

## Homework 2

For this, and all future homeworks, submit all relevant or necessary files to me through email: [bruney@live.unc.edu](mailto:bruney@live.unc.edu) with the subject: GROUPNAME.MATH383.FA22 . Include all group members names in the email. In addition, put a small list of the contributions from each member at the beginning or end of your code.

1. Make the following matrix variables in Matlab (use built-in Matlab commands like `linspace`, `ones`, `zeros`, `diag`, `rand`). Do not simply type all numbers into a matrix in the editor.

- (a) Create and display

$$M_1 = \begin{bmatrix} 1 & \dots & 1 \\ \vdots & \ddots & \vdots \\ 1 & \dots & 1 \end{bmatrix},$$

a  $5 \times 5$  matrix of all 1's

- (b) Create and display

$$M_2 = \begin{bmatrix} 1 & 0 & \dots & 0 \\ 0 & 2 & \dots & 0 \\ \vdots & & \ddots & \vdots \\ 0 & \dots & 0 & 10 \end{bmatrix},$$

a  $10 \times 10$  matrix with non-zero entries only on the diagonal.

- (c) Create and display  $M_3 = \begin{bmatrix} 4 & 0 & 4 & 0 \\ 0 & 4 & 0 & 4 \end{bmatrix}$

- (d) Create and display  $M_4$ , a  $2 \times 2$  matrix with random values between  $-2$  and  $2$ . Hint: read the help information for the 'rand' function.

- (e) Create and display  $M_5$ , the  $4 \times 4$  matrix

$$M_5 = \begin{bmatrix} M_4 & M_4 \\ M_3 & \end{bmatrix}$$

2. In this section you will write several simple functions in Matlab to practice the format of function files. Remember: *Every function must be in its own file, whose name is the same as the function name!* (plus the `.m` extension.).

- (a) Write a function that takes a single number as input and has one output, which is equal to one less than the square of the input. Name this function **function2a**.
- (b) Write a Matlab implementation of the following function:

$$f(x) = \frac{-x}{1-x^2}$$

*Make sure that your function can accept either a single number or a matrix, and if it is a matrix, the function should be applied element-wise.* Name this function **function2b**.

- (c) Write a function that takes a matrix as input, and produces two outputs: the first output is a matrix with the same dimensions as the input whose entries are all zero, and the second is a matrix with the same dimensions as the input whose entries are all one. Name this function **function2c**.
3. Consider the following two code excerpts. For each of them, explain in a sentence or two why they don't work, and propose (in words) a sensible change to fix the problem. Submit your responses as comments in matlab

(a)

```
function x = sample1(y)
    y = 2*x;
end
```

(b)

```
function out = sample2(x)
    % Implement the function y=x^2
    y = x.^2;
end
```