MATLAB

Class 1: Basics part 1

Goals of this MATLAB course

Taking you from **MATDRAB** to **MATFAB**

- By the end of the course, you should be comfortable reading MATLAB code, writing basic scripts, plotting data, and preforming basic analyses

The philosophy of a programing language

What language do computer speak?
Is it like Portuguese? French?

How are computer languages different than English languages?

What is an algorithm?

MATLAB introduction

Proprietary programing language

Interpreted language

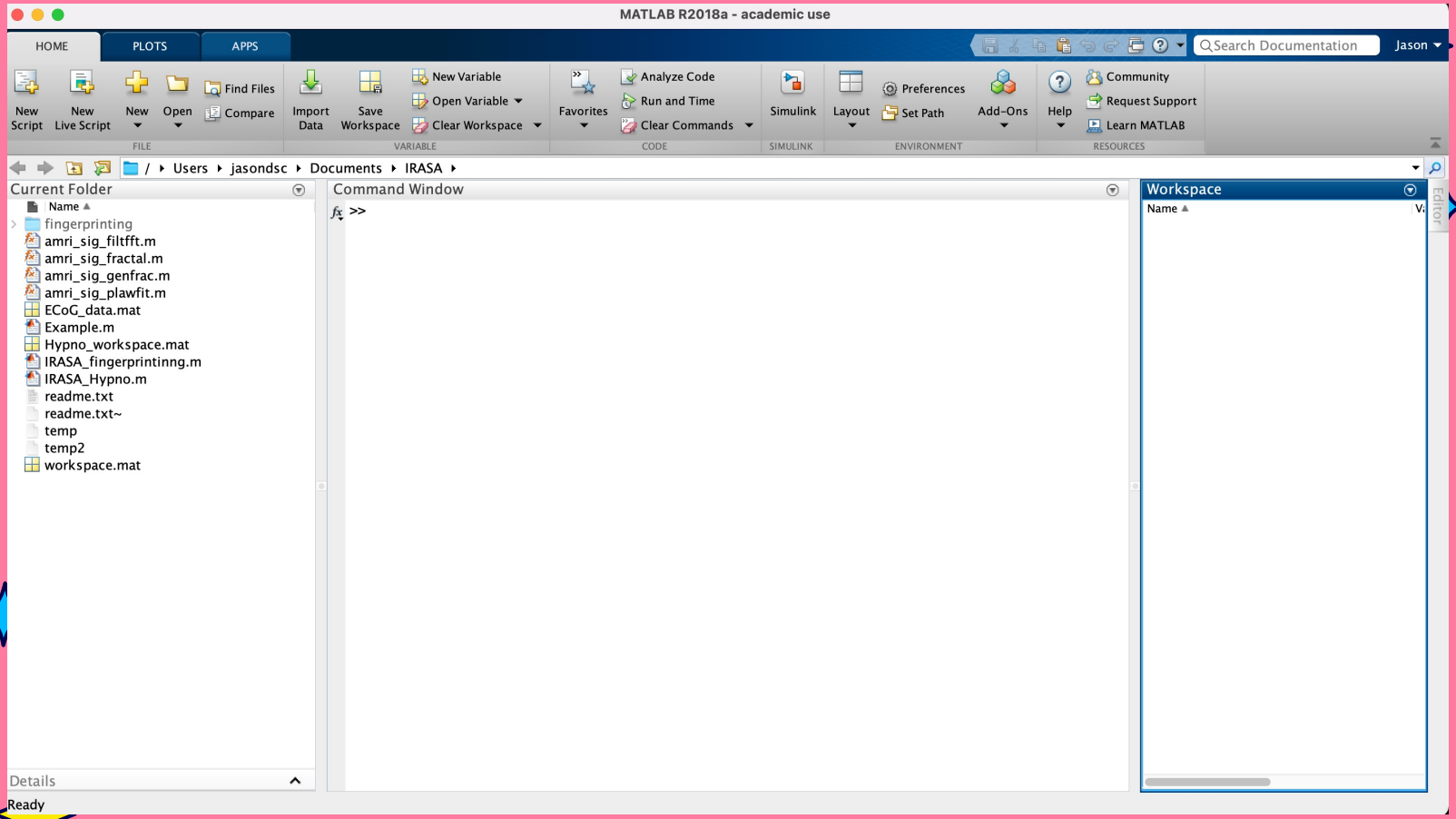
User friendly

Many toolboxes and addons

Designed for matrix operations, signal processing, equation solving

MATLAB Environment

