

Introduction to MATLAB bootcamp

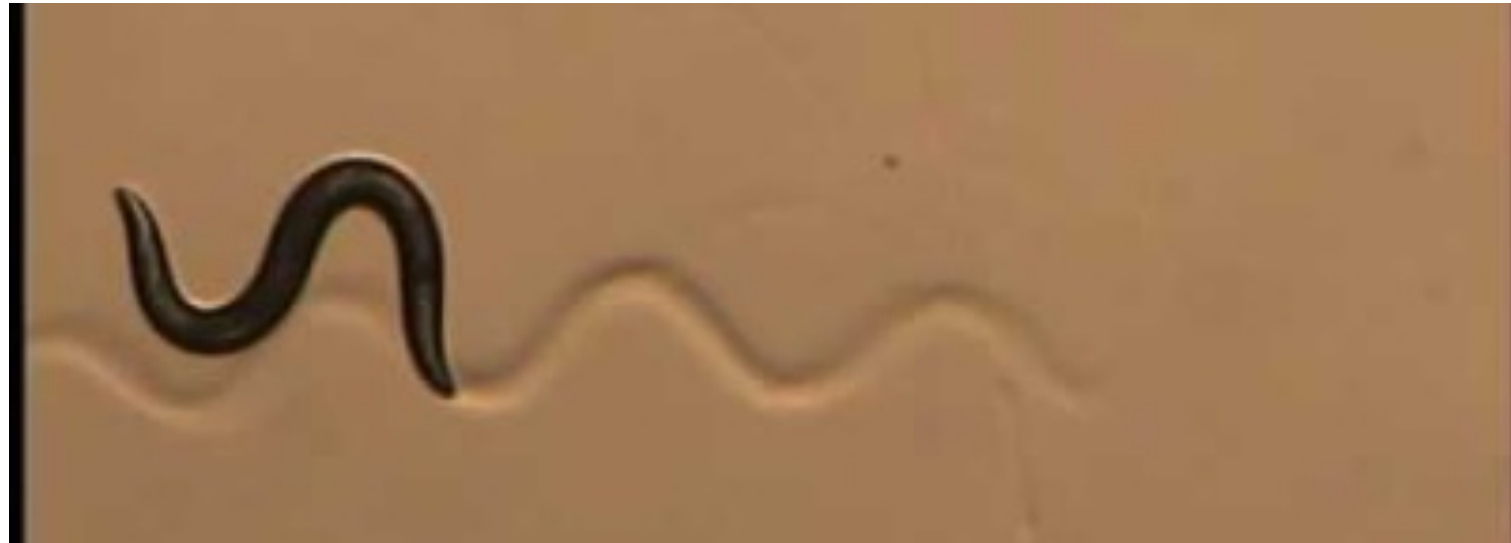
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Bootcamp overview

- Meeting time:
 - Wednesday: 1:30 - 3:30 pm
 - Thursday: 1:30 - 3:30 pm
- Zoom link:
- Instructor: Sandeep Kumar (sk35@princeton.edu)
- Weekly assignments: 2-3 hours, assigned Friday, due Tuesday 6pm; ungraded but will receive feedback; weekly code review

About me

- B.S - M.S. Physics, University of Hyderabad
- M. Eng. Biomedical Engineering, Cornell University
- Research Assistant, Salk Institute for Biological studies, San Diego
- 3rd year graduate student, Princeton Neuroscience Institute
 - Andy Leifer lab



Some other excellent resources to learn MATLAB

Please check these excellent resources:

- https://github.com/mInguyen/pni_summer_matlab2020
- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-057-introduction-to-matlab-january-iap-2019/>

HOME PLOTS APPS EDITOR PUBLISH FILE VERSIONS VIEW

Run current section (⌘↵)

New Open Save Go To Find Bookmark Refactor Run Section Run and Advance Run to End Run Step Stop

FILE NAVIGATE CODE SECTION RUN

Working directory

Current Folder

week_1_lecture_2.m × +

workspace

Files in the working directory

script

Workspace variable

Command Window

New to MATLAB? See resources for [Getting Started](#).

>> week_1_lecture_2
Hello world
>>

Command window

UTF-8 LF script Ln 3 Col 20

week_1_lecture_1.m

Command Window

```
>> num1=10

num1 =

    10

>> num2=20;
>>
```

Workspace

Name	Value	Size	Class
num1	10	1×1	double
num2	20	1×1	double

This is how you define a variable:

- 1) Here we created a new variable num1 and assigned it a value of 10
- 2) Note that the information always transfer from right to left! (try num1=num2; and see what is the new value of num1)
- 3) Observe that once you assign values to the variables they appear in the workspace
- 4) Can you tell the effect of using semicolon (;) at the end of command line?

