

1. Software Requirement:

MATLAB

2. Prerequisites:

You may refer to your lecture notes and the textbook.

3. Assignment Requirements:

Give extra attention to report document of this assignment, that is, providing only some piece of MATLAB code does not satisfy requirements. For all questions, you need to provide clear and scientific justifications; otherwise you cannot receive full points from that question.

4. Code Style and Naming Conventions

It is also required that you need to follow a standard coding style.

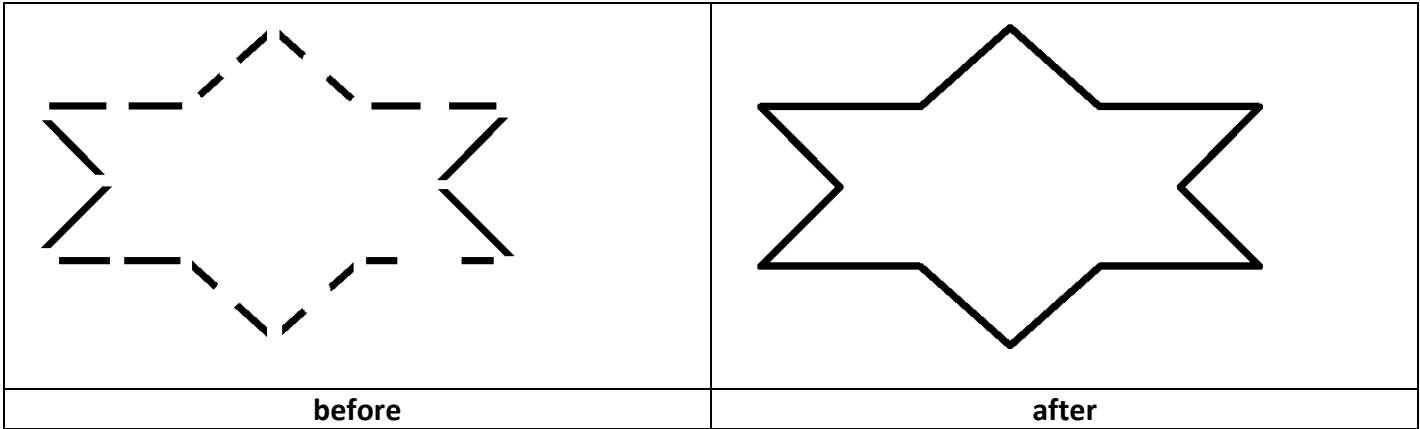
- All of the questions must be implemented as separate functions and function names must obey following format; “question_id_letter”. For example, if you are writing a code for question-4.a, your function name must be “question_4_a”.
- At the beginning of the each function, there must be a comment header describing the general inputs/outputs for your function. (Comment header’s format is specified in the file “comment_style.m”)
- All functions must be called by a single MATLAB script, whose name is “main.m”
- All of the output images must be written into a folder named as “outputs”.
(see: MATLAB’s imwrite function)

5. Assignment Questions

1) Morphology – Basic Operators (35 pts):

You are given an image, “broken_bars.bmp” for this question.

- a) By using MATLAB’s bwlable function label the connected components of the given image. (Hint: You may need to take complement of the given image.) Display your labelled image using MATLAB’s label2rgb function.
- b) By using basic morphology operators (erosion and dilation) connect the broken bars. The output should resemble the image below.

