



Dubai International Academic City, Dubai
IV Yr. B.E.(Hons.) Second Semester Academic Year 2011 – 2012
COMPREHENSIVE TEST

IMAGE PROCESSING (ELECTIVE)

Course No. : EA C443
Duration : 3 Hours

Date : 05-06-2012
Max Marks : 40
Weightage : 40%

Note : Answer all the questions

Q.1 Perform the intensity level slicing on the following image. Let $r_1=3$ and $r_2=5$. Obtain **5M**
the image with background and without background transformation.

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

Q.2 Equalize the following histogram **5M**

Gray Level	0	1	2	3	4	5	6	7
Number of pixels	790	1023	850	656	329	245	122	81

Q.3 Give the expression for 2D DFT, and 2D Inverse DFT. Determine the 2D DFT of **8M**
the following image :

0	1	2	1
1	2	3	2
2	3	4	3
1	2	3	2

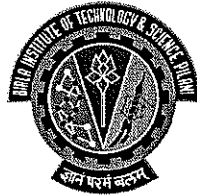
Q.4 Given below is a 3x3 image. What will the value of the center pixel change to when **5M**
this image is passed through a

- I. Arithmetic mean filter
- II. Geometric mean filter
- III. Harmonic mean filter
- IV. Max filter
- V. Min filter

1	7	5
6	2	3
1	4	2

- Q.5 What is Hough Transform? Explain. **6M**
Given four points in the xy plane with the following coordinates to join these points, use Hough transform to join these points.
(1,1)(2,2)(3,3)(4,4)
(use graph sheet given to you for this question)
- Q.6 During acquisition an image undergoes uniform linear motion in the vertical **4M**
direction for time T1. The direction of the motion then switches to the horizontal
direction for a time interval T2. Assuming that the time it takes the image to change
directions is negligible, and that the shutter opening and closing times are negligible
also, give an expression for the blurring function, $H(u,v)$
- Q.7 A two bit image which has pixel symbols 0,1 2 3 has probabilities 0.4, 0.2,0.1 and **4M**
0.3 respectively. Construct arithmetic coding to encode pixel symbol '3,0,3'
- Q.8 What is transform domain coding technique? With the help of block diagram Explain **3M**
step by step process to implement this coding.

Wish you good luck



Dubai International Academic City, Dubai
IV Yr. B.E.(Hons.) Second Semester Academic Year 2011 – 2012

IMAGE PROCESSING (ELECTIVE) TEST 2 (Open Book)

Course No. : EA C443
Duration : 50 Mins

Date : 16-05-2012
Max Marks : 20
Weightage : 20%

Note : Answer all the questions

Q.1 For the following 3x3 image, apply contra harmonic mean filter with $Q=1$

8	5	3
5	3	2
2	0	4

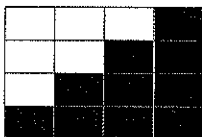
4M

Q.2 Consider the problem of image blurring caused by uniform acceleration in the x direction. If the image is at rest at time $t=0$ and accelerates with a uniform acceleration $x_0(t)=at^2/2$ for a time T, find the blurring function $H(u,v)$. You may assume that shutter opening and closing time are negligible.

4M

Q.3 Given following 4x4 , image apply split and merge technique to segment the image and obtain the quadtree representation.

2M



Q.4 Given following 8x8 , 3 bit image,

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

6M

Compute the compression ratio and redundancy that can be achieved by

- Huffman coding of pixels.
- Run length coding of the pixels.

Q.5 With respect to the Hough transform develop a general procedure for obtaining normal representation of a line from its slope-intercept equation $y=ax+b$. Also find the normal representation of the line $y=-2x+1$

4M



Dubai International Academic City, Dubai
IV Yr. B.E.(Hons.) Second Semester Academic Year 2011 – 2012

IMAGE PROCESSING (ELECTIVE) TEST 1 (Closed Book)