Helpful tips for MATLAB



The image shows a screenshot of the MATLAB Command Window. The window title is 'week_1_lecture_1.m'. The Command Window has a dark blue header with the text 'Command Window'. The main area is white and contains a list of commands: 'cler', 'clear', 'clc', 'num1=10', 'num2=20;', 'num1=10', 'num2=20;', and 'num3=num1;'. The command 'num3=num1;' is highlighted with a grey background. Below the list, the prompt '>>' is followed by 'num3=num1;'. A red cursor is visible at the end of the highlighted command.

```
week_1_lecture_1.m  
Command Window  
cler  
clear  
clc  
num1=10  
num2=20;  
num1=10  
num2=20;  
num3=num1;  
>> num3=num1;
```

- 1) You can press up arrow and select any of the previous commands.
- 2) You can autocomplete the name of a variable by pressing on tab key

clear, clc, close all

- clear %%% it removes all the elements from workspace
- clc %%% it clears the texts in the command window
- close all %%% it closes all the figures (will be useful later in the bootcamp)
- I usually include all these commands at the beginning of each matlab script

First MATLAB command

MATLAB In-built function

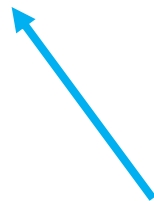


Input to the function passed inside the brackets



```
>> disp('Hello world, this is a MATLAB command')
```

```
Hello world, this is a MATLAB command
```



Output of the function

Help function in MATLAB

Command Window

```
>> help disp
```

disp Display array.

disp(X) displays array X without printing the array name or additional description information such as the size and class name.

In all other ways it is the same as leaving the semicolon off an expression except that nothing is shown for empty arrays.

If X is a string or character array, the text is displayed.

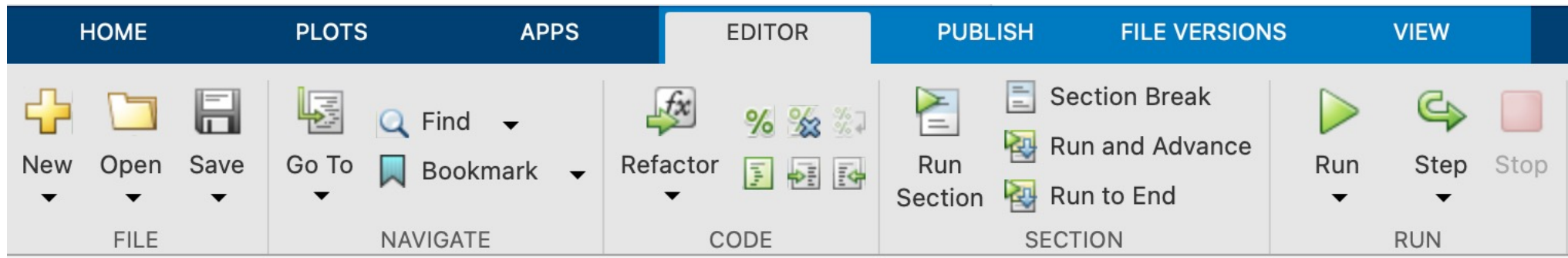
See also [formattedDisplayText](#), [sprintf](#), [num2str](#), [format](#), [details](#).

[Documentation for disp](#)

[Other functions named disp](#)