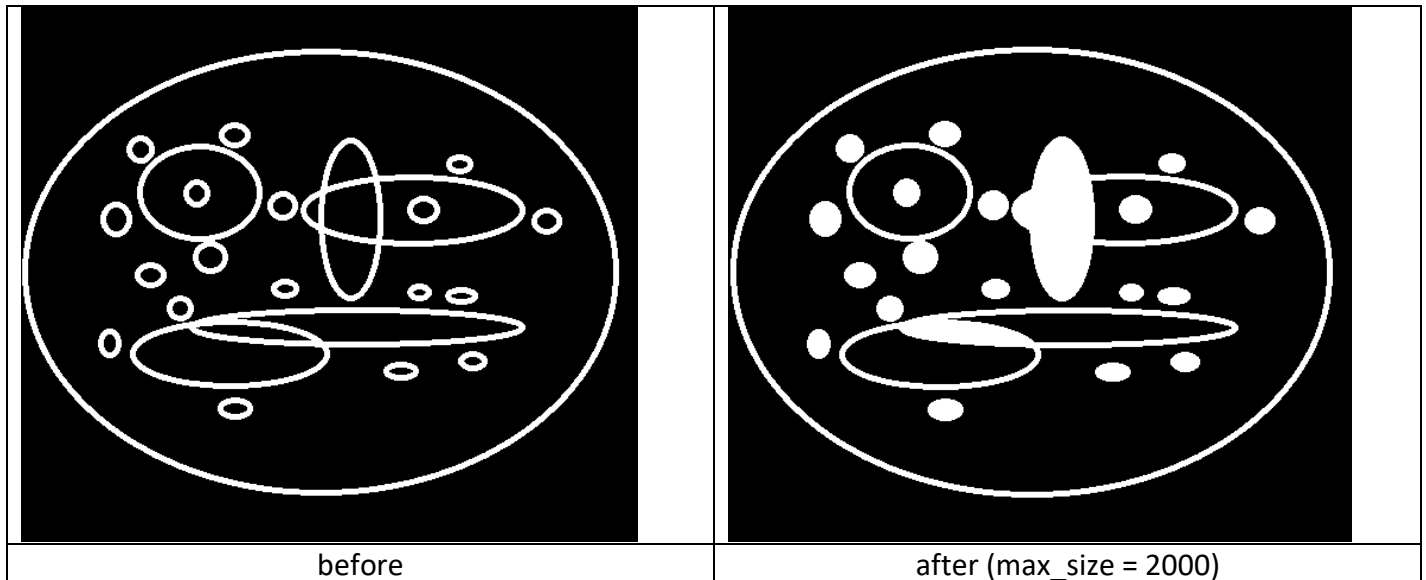


- c) Flood fill algorithm (see MATLAB’s imfill function) is a robust hole filling technique requiring no seed points. However, in some circumstances, you may need to fill the holes with a particular structural property. In this question, your job is to develop a hole filling algorithm which is capable of filling the holes according to size of their areas. Your function must have following prototype;

```
[filled_image] = question_1_c(bw_image,max_size)
```

Where bw_image is the binary input image and max_size specifies the maximum area to be filled. That is, any hole having area (measured in number of pixels) below the given value of max_size parameter must be filled by your algorithm. Similarly, any hole having area (measured in number of pixels) greater than the given value of max_size parameter must remain untouched.

A sample output of the desired algorithm can be seen below.



2) Wavelets and Multiresolution Processing (30 pts):

You are given an image, “barbara.png”.

- Choose one of the wavelet filters provided by MATLAB (see `wfilters` function). For your wavelet, plot followings into same figure;
 - decomposition low-pass filter
 - decomposition high-pass filter
 - reconstruction low-pass filter
 - reconstruction high-pass filter
- Use your wavelet to compute a 2-level decomposition of the given image.
- Display the decomposition up to level-1 only.
- Display the decomposition up to level-2 only.

3) Image Segmentation (35 pts):

You are given a 3-band RGB image “roads.jpg”.

- Segment the image by using Mean-Shift Algorithm. Save labelled result as “segments_meanshift.jpg”
- Segment the image by using K-means. Save labelled result as “segments_kmeans.jpg”
- Segment the image by using Watershed Algorithm. Save labelled result as “segments_watershed.jpg”
- Segment the image by using Region Growing. Save result as “segments_regiongrowing.jpg”. Providing just one road segment is sufficient for this question.
- Which technique(s) is/are more useful for road extraction problem? Why?

(Note: You don't have to implement these segmentation algorithms from scratch, that is, you can find many MATLAB implementations for desired segmentation algorithms on the net.)

4) Submission and Grading Policy

Assignments will be submitted via METU-Online. Create a rar or zip archive containing plain source codes (*.m files) and the document explaining your algorithms, implementations, results and discussions. Please pay attention on the documentation of your assignment.

There is no extension for this assignment. Late submissions will not be accepted.

You are expected to work individually NOT in groups. You will also be expected to follow the academic integrity rules.

Policy for Copying: Passing the work of others (either from another student or a code on internet etc.) off as your own is a breach of academic ethics and also of the University's disciplinary rules. Students are expected to work on the homeworks individually, not as a group. When you submit a work, it automatically implies that you claim the ownership of the work.

Note that METU is subscribed to some tools which allow cross checking of submitted works as well as checking with any work on internet or any university subscribed to the system. No exceptions will be allowed and any work found to be copied will result in failing the course.

Please send your questions about the assignment to ucinar@ii.metu.edu.tr or you may post a message to the forum on METU-Online.