Course No. : EA C443
Duration : 50 Mins

Date : 28-03-2012
Max Marks : 25
Weightage : 25%

Note : Answer all the questions

Q.1	<p>Given following 4x4 image ,</p> <table border="1"> <tr><td>3</td><td>6</td><td>7</td><td>6</td></tr> <tr><td>6</td><td>3</td><td>2</td><td>6</td></tr> <tr><td>3</td><td>1</td><td>5</td><td>1</td></tr> <tr><td>6</td><td>6</td><td>3</td><td>6</td></tr> </table> <p>Filter the above image with the filter mask given below.</p> <table border="1"> <tr><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>-8</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td></tr> </table> <p>Ans:</p> <table border="1"> <tr><td>-9</td><td>-27</td><td>-33</td><td>-33</td></tr> <tr><td>-32</td><td>9</td><td>19</td><td>-27</td></tr> <tr><td>-2</td><td>26</td><td>-12</td><td>14</td></tr> <tr><td>-38</td><td>-30</td><td>-5</td><td>-39</td></tr> </table>	3	6	7	6	6	3	2	6	3	1	5	1	6	6	3	6	1	1	1	1	-8	1	1	1	1	-9	-27	-33	-33	-32	9	19	-27	-2	26	-12	14	-38	-30	-5	-39	6																							
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-2	26	-12	14																																																															
-38	-30	-5	-39																																																															
Q.2	<p>Given a following 8x8, image which has only 8 gray levels.</p> <table border="1"> <tr><td>4</td><td>5</td><td>7</td><td>6</td><td>0</td><td>4</td><td>3</td><td>0</td></tr> <tr><td>4</td><td>3</td><td>1</td><td>5</td><td>4</td><td>2</td><td>5</td><td>2</td></tr> <tr><td>4</td><td>5</td><td>0</td><td>6</td><td>4</td><td>1</td><td>2</td><td>3</td></tr> <tr><td>6</td><td>4</td><td>0</td><td>7</td><td>6</td><td>4</td><td>5</td><td>2</td></tr> <tr><td>2</td><td>5</td><td>0</td><td>7</td><td>3</td><td>2</td><td>3</td><td>1</td></tr> <tr><td>2</td><td>4</td><td>3</td><td>1</td><td>3</td><td>0</td><td>5</td><td>6</td></tr> <tr><td>0</td><td>5</td><td>3</td><td>1</td><td>5</td><td>6</td><td>5</td><td>3</td></tr> <tr><td>7</td><td>4</td><td>2</td><td>5</td><td>5</td><td>1</td><td>3</td><td>7</td></tr> </table> <p>a) Plot the Histogram of the image b) Using Histogram equalization technique, obtain transformation function $T(r)$ and equalized histogram.</p>	4	5	7	6	0	4	3	0	4	3	1	5	4	2	5	2	4	5	0	6	4	1	2	3	6	4	0	7	6	4	5	2	2	5	0	7	3	2	3	1	2	4	3	1	3	0	5	6	0	5	3	1	5	6	5	3	7	4	2	5	5	1	3	7	2+4=6
4	5	7	6	0	4	3	0																																																											
4	3	1	5	4	2	5	2																																																											
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6	4	0	7	6	4	5	2																																																											
2	5	0	7	3	2	3	1																																																											
2	4	3	1	3	0	5	6																																																											
0	5	3	1	5	6	5	3																																																											
7	4	2	5	5	1	3	7																																																											

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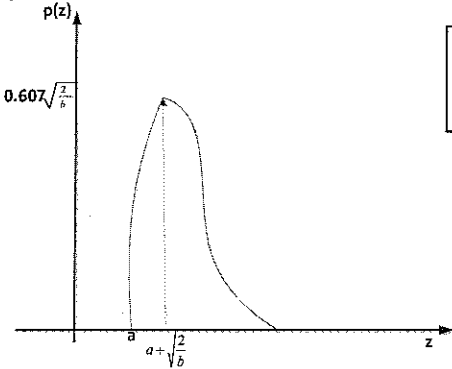
IMAGE PROCESSING (ELECTIVE)

Course No. : EA C443
Duration : 20 Mins

quiz 2

Date : 09-05-2012
Max Marks : 7
Weightage : 7%

Note : Answer all the questions , write the answers to the quiz questions in the box provided for the answers. Write the MATLAB program in the editor and display the output.