- Command Window
- Current Folder
- Workspace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Search Documentation
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Clear Workspace
Favorites
Analyze Code
Run and Time
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Learn MATLAB
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amri_sig_genfrac.m
amri_sig_plawfit.m
ECoG_data.mat
Example.m
Hypno_workspace.mat
IRASA_fingerprintinng.m
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readme.txt~
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workspace.mat
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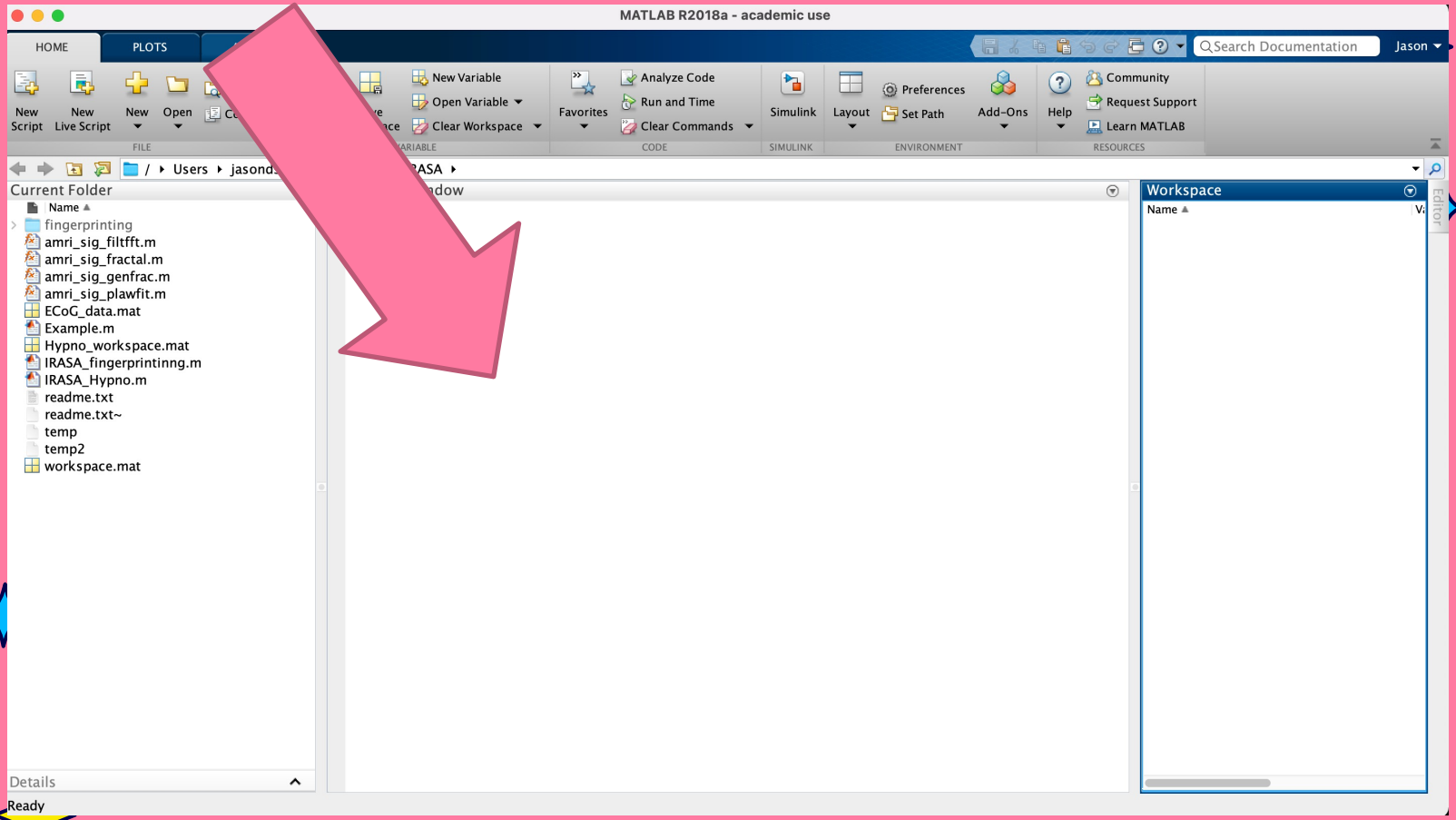
