

# General Coding Concepts

MATH-151: Mathematical Algorithms in Matlab

August 23, 2023



# STATEMENTS AND COMMANDS

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  - It will do *exactly* and *only* what you command it to do

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- Mathematical functions

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- `log(1)`
- `sqrt(120)`

- Presentation statements

- `display(18/3 + 7)`
- `plot(x,y)`

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- To do this, instead of using numbers directly, we often will apply those values to variables. For example
  - `x = 7;` tells the computer that wherever it sees `x` to use 7 instead.
  - Similarly we can set `y = 10;` and see how they interact!

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>> x = 7;  
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>> x + y  
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- This is called assigning a value to a variable. A very important use is that we can use those variables throughout our code, and even use it to update the variable itself!
  - For example `x = x + 2;` is interpreted as “take `x`, add 2 to it, and that is our new `x`”

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- In Matlab `=` is used for assignment, so its a little different than the `=` you've seen in the past. Some languages use `<-` for assignment to make this more clear.

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  - End of the line
    - Press the enter key! Matlab will see an invisible character called the "Line Feed" and know the statement is complete
    - Matlab will perform this statement **and print the result to the Command Window**

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  - Semicolon (;)
    - A Semicolon indicates to Matlab that a command is finished and **do not print result to Command Window**
    - Eventually, most of your commands will end with a semicolon

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  - You'll probably find that "other person" is yourself at a later date!

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- Comments are lines in code that are ignored by the computer, but allow us to describe in words what we intend for the code to do
- In Matlab, we use the symbol % to tell the computer that everything afterwards on that line is a comment



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- Comments are lines in code that are ignored by the computer, but allow us to describe in words what we intend for the code to do
- In Matlab, we use the symbol % to tell the computer that everything afterwards on that line is a comment
- Some helpful guidelines on effective commenting
  - Describe what variables represent (also use descriptive variable names as your codes become more complicated)
  - Focus on **what** code is doing, rather than **how** it is doing it

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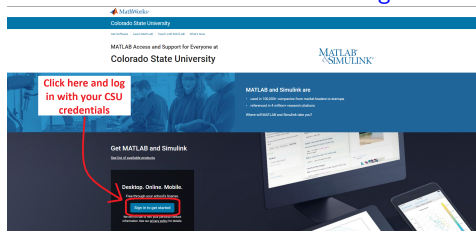
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- Computers can only store a finite number of digits, so irrational numbers like  $\pi$  and  $\sqrt{2}$  will always be just a \*little\* wrong. Also, most functions (like the  $\sin(x)$ ) are represented by a finite number of terms in their Taylor Series expansions.
- Computer models are still very practical and useful, just keep in mind that there is always error!

# INSTALLING MATLAB

- In that class we will be focusing on Matlab as our coding language

Here's the Matlab install link again!



- The install process asks which toolboxes you want to install. This class will not require any of them, but here are some that I've used the most
  - Image Processing Toolbox
  - Navigation Toolbox
  - Parallel Computing Toolbox
  - Signal Processing Toolbox
  - Statistics and Machine Learning Toolbox
- Installation can take a while! It took me about an hour!

# MATLAB DEMO

I am going to show you a quick script in Matlab to help show you around the program.

# SCRIPTS

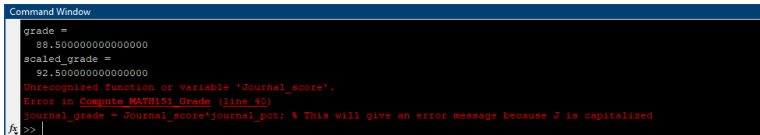
- One of the primary ways we will interact with Matlab is through **scripts**
  - Click the "New Script" button on the command window to create a new script
- These are files, {Filename}.m, that contain a collection of statements for Matlab, so you don't need to enter them one by one into the Command Window
- When you want to **execute** a script, there is a run button toward the top of the Editor window.
  - You can also press F5 on your keyboard

```
1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%  
2 % Compute_MATH151_Grade.m  
3 %  
4 % C. Ruchelme, Colorado State University  
5 % 8/5/2023  
6 %  
7 % This script can be used to calculate a grade for the Fall 2023 semester  
8 % MATH-151 course. But it is also intended to be used as a quick demo into  
9 % how Matlab works and some processing concepts  
10 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%  
11  
12 % I usually start scripts with this, it basically wipes Matlab clean  
13 % close all windows; forget all variables in memory; clear the command window;  
14 close all; clear all; clc;  
15  
16 % Grading Scheme. Also note, I like to align = signs for readability  
17 journal_pct = 0.85;  
18 lab_pct    = 0.80;  
19 final_pct  = 0.15;  
20  
21 % Student Grades  
22 journal_score = 94;  
23 lab_score    = 86;  
24 final_score  = 100;  
25  
26 % Calculate the student's total grade  
27 grade = journal_score*journal_pct + lab_score*lab_pct + final_score*final_pct;  
28 display(grade)  
29  
30 % Oh! My lab grading was a bit hard. Lets apply a curve!  
31 lab_score = lab_score + 5;  
32  
33 % When statements get long we can use ... to split it to multiple lines  
34 scaled_grade = journal_score*journal_pct + ...  
35               lab_score*lab_pct + ...  
36               final_score*final_pct;  
37 display(scaled_grade)  
38  
39 % Finally, remember all variable names are case sensitive  
40 journal_grade = journal_score*journal_pct; % This will give an error message because J is capitalized  
41  
42 % Lastly lets calculate the average grade in the class  
43 student_grades = [91, 88, 99, 96, 87]; % Indeed is this!  
44 average_grade = mean(student_grades); % mean? What is that doing?  
45 display(average_grade)  
46
```



# ERRORS

- An error occurs when Matlab tries to process a statement, but cannot interpret it
- It will respond by beeping angrily and posting an **error message** to the command window. Telling you where the error occurred, and what's wrong



```
Command Window
grade =
    88.5000000000000000
scaled_grade =
    92.5000000000000000
Unrecognized function or variable 'Journal_score'.
Error in Compute_MATH151_Grade (line 49)
    journal_grade = Journal_score*journal_pct; % This will give an error message because J is capitalized
f3 >> |
```

- In this case it is trying to use Journal\_score, but the variable doesn't exist.
- The variable journal\_score, does exist though! Variable names are case-sensitive
- A lot of your time coding will be fixing errors. Don't get discouraged by them, they are a learning opportunity!
  - A lot of time they are typos though...