Q.1	<p>Given following 3x3 image , apply geometric mean filter on the same , and get the shown pixel value at the coordinate shown as $f(x,y)$</p> <table style="display: inline-table; margin-right: 20px;"> <tr><td style="padding: 2px 5px;">3</td><td style="padding: 2px 5px;">4</td><td style="padding: 2px 5px;">5</td></tr> <tr><td style="padding: 2px 5px;">4</td><td style="padding: 2px 5px;">2</td><td style="padding: 2px 5px;">4</td></tr> <tr><td style="padding: 2px 5px;">4</td><td style="padding: 2px 5px;">5</td><td style="padding: 2px 5px;">4</td></tr> </table> <table style="display: inline-table; margin-right: 20px;"> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px; text-align: center;">$f(x,y)$</td><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr> </table> <div style="border: 1px solid black; padding: 5px; display: inline-block;">Ans:</div>	3	4	5	4	2	4	4	5	4					$f(x,y)$					0.5
3	4	5																		
4	2	4																		
4	5	4																		
	$f(x,y)$																			
Q2	<p>Frequency domain model for the image degradation/restoration process is given by</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div>	0.5																		
Q3.	<p>Identify the noise model for following probability density functions</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px; border: 1px solid black; width: 300px; height: 40px;"></div> </div>	0.5																		
Q4.	<p>The compression ratio of an algorithm is 5:1</p> <div style="border: 1px solid black; width: 300px; height: 40px; margin-left: auto; margin-right: auto;"></div>	0.5																		
Q5.	<p>Write the expression for the root mean square error Fidelity criteria ,</p> <div style="border: 1px solid black; padding: 10px; margin-left: 20px; width: 50%;">Ans:</div>	0.5																		
Q6.	<p>Which of the following redundancy criteria is not reversible</p> <ul style="list-style-type: none"> A. Coding redundancy B. Inter-pixel redundancy C. Psycho-visual redundancy <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;">Ans:</div>	0.5																		

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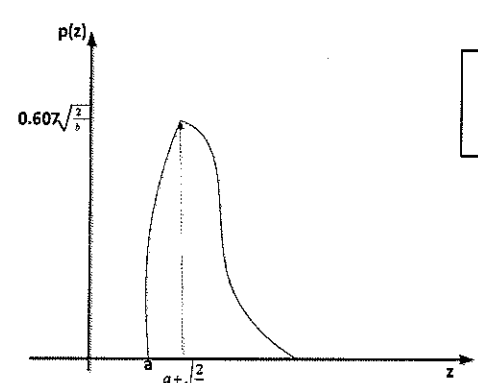
IMAGE PROCESSING (ELECTIVE)

Course No. : EA C443
Duration : 20 Mins

QUIZ-2

Date : 09-05-2012
Max Marks : 7
Weightage : 7%

Note : Answer all the questions , write the answers to the quiz questions in the box provided for the answers. Write the MATLAB program in the editor and display the output.

Q.1	<p>Given following 3x3 image , apply geometric mean filter on the same , and get the shown pixel value at the coordinate shown as f(x,y)</p> <table border="1" style="display: inline-table; margin-right: 20px;"> <tr><td>3</td><td>4</td><td>5</td></tr> <tr><td>4</td><td>2</td><td>4</td></tr> <tr><td>4</td><td>5</td><td>4</td></tr> </table> <table border="1" style="display: inline-table; margin-right: 20px;"> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td>f(x,y)</td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table> <div style="border: 1px solid black; padding: 5px; display: inline-block;">Ans: 3.7 ≈ 4</div>	3	4	5	4	2	4	4	5	4					f(x,y)					0.5
3	4	5																		
4	2	4																		
4	5	4																		
	f(x,y)																			
Q2	<p>Frequency domain model for the image degradation/restoration process is given by</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>Ans: $G(u,v)=F(u,v)H(u,v)+N(u,v)$</p> </div>	0.5																		
Q3.	<p>Identify the noise model for following probability density functions</p>  <div style="border: 1px solid black; padding: 10px; margin: 10px 0;">Ans: Rayleigh</div>	0.5																		
Q4.	<p>The compression ratio of an algorithm is 5:1</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;">Ans: 0.8</div>	0.5																		
Q5.	<p>Write the expression for the root mean square error Fidelity criteria ,</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>Ans: $e_{rms} = \sqrt{\frac{1}{MN} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} [\hat{f}(x,y) - f(x,y)]^2}$</p> </div>	0.5																		
Q6.	<p>Which of the following redundancy criteria is not reversible</p> <p>A. Coding redundancy B. Inter-pixel redundancy C. Psycho-visual redundancy</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;">Ans: C</div>	0.5																		