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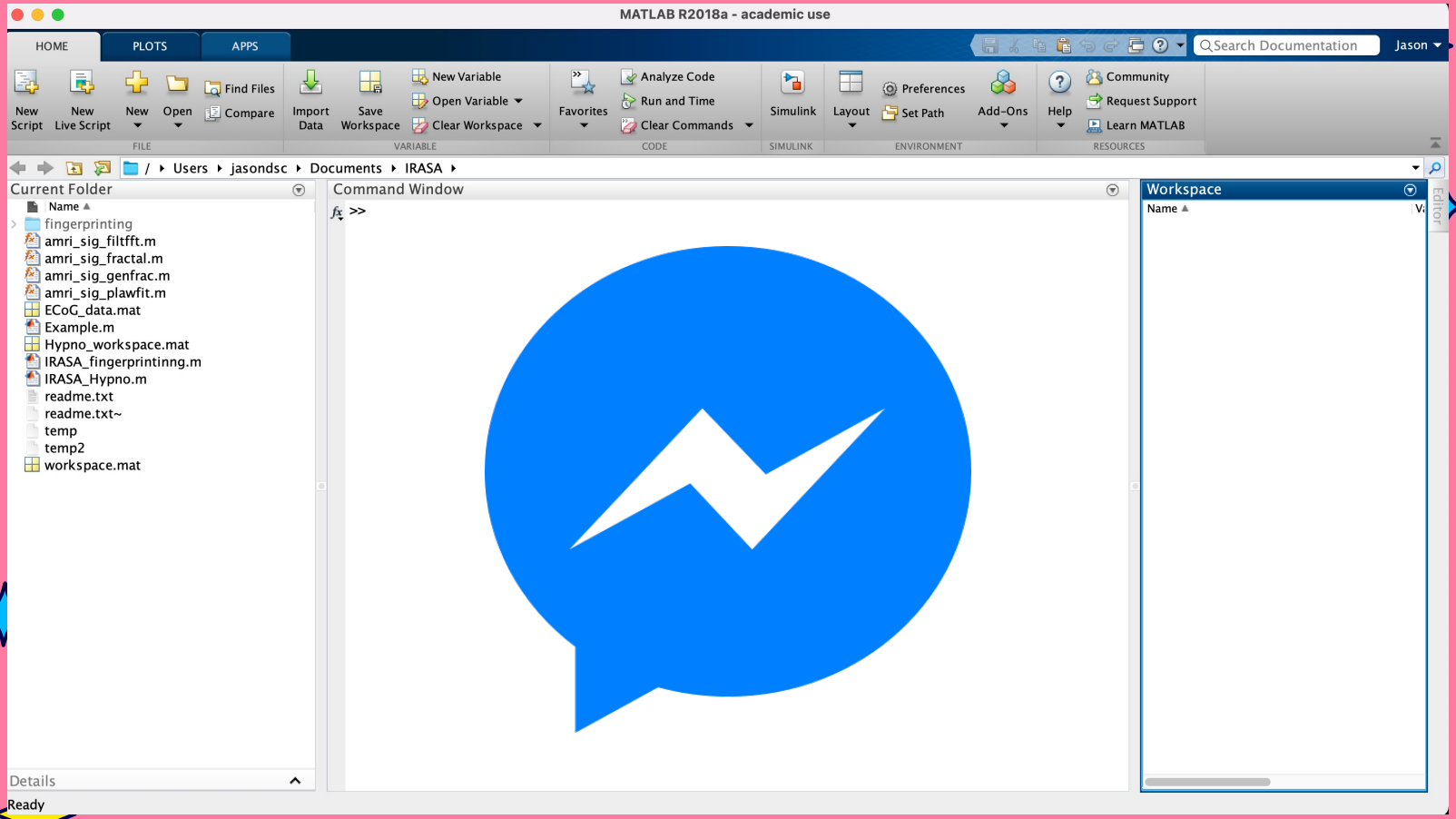
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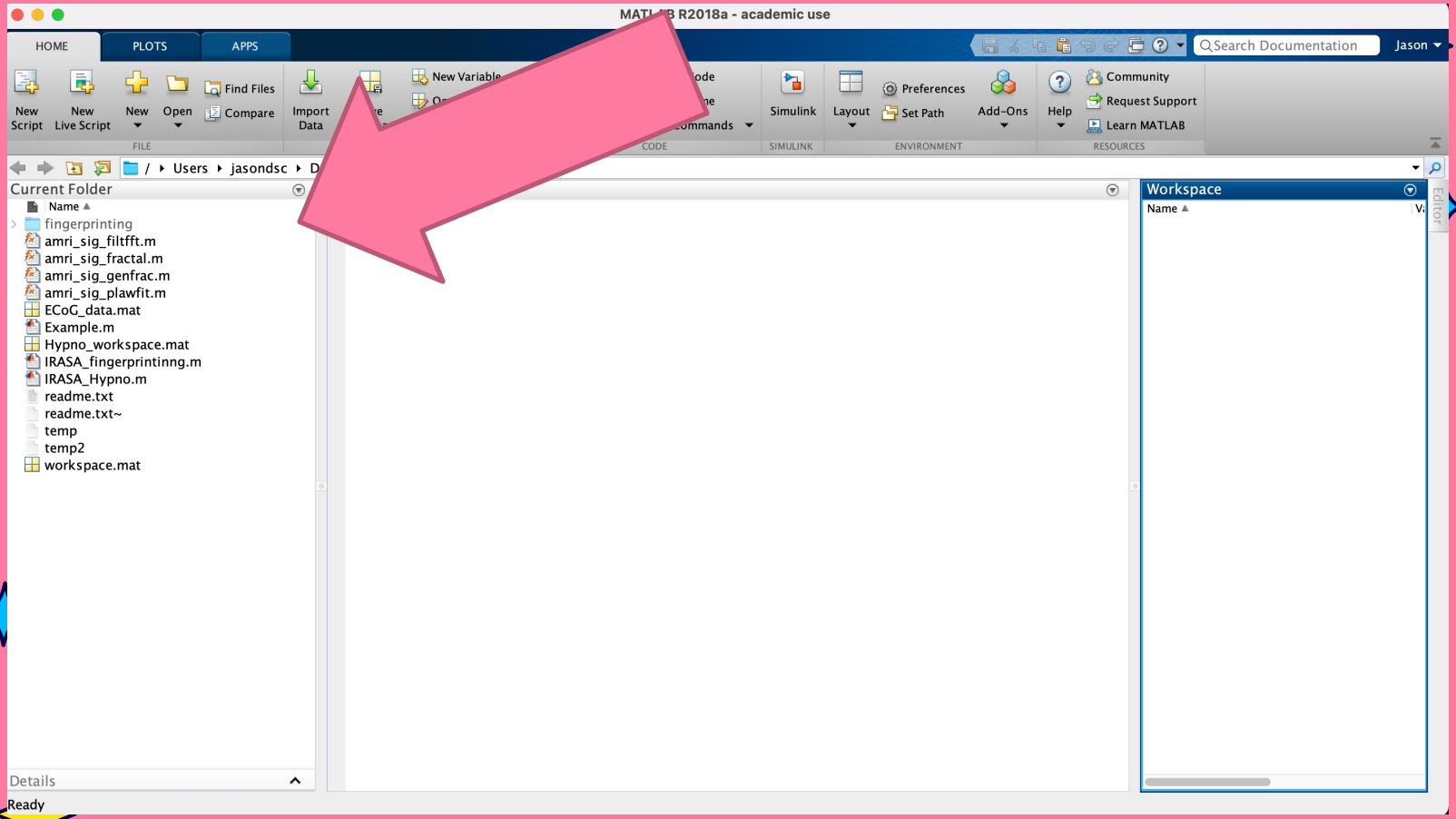
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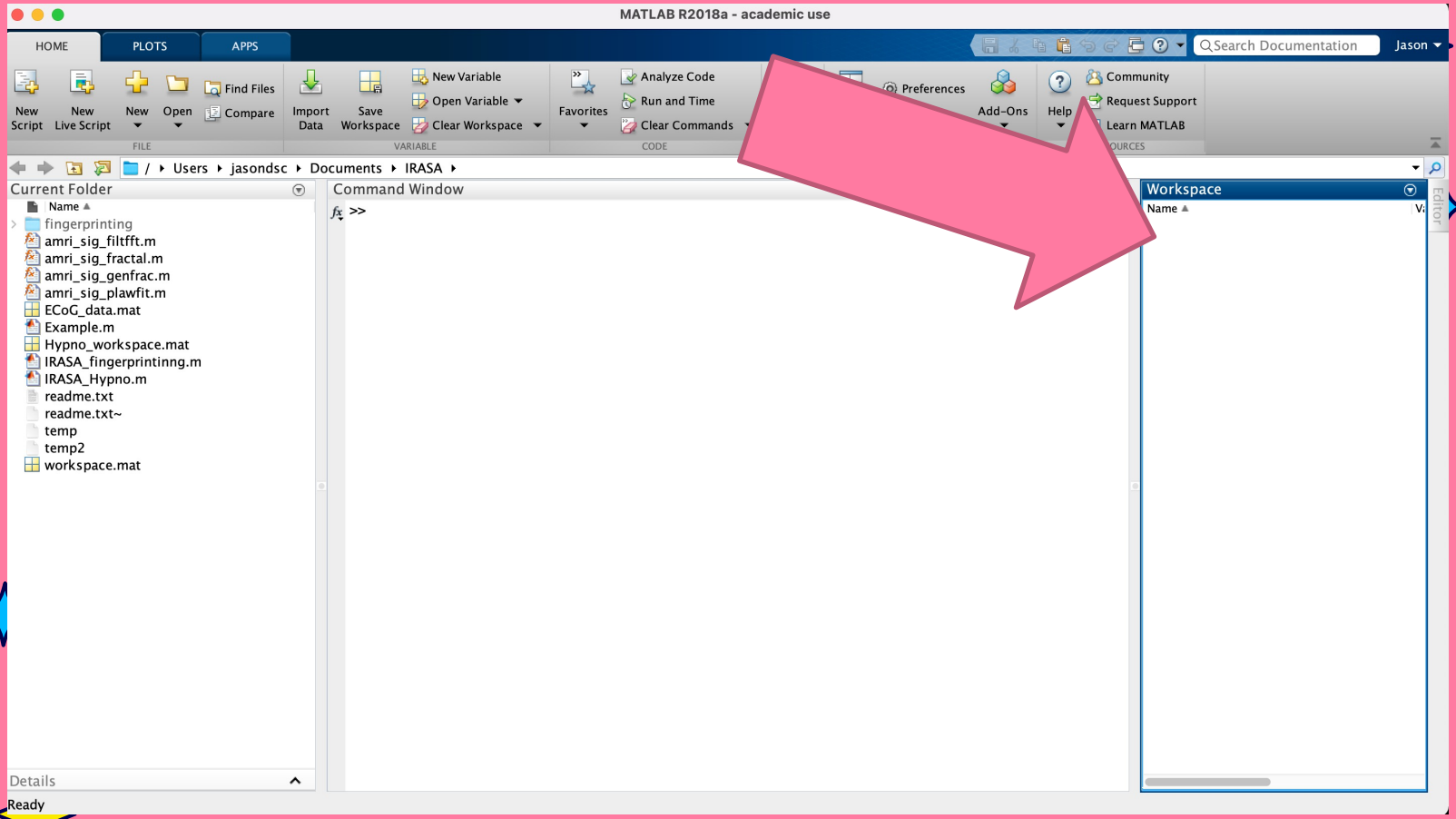
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Basic MATLAB Commands

