



COMSATS University Islamabad, Lahore Campus

Terminal Examination – Fall 2023

Course Title:	Digital Image Processing	Course Code:	CSC 331	Credit Hours
Course Instructor/s:	Dr. Usama Ijaz Haqwa	Program Name:	BSCS	
Semester:	6,7	Batch:		
Time Allowed:	180 Minutes	Section:	A,B,C,	Date: 02/01/24
Student's Name:	[Redacted]	Maximum Marks:	60	
	Reg. No.	[Redacted]		
Important Instructions / Guidelines:				
<ul style="list-style-type: none">Read the question statements carefully and while answering mention your assumptions clearly (iFor all code based answers, the language will be MATLAB				

Q1 CLO: <1>: Bloom Taxonomy Level: <Understanding> [2 Marks]
What is the effect of repeatedly applying a compound operation (opening/closing) (means applying the same compound operation on the output image again)? (Assume that the structuring element is not a one single point but anything bigger than that).

Q2 CLO: <1>: Bloom Taxonomy Level: <Understanding> [2 Marks]
Erosion and dilation are dual operations. Please Justify this statement.

Q3 CLO: <2>: Bloom Taxonomy Level: <Analyzing> [3 Marks]
If we decrease the intensity of a colored image, what is its effect on Cyan, Magenta, and Yellow planes of the image (of course in CMY domain)? Do not draw transformations rather explain it.

Q4 CLO: <2>: Bloom Taxonomy Level: <Analyzing> [2 Marks]
Are single valued (Strictly monotonically increasing/decreasing) transformation functions reversible? Why?

Q5 CLO: <4>: Bloom Taxonomy Level: <Applying> [3 Marks]
Write down the Matlab code for implementing the morphological operation "Erosion". The image name is A, which you have to read in and you have to create your SE (any you wish), call the builtin function for Erosion and finally display eroded image.

Q6 CLO: <2>: Bloom Taxonomy Level: <Analyzing> [3 Marks]
What are the disadvantages of global histogram equalization and how is local histogram equalization beneficial in such cases. Can we reduce the disadvantages of local histogram equalization by using adaptive histogram equalization? how?

Q7 CLO: <4>: Bloom Taxonomy Level: <Applying> [2 Marks]
If we convert a noisy RGB image (corrupted with random noise) to the HSI domain, Why the H and S planes look noisier than the RGB image itself, whereas the I plane looks less noisy than the noisy RGB image itself?

Q13
The table be
=10,000. Per
Where n is the

Q8 CLO: <4>: Bloom Taxonomy Level: <Applying> [2 Marks]
What is the problem with histogram equalization of color images in CMY domain? Is there a way to address this problem?

Q9 CLO: <4>: Bloom Taxonomy Level: <Applying> [4 Marks]
Write down the MATLAB code for the following task.
We have to segment out (keep intact the colors of) an area out of RGB image, named "myImage". The area to be segmented/kept intact should be of pure green color. Assign black color to everything else. (Note: You have to perform these steps in HSI domain).

Q10 CLO: <3>: Bloom Taxonomy Level: <Applying> [3 Marks]
For what sort of noise scenario, Contra harmonic Mean Filter is employed? How do we choose the proper value of Q (the order of filter)? For which type of noise, this filter is not suitable?

Q11 CLO: <5>: Bloom Taxonomy Level: <Analyzing> [4 Marks]
The following binary image is corrupted by salt and pepper noise. Describe a morphological algorithm to remove the noise and retain the shapes as much possible. Give justification of each morphological operation/step.



Q12 CLO: <2>: Bloom Taxonomy Level: <Analyzing> [3 Marks]
The two texture images shown below are quite different, but their histograms are identical. Both images have size 80×80 , with black (0) and white (255) pixels. Suppose that both images are blurred with a 3×3 Geometric Mean Filter. Would the resultant histograms still be the same? Explain your answer.
Note: the black border lines are used to signify the boundaries of the two images but not part of them.



