BME1901 – Introductory Computer Sciences
Homework – 1

INFORMATION

Write appropriate scripts (m-file) and/or user defined functions in MATLAB to solve the given below problem. To be able to write appropriate code snippets that handle the given problems you may need to do some additional research and study. Show your references as a footnote where necessary. You may discuss and work with your friends to find solutions. However, everyone should **write** their **report alone** and use their **own words**. Any **cheating, copy-paste, etc.** will result in **zero grade** for students who are involved. A **report format** is given as a part of this homework, use it to write your own report. Your report (in **pdf** format) should include your code files, your results (images, graphs, text, etc.), as well as your comments about your code and your results. The **deadline** for the report is **29.12.2022, 23:59**. Compress all your materials (**your report, scripts, and function files**) to a **single .zip file** and upload it to the link given below. Homeworks sent as an e-mail will **not** be graded. Any late or no submissions will be **graded with zero**.

Submission Link: https://forms.gle/xS7N54qQe63AHKGx8

Note: If you do not receive a confirmation e-mail after submitting your homework, you may contact Res.Asst. Fatih Ekrem Onat to verify your submission.

QUESTION 1:

You are asked to write a program file that will be named as 'Q1.m'. This main '.m' file will contain all your work and a template (Q1_Empty.m) will be given to you beforehand to guide you for the asked tasks.

In Q1, a function (named as "createSmoothedImage"), which returns you a smoothed randomly generated matrix (this matrix can be interpreted as an image when proper visualization built-in Matlab functions are used), will be given to you. A seed value is passed to "createSmoothedImage" to be able to guarantee the creation of the same image in every call of this function. You will be asked to write a Matlab code which applies intensity-based thresholding to this image. The elements of the matrix have already been normalized by using the mean and standard deviation of the convolved matrix elements. Please write the code file which realizes the asked tasks and creates the correct plots. An exemplary case outputs, in which the seed value is chosen as 4, are given to you to be able compare validate your code.

- You should run your code for the seed values 4, 5 and 6. You should put your obtained results and other required information to your report (a report template has already been given to you). Your report should include your results (images, graphs, text, etc.), as well as your comments about your code and your results. Separately you should add your code files to your final ZIP file.

- You should write the code segment which show the Histogram of your image.

- You should write the code segment which detects the peaks exceeding 2 and obtain the location information of these segmented blobs.

- You should write the required code snippets for visualizing the segmented peaks (blobs) and their boundaries (on the original image as a contour-line).

- The required figures for the seed value = 4 case are given below for validation of your findings.

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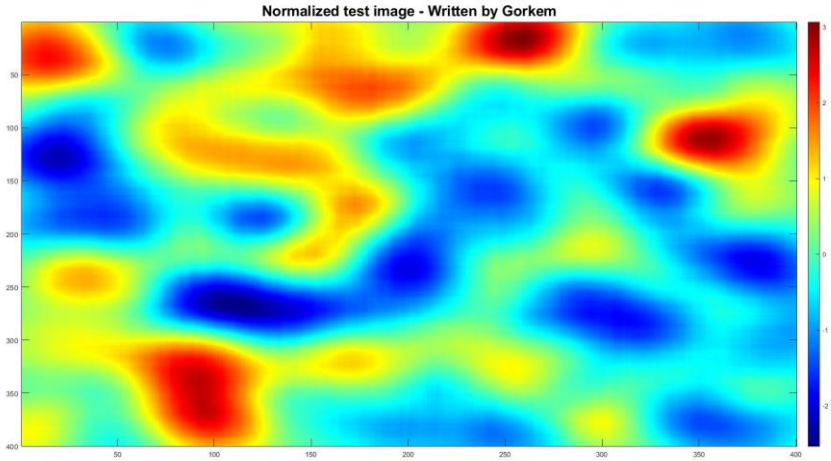