Running your MATLAB script

1. Running from command window
2. Run section
3. Run and advance
4. Run to end
5. Run



Assigning values to variables

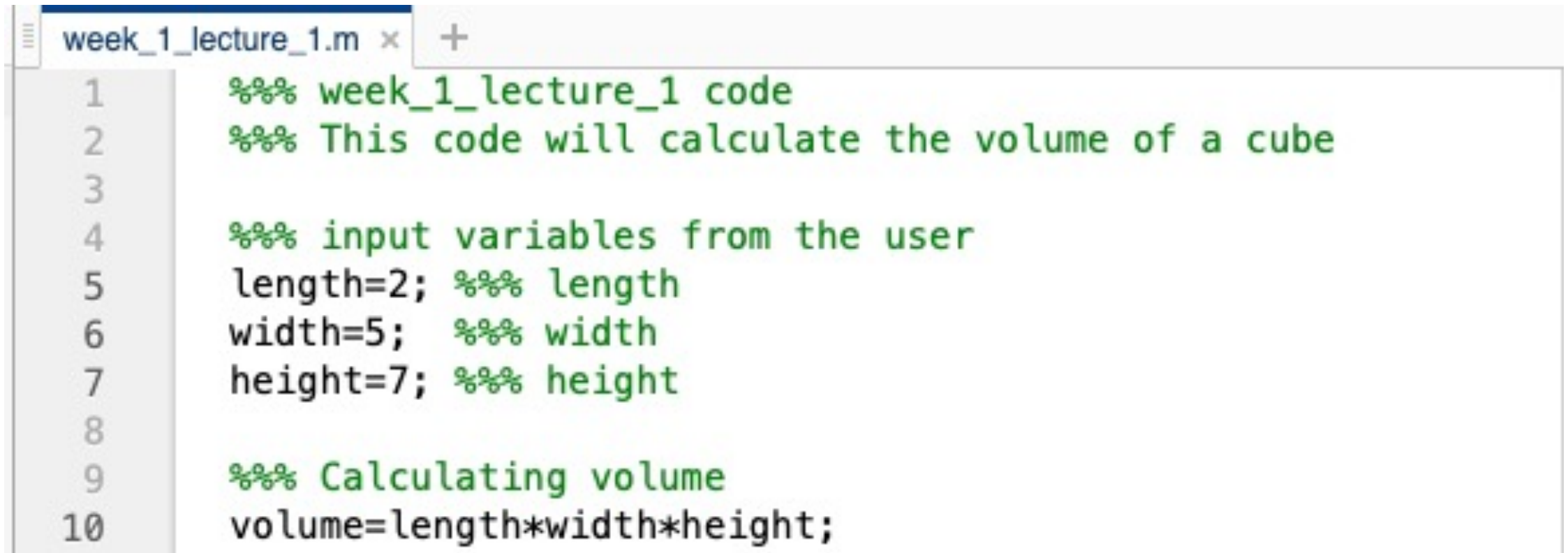
- `a=5;`
 - `a+2`
-
- What is the new value of `a`?
 - How can you increase the value of variable `'a'` by 2?

Calculation using variables

- `volume= length x width x height`
- `length=2;`
- `width=5;`
- `height=7;`
- `volume=length*width*height;`

- How will you print the value of the variable volume?
- How will you print the value of the variable volume and width together?

Using MATLAB editor



```
week_1_lecture_1.m × +
1      %%% week_1_lecture_1 code
2      %%% This code will calculate the volume of a cube
3
4      %%% input variables from the user
5      length=2; %%% length
6      width=5;  %%% width
7      height=7; %%% height
8
9      %%% Calculating volume
10     volume=length*width*height;
```

- 1) Any line of code which begins with % is considered as comment and is not executed by MATLAB.
- 2) Using %% will divide the code into sections (very helpful)
- 3) Adding comments at the very top of the code will be displayed when you use help filename.m

Predefined values and variables in MATLAB

Expression	Description
pi	The number π up to 15 significant digits.
i, j	The complex number $\sqrt{-1}$.
inf	Represents the mathematical Infinity concept, for example, a result of division by zero.
NaN	Stands for Not-A-Number. Represents the result of a meaningless mathematical function, like 0/0.
clock	Contains the current date and time in the form of a 6-element row vector: year,month,day,hour,minute,second.
date	Contains a string representing today's date.
eps	Stands for epsilon . It represents the smallest number that can be represented by your MATLAB software.
ans	A special variable that MATLAB uses to store the result of MATLAB's command line.

Keywords in MATLAB

- MATLAB has pre-defined keywords such as while, for, if, parfor, global etc.
- You cannot use these keywords as a variable e.g. you cannot use `while=1;`
- To see the complete list of keywords, enter `iskeyword` in the command window.
- Also, try not to use MATLAB functions as variable names. For e.g. avoid use `mean=4`, `sin=20`;

Time taken by MATLAB to execute a code

```
22 %%  
23 tic  
24 exp(500)  
25 toc  
26
```

Command Window

```
>> tic  
exp(500)  
toc  
  
ans =  
  
1.4036e+217  
  
Elapsed time is 0.034693 seconds.  
  
>>
```

MATLAB tells the time to execute a command between tic and toc

Infinity and NaN (Not a number)

- Inf: Inf is the outcome of division by 0 (e.g. $1/0$) or overflow when the result is too large (e.g. $\exp(1000)$)
- NaN: MATLAB uses NaN to represent the numbers which are not real or complex. e.g. $0/0$, Inf/Inf
- Usually in experiments/data analysis, the missing data points are represented by NaN.