Q13

CLO: <4>; Bloom Taxonomy Level: <Applying>

[6 Marks]

The table below shows the intensity distribution of a 3-bit image ($I=8$) of size 100×100 (MN = 10,000). Perform histogram equalization to transform it into an 8-bit histogram equalized image. Where r_k is the k th intensity value and n_k is the number of pixels in the image with intensity r_k .

r_k	n_k
$r_0 = 0$	2200
$r_1 = 1$	1500
$r_2 = 2$	400
$r_3 = 3$	950
$r_4 = 4$	2800
$r_5 = 5$	450
$r_6 = 6$	750
$r_7 = 7$	880

Q14

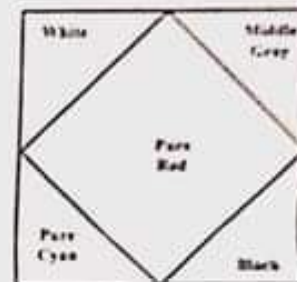
CLO: <4>; Bloom Taxonomy Level: <Applying>

[6 Marks]

A Square image is shown with its colors in the following diagram. Assume the image consists of "n" number of pixels.

What will be the histograms of the three color components for the following color models:
(Assume pure red portion is half of the image in size)

- a) RGB
- b) CMY
- c) HSI



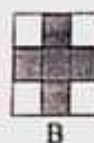
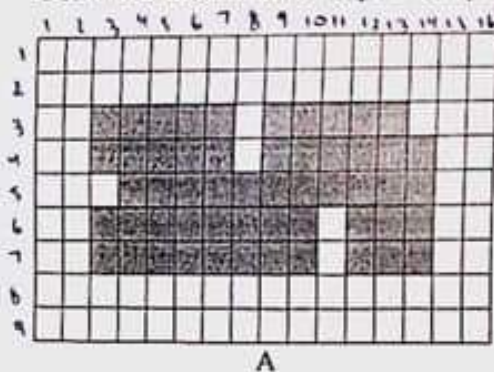
Q15

CLO: <5>; Bloom Taxonomy Level: <Analyzing>

[6 Marks]

Extract the internal boundary of the shaded object in image A using structuring element B (Both shown below).

Draw the intermediate step/s with proper equations. Note: Shaded locations are 1's.



Q16

CLO: <5>: Bloom Taxonomy Level: <Analyzing>

[6 Marks]

What will be the shape of object given below after performing opening using the structuring element SE? (The structuring element is already flipped twice/mirrored. You can apply it straight away.)

0	1	0
1	1	1
0	1	0

SE

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

Q17

CLO: <3>: Bloom Taxonomy Level: <Applying>

[1+2 Marks]

What would be the resulting interpolated pixel value if the calculated row no and column no are (8.2, 3.6). The values at location (8, 3), (8, 4), (9, 3) and (9, 4) are 30, 10, 70 and 50 respectively.

- (a) Nearest Neighbor Interpolation
- (b) Bilinear Interpolation

You have to solve it instead of just providing the answer.



COMSATS University Islamabad, Lahore Campus

Terminal Examination – Fall 2022

Course Title:	Digital Image Processing	Course Code:	CSC 331	Credit Hours:	03
Course Instructor/s:	Dr. Usama Ijaz Bajwa	Program Name:	BSCS		
Semester:	6,7,8	Batch:		Section:	A,B,C,D
			Date:		19/01/23
Time Allowed:	180 Minutes	Maximum Marks:	70		
Student's Name:		Reg. No.			

Important Instructions / Guidelines:

- Read the question statements carefully and while answering mention your assumptions clearly (if any)
- For all code based answers, the language will be MATLAB

Question No 1: CLO: <1>: Bloom Taxonomy Level: <Understanding> (2)

How does the erosion and dilation operations resemble the Min and Max filters?

Question No 2: CLO: <1>: Bloom Taxonomy Level: <Understanding> (4)

How can "local statistical parameters" help us do local enhancement for an image, which can have regions with totally different characteristics (background, enhanced foreground, and low contrast areas)?

Question No 3: CLO: <1>: Bloom Taxonomy Level: <Understanding> (4)

Which areas within an image would the following condition select/emphasize on, in local enhancement using statistical parameters? What is the relationship between k_1 and k_2 ?

$$k_1 \sigma_G \leq \sigma_{S_{xy}} \leq k_2 \sigma_G$$

Question No 4: CLO: <1>: Bloom Taxonomy Level: <Understanding> (4)

Are the single valued (Strictly monotonically increasing/decreasing) and the multi valued (non-strictly monotonically increasing/decreasing) transformation functions, point pixel operations? What is the difference between them?

