An Introduction to MATLAB

AIV M1 Bootcamp

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Attendance

Please arrive on time. Attendance to the class is mandatory for all students. If you already know MATLAB and find these exercises too easy, ask us, and we will happy to find more complicated exercises for you! If you have to skip a class we expect you to catch up before the following class.

Evaluation

We will not grade you: the goal of this class is to give you tools to survive this semester! However you should not underestimate the importance of this class: not being comfortable with MATLAB would seriously compromise your chances of succeeding your M1.

Prerequisite

You do not need any prior programming nor biological knowledge. A part of the exercises relies on real published dataset, but we choose simple enough problems so biological knowledge is never the bottleneck.

Documentation

The first thing we are going to teach you is to use MATLAB documentation. For all the following exercises, we thus provide the name of the MATLAB functions you should use so you can efficiently use this documentation. This will allow you to go at your own speed.

General Remind

1. Create a folder to keep your program organized.
2. Comment your code: anything following % is seen as comment. Comment thoroughly to avoid wasting time later!
3. Always test and verify your code.

About variables names in MATLAB

1. First character must be a letter (after the name can contain any combination of letters, numbers and underscore; punctuation and space are not allowed).
2. MATLAB is case-sensitive: var1 is different from Var1.
3. Give meaningful names to your variables/functions.
4. Avoid built-in names for variables: i, j, e, Inf, -Inf, pi, NaN, realmin, realmax …

Part I - Exercises

A. The very beginning

1. Start MATLAB
2. Calculate $3.15 + \frac{45.6 + 4.987}{32} * 8.4$ and store the results in the variable *x*.
3. Type *doc cos* in the command window.
4. Calculate $\cos\left(\frac{\pi}{2}\right)$, $\cos\left(\frac{3\pi}{2}\right)$, $\cos(\frac{3\pi}{5})$ and store the last result in the variable *y*.
5. Write a MATLAB script to swap the content of variables *x* and *y*.

B. Functions and algorithms

1. Documentation: *functions*.
2. Write a MATLAB function **m2sum** that takes two numbers and returns their sum.
3. Write a MATLAB function **pw** that asks two numbers as input and raises the first number to the second one.
4. Write a MATLAB function that takes an integer *n* and displays *n* time "hello". Documentation: *for*, *disp*.
5. Write a MATLAB function that takes a vector of length *n* (with $n > 50$) and plots the square root of all elements.
6. Write a MATLAB function **sequence0** that takes an integer *n* and returns the n^{th} element of the sequence (u_n) defined by:
   - $u_0 = 0$
   - $u_{n+1} = 2*\cos(u_n) + 1$
7. Write a MATLAB function **sequence1** that takes an integer *n* and returns the n^{th} element of the sequence (u_n) defined by:
   - $u_0 = 1$
   - $u_{n+1} = u_n + n^2 - 4$
8. Write a MATLAB function **sequence2** that does the same thing for the sequence defined by:
   - $u_0 = 8$
   - $u_{n+1} = u_n/4$ if u_n is even, $2*u_n+1$ otherwise. Documentation : *if*, *mod*.
9. Write a MATLAB function **pra0** that takes five numbers and returns their sum if one of them is zero, their product otherwise.

10. Write a MATLAB function **pra1** that takes three numbers and returns the "middle" one (the one that is nor the highest nor the lowest).

11. Write a MATLAB function **pra2** that takes three numbers and returns the product of the two lowest numbers.

12. Write a MATLAB function **pra3** that takes five numbers and returns 0 if at least two of the numbers are equals, 1 otherwise.

C. More advanced algorithms

1. Write a MATLAB function **mgcd** that takes two integers and returns their greater common divider. Documentation: while.

2. Write a MATLAB function **misprime** that takes a positive integer and tells whether it is a prime number. Documentation: sqrt, floor, break.

3. Calculate the sum of the first 500 prime integers.