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IMAGE PROCESSING (ELECTIVE)

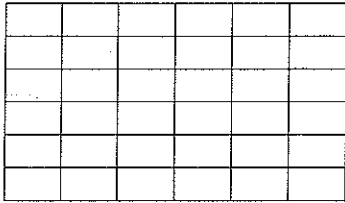
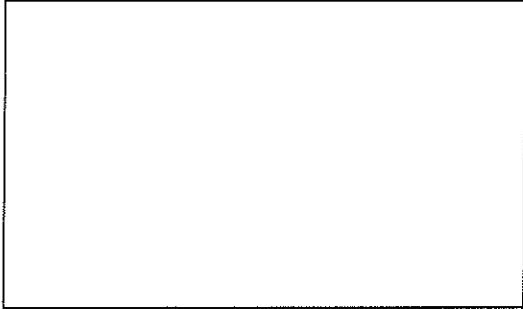
Course No. : EA C443
Duration : 30 Mins

quiz-I

Date : 21-03-2012
Max Marks : 8
Weightage : 8%

Note : Answer all the questions , write the answers to the quiz questions in the box provided for the answers. Write the MATLAB program in the editor and display the output.

Q.1	<p>Given following 3x3 image which has 8 intensity levels in it.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr><td style="padding: 2px 5px;">4</td><td style="padding: 2px 5px;">7</td><td style="padding: 2px 5px;">3</td></tr> <tr><td style="padding: 2px 5px;">3</td><td style="padding: 2px 5px;">5</td><td style="padding: 2px 5px;">4</td></tr> <tr><td style="padding: 2px 5px;">1</td><td style="padding: 2px 5px;">0</td><td style="padding: 2px 5px;">2</td></tr> </table> <p>The intensity transformation is given by $s=T(r)$ where r is an input image and s is an output image. It is required to do the bit plane slicing of the given image. The 2nd bit plane is given by</p> <p>Ans:</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr> </table>	4	7	3	3	5	4	1	0	2										0.5
4	7	3																		
3	5	4																		
1	0	2																		
Q2	<p>What is the storage space required to save 1024x1024 , gray scale image.</p> <p>Ans:</p> <div style="border: 1px solid black; width: 300px; height: 30px; margin: 10px auto;"></div>	0.5																		
Q3.	<p>A fiber optic channel can transmit 1Mbits of data per second. Calculate the time required to transmit 10 frames of the video , where each frame has 512x512 gray scale pixels.</p> <p>Ans:</p> <div style="border: 1px solid black; width: 300px; height: 30px; margin: 10px auto;"></div>	0.5																		
Q4.	<p>Given following intensity transformation function</p> <p>Ans:</p> <div style="border: 1px solid black; width: 300px; height: 30px; margin: 10px auto;"></div>	0.5																		
Q5.	<p>Given following 3x3 image, using nearest neighbor approach zoom the image to get 6x6 image.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr><td style="padding: 2px 5px;">4</td><td style="padding: 2px 5px;">7</td><td style="padding: 2px 5px;">3</td></tr> <tr><td style="padding: 2px 5px;">3</td><td style="padding: 2px 5px;">5</td><td style="padding: 2px 5px;">4</td></tr> <tr><td style="padding: 2px 5px;">1</td><td style="padding: 2px 5px;">0</td><td style="padding: 2px 5px;">2</td></tr> </table>	4	7	3	3	5	4	1	0	2	0.5									
4	7	3																		
3	5	4																		
1	0	2																		

	<p>Ans:</p> 	
Q6.	<p>Draw an approximate histogram for the darker image.</p> <p>Ans:</p> 	0.5
MQ7	<p>Write a MATLAB program to extract the hidden text message in the given image. The message bits are interleaved in the LSB of the each pixel. The pixels are selected in raw wise sequentially.</p>	2
MQ8	<p>Write a MATLAB program to read an image and then add salt and pepper noise to the image and filter it using both mean and median filtering techniques.</p>	1.5
MQ9	<p>Write a MATLAB program to display the histogram of an image and enhance the poor contrast image using to get a better image.</p>	1.5