Question No 5: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (4)

How can we use erosion/dilation or opening/closing operations in improving the image quality? Support your reasoning with example/s

Question No 6: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (6)

How does color image segmentation vary from each other in different image domains (RGB, CMY, HSI). Describe the logic used for segmentation in each domain.

Question No 7: CLO: <3>: Bloom Taxonomy Level: <Applying> (5)

Write down the MATLAB code for the following task.

Extract the 8th (MSB) and the 1st (LSB) bit plane from a given image "myImage.jpg". After extraction, use/combine both planes to regenerate the image and display it.

Question No 8: CLO: <3>: Bloom Taxonomy Level: <Applying> (5)
Write down the MATLAB code for segmenting out "pure red" color from a given colored image, named "myColImage.jpg". This segmentation needs to be done in HSI color space.

Question No 9: CLO: <4>: Bloom Taxonomy Level: <Applying> (6)
Is there any difference in applying image processing operations on a colored RGB image, either per color component processing OR vector based processing? Justify your answer with brief examples of different operations.

Question No 10: CLO: <4>: Bloom Taxonomy Level: <Applying> (4)
For color images, image enhancement using histogram equalization is best to be performed in which of the following domains and why? (RGB and HSI)

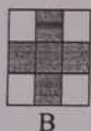
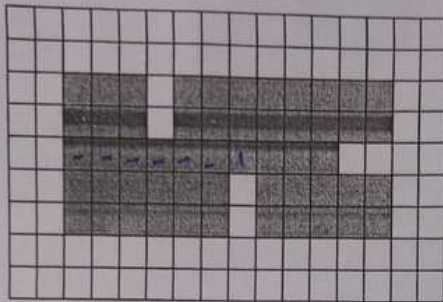
Question No 11: CLO: <4>: Bloom Taxonomy Level: <Applying> (4)
Write down the pseudocode for implementing a modified Median Filter, which can be used when the probability of noise is greater than 0.5.

Question No 12: CLO: <4>: Bloom Taxonomy Level: <Applying> (4)
Consider a scenario, when we are given (noise only degraded) images and we have to denoise them, What way forward will we choose to determine noise type and select a suitable filter?
In another scenario, we are given (geometrically altered) image and we have to correct it or align it with the given reference image, how we will be able to do that?

Question No 13: CLO: <4>: Bloom Taxonomy Level: <Applying> (4)
Are Contra harmonic mean filter and alpha trim mean filter similar in any context? Are they different from each other in some other context? How?

Question No 14: CLO: <4>: Bloom Taxonomy Level: <Applying> (2)
What is the drawback (in terms of image quality) of min filter when applied to remove noise ?

Question No 15: CLO: <5>: Bloom Taxonomy Level: <Analyzing> (6)
 Extract the **internal boundary** of the shaded object in image *A* using structuring element *B* (Both shown below). Draw the intermediate step/s with proper equations. Note: Shaded locations are 1's.



Question No 16: CLO: <5>: Bloom Taxonomy Level: <Analyzing> (6)
 What will be the shape of object given below after performing closing using the structuring element *SE*? (The structuring element is already flipped twice/mirrored. You can apply it straight away.)

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

0	1	0
1	1	1
0	0	0

SE



COMSATS University Islamabad, Lahore Campus

Terminal Examination – Spring 2023

Course Title:	Digital Image Processing	Course Code:	CSC 331	Credit Hours:	03
Course Instructor/s:	Dr. Usama Ijaz Bajwa	Program Name:	BSCS		
Semester:	6,7	Batch:		Section:	A,B,C
Time Allowed:	180 Minutes	Date:	23/06/23	Maximum Marks:	90
Student's Name:		Reg. No.			

Important Instructions / Guidelines:

- Read the question statements carefully and while answering mention your assumptions clearly (if any)
- For all code based answers, the language will be MATLAB

Question No 1: CLO: <1>: Bloom Taxonomy Level: <Understanding> (3)
Are the erosion and dilation operations inverse of each other? Please provide justification of your answer

Question No 2: CLO: <1>: Bloom Taxonomy Level: <Understanding> (2)
What is the purpose of tandem usage of erosion and dilation operation in compound operations like opening or closing?