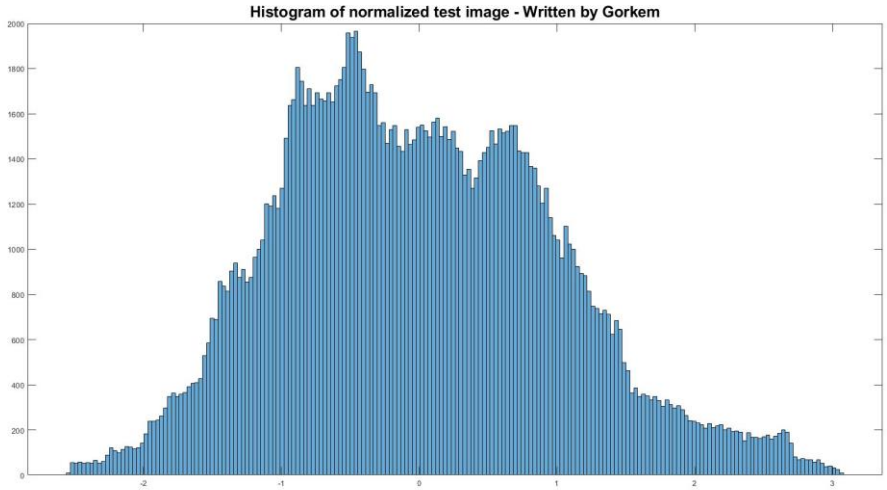

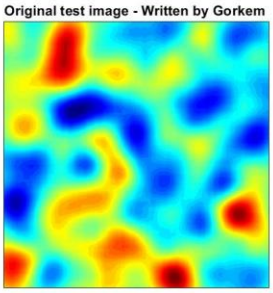

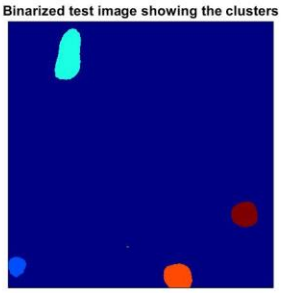

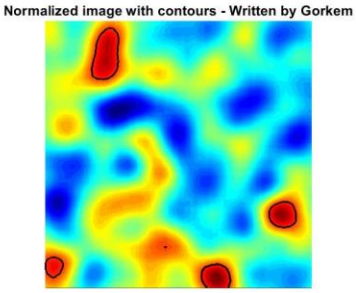

- You should write the required code snippets to summarize the findings of your segmentation approach by printing the number of segmented peaks (also can be named as clusters), the area of the smallest and largest clusters. An exemplary command window output is also given below:

```
There are 5 clusters in the image - Written by Gorkem
The area of the largest cluster is 2348 pixels - Written by Gorkem
The area of the smallest cluster is 3 pixels - Written by Gorkem
```

QUESTION 2:

You are asked to write a program file that will be named as 'Q2.m'. This main '.m' file will contain all your work and a template (Q2_Empty.m) will be given to you beforehand to guide you for the asked tasks.

In Q2, you are asked to write a main code which identifies the day of January (e.g., Monday, Thursday ....) on any year. To be able to do that task, you will use the Gauss' date formula which is explained below:

Gauss' date formula

Carl Friedrich Gauss described a method for calculating the day of the week for 1 January in any given year in a handwritten note in a collection of astronomical tables. He never published it. It was finally included in his collected works in 1927.

Gauss' method was applicable to the Gregorian calendar. He numbered the weekdays from 0 to 6 starting with Sunday. He defined the following operation:

The weekday of 1 January in year number **A** is

$$R(1 + 5R(A-1,4) + 4R(A-1,100) + 6R(A-1,400), 7)$$

where $R(y, m)$ is the remainder after division of $\boldsymbol{y}$ by $\boldsymbol{m}$, or $\boldsymbol{y}$ modulo $\boldsymbol{m}$.

The algorithm for the day-of-week of 1 Jan can be proven using modulo arithmetic. The main point is that because 365 mod 7 = 1, each year adds 1 day to the progression. The rest is adjustment for leap year.

- In your main "Q2.m" file, you will get the year information (**A**) from the user. You will also write a function named as "January1Finder" and you will call this function to calculate the corresponding day information (for example Sunday or Wednesday) for the entered year. Additionally, your function must return the index value of the weekday (for example 0 for Sunday and 3 for Wednesday). This index value will be necessary in the second part of your solution in which the same problem will be solved without using "switch-case".

- The structure of "January1Finder" function will be like this:

[day day1_Jan] = January1Finder(year_val)

year_val = is the year entered by the user

day = weekday of 1 January for the entered year (e.g. Wednesday or Saturday)

day1_Jan = is the index of corresponding weekday (for example 6 for Saturday and 3 for Wednesday).

- In your "January1Finder" function you will use switch-case to convert index (day1_Jan) info to weekday (day) info.

- After the "January1Finder" function is called in your main .m file and the [day day1_Jan] values are obtained (as returning values of your function). You will obtain the current year info and print your findings by considering the appropriate grammar for past tense and future tense. Hint : You need to consider the current year and entered year info.

- In the Second part, you need to write the code segment which identifies the correct weekday without using switch-case. You will only use the "day1_Jan" variable which is obtained from the "January1Finder" function. "day1_Jan" is the result of Gauss' method calculation whose formulation has already been given above. Do the same identification of weekday by just using index info and print it to the command window.

- Sample calls of "Q2.m" file and its findings are given below for validation:

```
please enter the year value that is interested: 2048
- Written by Gorkem -   1 January 2048 will be a Wednesday
***********Second Part***********
- Written by Gorkem - 1 January 2048: Wednesday
  ***************
```

```
please enter the year value that is interested: 2010
- Written by Gorkem -  1 January 2010 was a Friday
***********Second Part***********
- Written by Gorkem - 1 January 2010: Friday
```

You should write a report on your work using the supplied report format. You should be expressive and unique on your explanations and comments.

[1] https://en.wikipedia.org/wiki/Determination_of_the_day_of_the_week#Gauss's_algorithm