

Homework 2

28.03.2024

This homework aims to cultivate your ability to conceptualize problems in terms of matrices and vectors, reflecting MATLAB's approach to data organization. You'll discover that complex tasks can frequently be streamlined into a few lines of code by leveraging the right functions and organizing data effectively. Additionally, this task is intended to enhance your proficiency in utilizing help resources to familiarize yourself with unfamiliar functions, which are highlighted in **bold** for your convenience. Remember, spaces are not permitted in the naming of script files.

Homework must be submitted in Google Classroom by 17:00 on 04.04.2024.

What to turn in: At the end of the homework, you will be asked for a MATLAB file (m. file) and a document (*.doc or *.pdf). Copy your MATLAB code into this document in an organized manner. If a question asks you to plot or display something to the screen, also include the plot and screen output your code generates. When submitting these two files to Google Classroom, you must upload the zip file named as:

“HW2_NameSurname_Number.zip”.

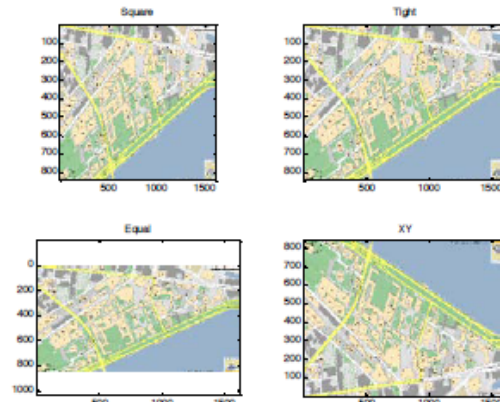
Question-1:

Over the last eight years, the enrollment numbers for an English course, have been observed as follows: 15, 20, 30, 45, 65, 90, 120 and 155 students respectively. This trend suggests that the class size may be experiencing exponential growth. To analyze this growth pattern, you are asked to plot these enrollment figures on a standard graph using MATLAB.

- Use MATLAB to plot the given enrollment numbers against the corresponding years.
- Utilize magenta square symbols ('ms') for the data points, ensuring each marker has a size of 10 ('MarkerSize', 10) and a line width of 4 ('LineWidth', 4). Note that there should be no lines connecting the data points.
- Adjust the x-axis limits (xlim) as necessary to ensure all eight data points are clearly visible on the plot.
- Label the x-axis as "Year" and the y-axis as "Number of Students".
- Provide a title for your plot, such as "Growth of Class Size in English Course Over 8 Years".
- Include a brief discussion in your assignment report, interpreting the plot and commenting on whether the growth appears exponential when viewed on a standard graph.

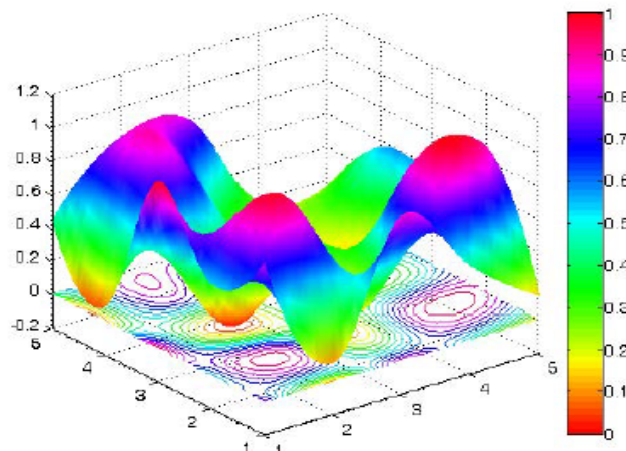
Question-2:

Subplot and axis modes. Make a new figure that has a 2x2 grid of axes (**subplot**). Load the file `mitMap.mat`. This file contains an image matrix called `mit` and the appropriate colormap in `cMap`. In each axis display the `mit` image (**image** or **imagesc**) and set the colormap to `cMap` (**colormap**). Set the axis of the top left image to be square, the top right to be tight, the bottom left to be equal, and the bottom right to be xy (**axis square**, **axis tight**, etc.). Also add the appropriate title to each axis as below. Note that images are displayed with the origin in the top left corner of an axis (this is mode `axis ij`), and `axis xy` moves the origin to the bottom left corner, flipping the image.

**Question-3:**

Interpolation and surface plots. Write a script called `randomSurface.m` to do the following

- To make a random surface, make `Z0` a 5x5 matrix of random values on the range (0,1) (**rand**).
- Make `X0` and `Y0` using **meshgrid** and the vector `1:5` (use the same vector for both inputs into **meshgrid**). Now, `X0`, `Y0`, and `Z0` define 25 points on a surface.
- We are going to interpolate intermediate values to make the surface seem smooth. Make `X1` and `Y1` using **meshgrid** and the vector `1:0.1:5` (again use the same vector for both inputs into **meshgrid**).
- Make `Z1` by interpolating `X0`, `Y0`, and `Z0` at the positions in `X1` and `Y1` using cubic interpolation (**interp2**, specify `cubic` as the interpolation method).
- Plot a surface plot of `Z1`. Set the colormap to `hsv` and the shading property to `interp` (**surf**, **colormap**, **shading**).
- Hold on to the axes and plot the 15-line contour on the same axes (**contour**).
- Add a colorbar (**colorbar**).
- Set the color axis to be from 0 to 1 (**caxis**). The final figure should look something like this (if you cannot copy/paste the figure into your document appropriately, try changing the figure copy options to use a bitmap format):



Question-4:

Linear system of equations. Solve the following system of equations using `\`. Compute and display the error vector

$$3a + 6b + 4c = 1$$

$$a + 5b = 2$$

$$7b + 7c = 3$$

Question-5:

At a university, an analysis of the midterm and final exam scores for 10,000 students enrolled in different departments is to be conducted. For this analysis, you are required to first create a dataset in MATLAB and then perform operations on this dataset. The dataset should contain the following information for each student: Student ID, Department, Midterm Score, and Final Exam Score. The midterm and final exam scores should be random values between 0 and 100.

In the **main.m** file, create a dataset for 10,000 students. This dataset should include randomly generated midterm and final exam scores for each student. Student IDs should be sequential from 1 to 10,000. The departments should be randomly selected from the following list:

- Computer, Mechanical, Electrical, Civil and Chemical Engineering

Write a function named **AverageGrades.m**. This function should take two parameters: the dataset you created and the name of the department you want to analyze. The function should calculate and return the average final exam score of the students in the specified department. If there are no students in the specified department, the function should return to **NaN**.

In the **main.m** file, use the **AverageGrades.m** function to calculate and display the average final exam score for a specific department (e.g., "Computer Engineering").

Some Remarks:

You may use loops (for/while) to create the dataset.

Use MATLAB's **randi** function to generate random numbers.

Use the **strcmp** function for string comparisons.

If there are no students in the specified department, the message "No students found in this department" should be displayed on the screen.