Question No 3: CLO: <1>: Bloom Taxonomy Level: <Understanding> (2)
How does the direction and impact of applying a structuring element SE relate to the size and shape of the structuring element?

Question No 4: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (4)
Which morphological operation can bridge the gap between broken connectivity and how do we select the right shape of structuring element to do that?

Question No 5: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (4)
How color slicing/segmentation can be performed in RGB domain and what are the alternative options in other color domains?

Question No 6: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (6)
To apply histogram equalization on a colored image, which coloring domain is preferable and why? Also draw (as much possible) and discuss the transformation functions of applying the histogram equalization in that preferred coloring domain.

Question No 7: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (4)
Why do we prefer to remove noise from a colored image in a particular color domain only?

Question No 8: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (6)
For which of the following image processing operations, the result of "per-color-component" processing and "vector-based" processing is equal or not and why?
a. Averaging/Smoothing Operation

- b. Median filter to remove noise
- c. Edge Detection Operation

Question No 9: CLO: <4>: Bloom Taxonomy Level: <Applying> (9)
 Draw the Transformation functions for inverting the colors of a colored image in all the three 1) RGB, 2) CMY and 3) HSI color domains. Draw them to the scale and with proper labelling.

Question No 10: CLO: <1>: Bloom Taxonomy Level: <Understanding> (4)
 How can we estimate the type of noise induced by the camera in case:
 a. We have the camera available.
 b. We have only the images available

Question No 11: CLO: <2>: Bloom Taxonomy Level: <Analyzing> (6)
 How can "local statistical parameters" help us do local enhancement for an image, which can have regions with totally different characteristics (background, enhanced foreground, and low contrast areas)?

Question No 12: CLO: <3>: Bloom Taxonomy Level: <Applying> (4)
 Which areas within an image would the following condition/expression, select/emphasize on, in local enhancement using statistical parameters? What is the relationship between k_1 and k_2 ?

$$k_1 \sigma_G \leq \sigma_{s_{xy}} \leq k_2 \sigma_G$$

Question No 13: CLO: <4>: Bloom Taxonomy Level: <Applying> (6)
 How does the adaptive median filter ensure the following, support with mathematical expressions.

- a. Determining the severity of noise and appropriate action.
- b. Determining if the pixel at the center of the filter is noisy or not and the appropriate action.

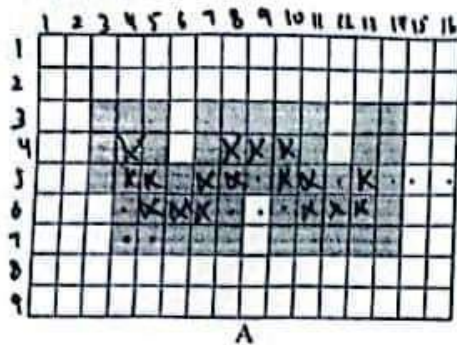
Question No 14: CLO: <3>: Bloom Taxonomy Level: <Applying> (4)
 What advantages does the adaptive histogram equalization has as compared to simple global and local histogram equalization. How does it achieve that?

Question No 15: CLO: <4>: Bloom Taxonomy Level: <Applying> (8)
 Write down the MATLAB code for segmenting out "pure red" color from a given colored image, named "myCollImage.jpg". This segmentation needs to be done first in RGB color space/domain and then in HSI color space/domain.

Question No 16: CLO: <3>: Bloom Taxonomy Level: <Applying> (6)
 Write down the MATLAB code for the following task.
 Extract the 8th (MSB) and the 1st (LSB) bit plane from a given image "myImage.jpg". After extraction, use/combine both planes to regenerate the image and display it.

120 60
 0 0 6
 180 240 300

Question No 17: CLO: <5>: Bloom Taxonomy Level: <Applying> (6)
 Extract the internal boundary of the shaded object in image A using structuring element B (Both shown below). Draw the intermediate step/s with proper equations. Note: Shaded locations are 1's.



Question No 18: CLO: <5>: Bloom Taxonomy Level: <Applying> (6)
 What will be the shape of object given below after performing closing using the structuring element SE? (The structuring element is already flipped twice/mirrored. You can apply it straight away.)

