

Lab 4 Introduction to Matlab

I. Lab Assignments

Part A: Review of Numerical Computations

1. Use a single Matlab command to create a vector consisting of all the EVEN numbers between 7 and 101. Use a Matlab command to find out the number of elements in the vector.

2. Create the following matrices:

$$A = \begin{bmatrix} 2 & 5 & 1 \\ 4 & 3 & 7 \\ 8 & 6 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 3 & 1 & 6 \\ 2 & 3 & 8 \\ 7 & 2 & 0 \end{bmatrix}$$

- a) Use a single Matlab command, find the sums of all the elements on the same row of A.
 - b) Use a single Matlab command, find the summation of the elements on the 2nd row of A.
 - c) Use a single Matlab command, find the product of the elements on the 1st column of B.
 - d) Use a for loop, find the summation of the diagonal elements of A.
 - e) Find $A.*B$ and $A*B$ manually, and verify your results with Matlab.
3. Use Matlab to create a vector $x = e^{-2t}$, $t = 0:0.1:10$,
 - a) Add 5 to each element of x, and store the result in a vector.
 - b) Add 3 to only the ODD-index elements of x (e.g x(1), x(3), x(5)...), and store the result in a new vector y.
 4. Load the matrix A stored in random_matrix.mat (can be downloaded from course website).
 - a) Find the dimension (size) of the matrix.
 - b) Find the number of elements in A that is greater than 0.
 - c) Find the number of elements in the 2nd row of A that is greater than 0.
 - b) Find the summation of all the elements in A.
 - d) Find the summation of all the even-index element in the 3rd row of A.
 5. Write a Matlab function $y = rms(x)$ and save it in rms.m in your work folder. The input of the function is a vector x, the output of the function is a scalar y, which is the root mean square value of the elements in x. That is

$$y = \sqrt{\frac{1}{N} \sum_{n=1}^N x^2(n)}$$

Test your function with the input $x = [1 \ 5 \ 2 \ 3 \ 8]$.

Part B: Review of Symbolic Computations

6. Go through pages 43 – 47 of the L. Chaparro book (part of the Section 0.5.2 Soft Introduction to Matlab: Symbolic Computations). Practice all the examples given in the textbook.
7. Plot the following functions for x between 0 and 5
 - a) $\exp(3x^2)$
 - b) $\exp(-x)\cos(2\pi x)$
 - c) $\text{sinc}(x)$
 - d) $\text{sinc}^2(x)$
8. Consider the function $x\exp(3x^2)$
 - a) Find the differentiation
 - b) Find $\int x\exp(3x^2)dx$
 - c) Find $\int_0^3 x\exp(3x^2)dx$

II. Homework Assignments

Part A: Review of Numerical Computations (please finish all the following problems with numerical computation)

1. Plot the following functions for $-2 < t < 2$, and save the results as jpeg files.
 - a) $y = \cos(2\pi t)$
 - b) $y = \cos(2\pi t + \pi/3)$
 - c) $y = \begin{cases} e^{-2t}, & t \geq 0 \\ e^{5t}, & t < 0 \end{cases}$
 - d) $y = e^{-|t|} \cos(2\pi t)$

Part B: Symbolic Computations (please finish the following problem with symbolic computation)

1. Consider the exponential function $y = \exp(-ax)$.
 - (a) Find dy/dx manually. Use Matlab to verify your calculation.
 - (b) Find $\int_a^b \exp(-ax)dx$ manually. Use Matlab to verify your calculation.
 - (c) Plot y when $a = 2$;
 - (d) Plot y when $a = 0.5$.