Assignment # 3

Course Title Digital Image Processing Due Date: 05/04/2022

Instructions:

1. Assignments are to be done individually. You must complete this assignment by yourself. You cannot work with anyone else in the class or with someone outside of the class.
2. You can use any programming language of your choice, such as Python, MATLAB, or C++, etc.
3. Plagiarism of any kind (copying from others and copying from the internet, etc.,) is not allowed.
4. You can use any library unless it is specified to avoid using it.
5. Your code must be properly commented.
6. The data required for this assignment is also provided.
7. Any assignment submitted even one second late will be considered **LATE** and **ZERO** will be provided.
8. No marks will be assigned if any of the deliverables are missing.
9. The main objective of this code is to harness your knowledge with the topics we covered so far, so, you are expected to use the techniques discussed in the class so far. Anyone using advanced methods not covered yet will earn no credit for the questions.

Deliverables:

1. The source code of the program. You must comment on the code properly. All figures must have captions.

Put the source code in a folder, ZIP it and submit it. Your folder must be named as below:

ROLLNO_NAME.ZIP

Question 1.

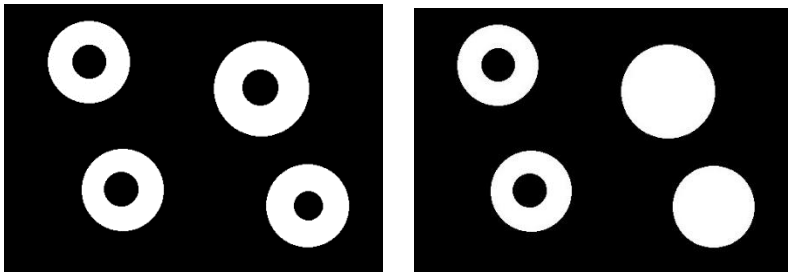
Consider the images in Figure 1.

a) For the image shown in a), calculate the centroids of each object and display them in red color. Note: you cannot use Image Moments to find centroids.

b) Fill the holes of these objects (figure-1 a) using Morphological Dilation as discussed in class. You can use the centroids calculated in a) as marker points for dilation to fill the centers.

c) Calculate the diameter of the biggest hole (figure-1 a) and display its diameter above that circle in green color.

d) For Figure-1 (b), count the number of objects with holes and without holes and display the count as:
Objects with holes: XX
Object without hole: YY



a) b)

Figure 1. a) Circles with holes. b) Circles with and without holes

Question 2.

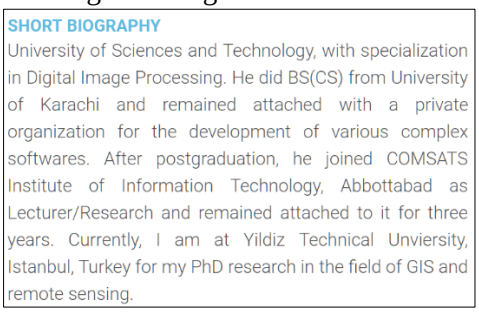
For the image shown in Figure 2, find the number of persons in the image. Draw a bounding box around each person and display the image.

Figure 2. Thermal Image to capture human

Question 3.

a) For the image shown in Figure 3, count the number of text lines in the image.

b) Count the number of words in the given image.



SHORT BIOGRAPHY

University of Sciences and Technology, with specialization in Digital Image Processing. He did BS(CS) from University of Karachi and remained attached with a private organization for the development of various complex softwares. After postgraduation, he joined COMSATS Institute of Information Technology, Abbottabad as Lecturer/Research and remained attached to it for three years. Currently, I am at Yildiz Technical Unviersity, Istanbul, Turkey for my PhD research in the field of GIS and remote sensing.

Figure 3. Biography text.

Question 4.

Consider the Sudoku game image shown in Figure 4. Only identify the empty squares, color them red, and display the output image. The rest of the squares will remain unchanged.

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

Figure 4. Sudoku Game image

Question 5.

Figure 5 shows an image of the Urdu alphabet. All these characters have different widths and heights. For instance, Alif is thin but tall. Similarly, Pay پ has a more extended width than height and three associated dots.

a) Write a program that displays all characters whose width exceeds their height.
b) Write a program that displays all the alphabets that have almost the same width and height.
c) Write a program that displays all alphabets that have dots (Nukta).
d) Write a program to display all alphabets which are composed of four components, e.g. پ . It has one body and three dots.
e) Write a code to display all alphabets which have holes in them. E.g., ھ has two holes, ہ has one hole.

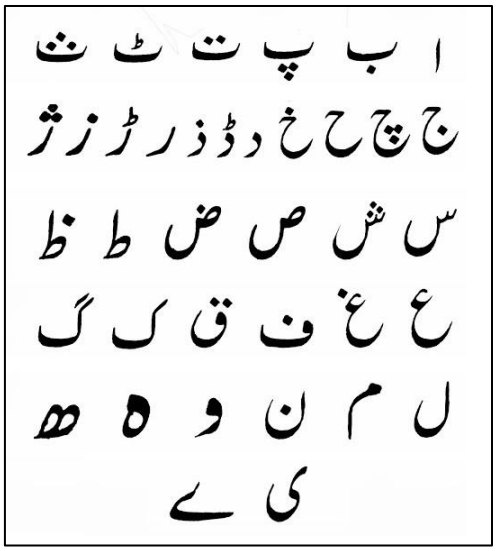


Figure 5. Urdu alphabets

Question 6.

Figure 6 shows an image of a bubble sheet filled for an exam. There are five questions, and for each question, there are four choices.

Write a program that applies DIP techniques to identify the candidate's answer for each question. Display the output in the format as shown below:

1:A, 2:B, 3:C, 4: A, 5:D

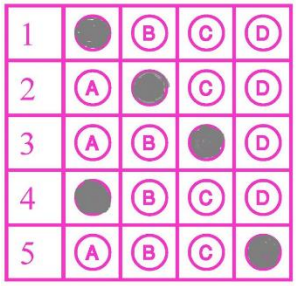


Figure 6. Bubble sheet for MCQ-based Exam