1:9,
%    if (k==row)
%       col=colend;
%    else
%       col=len3;
%    end
     for m=1:col,
        alldata(n)=data3(k,m);
        n=n+1;
     end
  end
  for i=1:n-1,
     alldata(i)=bitand(alldata(i),1);
  end
alldata=double(alldata);
alldata=alldata;
len1=length(alldata);

%get the 8bit data by selecting every 8 bits
a_text=[];
in1=1;in2=7;
for cnt=1:len1-1,
a_text=[a_text ; alldata(in1:in2)];
in1=in2+1;
in2=in2+7;
end

% Reconstruct the text
```

ID No.	Name:

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EA C443 IMAGE PROCESSING (ELECTIVE)

QUIZ 1 (CLOSED BOOK)

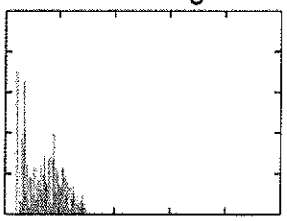
WEIGHTAGE 3% , MAX MARKS 6, TIME 10 MINUTES

Note : Answer all the questions

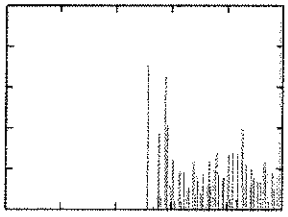
1. Following 2x2 , 4 bit image segment is given, sketch the second bit plane [1M]

$$\begin{bmatrix} 5 & 8 \\ 12 & 15 \end{bmatrix}$$ ans :

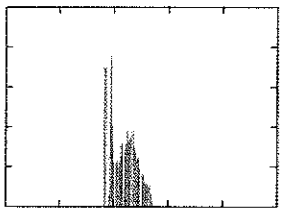
2. Given following 4 histograms, identify the nature of its image. [2M]



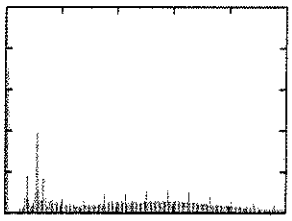
Ans :



Ans :



Ans :



Ans :

3. Following 8x8 image need to be median filtered, find (5,5) , (6,5) pixels of the median filtered image. [1M]

6	7	8	9	5	6	8	2
5	6	7	8	1	2	3	4
5	6	7	8	8	7	1	4
2	5	6	7	8	6	6	7
4	8	5	5	8	3	9	3
8	9	7	8	9	8	9	7
7	8	4	4	5	1	0	2
3	5	7	9	7	8	9	8

4. Given following 2x2, image find the 2D DFT [2M]

$$\begin{bmatrix} 4 & 5 \\ 3 & 2 \end{bmatrix}$$