Commands to clean your environment **clear**, **clc** and **close**

To find what files are in a directory **dir( )**

To find what directory you are in or change it: **pwd( )** and **cd( )**

To open and write .mat files **load( )** and **save( )**

Basic MATLAB Commands

To check if a variable or file exists: **exist()**

To list what MTALAB .m and .mat files are in your folder: **what( )**

To find out which version of a function you are using is: **which( )**

Functions

Functions are called by using ( ), their outputs and inputs can vary

Example calls of functions:

```
max(a);

figure or figure()

[maxA, location] = max(A);

[~, name, ext] = fileparts( helpfile );

coeff = pca(X(:,3:15),  'Rows',  'pairwise');
```


I don't know her.

Help Function

When you are unclear on what a function does, takes as inputs, or outputs you can always ask for **HELP**

The function help (followed by a function name) returns a description of that function. For details read more about each function on MATLAB's website

Help Example

>> help fileparts

fileparts Filename parts.

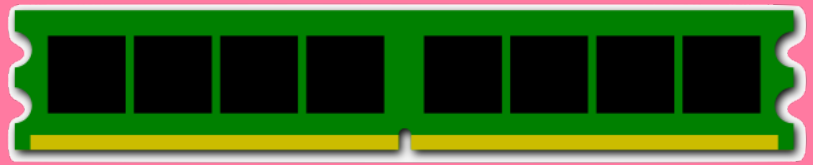
[FILEPATH, NAME, EXT] = fileparts(FILE) returns the path, file name, and file name extension for the specified FILE. The FILE input is the name of a file or folder, and can include a path and file name extension. The function interprets all characters following the right-most path delimiter as a file name plus extension.

If the FILE input consists of a folder name only, be sure that the right-most character is a path delimiter (/ or \). Othewise, fileparts parses the trailing portion of FILE as the name of a file and returns it in NAME instead of in FILEPATH.

What is a variable

A variable is assigning a location in memory some information you want to keep for later

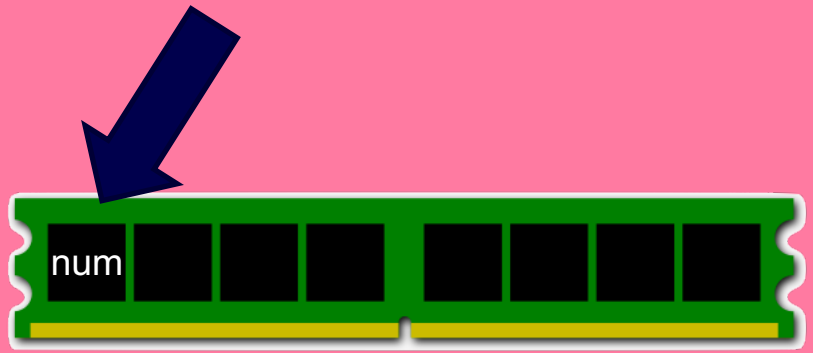
variable_a = 514,398,6644



What is a variable

A variable is assigning a location in memory some information you want to keep for later

num = 514,398,6644



Data Types

Booleans

Variables that are either TRUE or FALSE

Char

Variables that represent words or text

Integers

Variables that represent numbers


YOU CAN'T SIT WITH US
memegenerator.net

Booleans

Variable that can only take two states: **TRUE** or **FLASE**

Used in accessing information, loops, and conditional statements

They are the computer's equivalent to a question

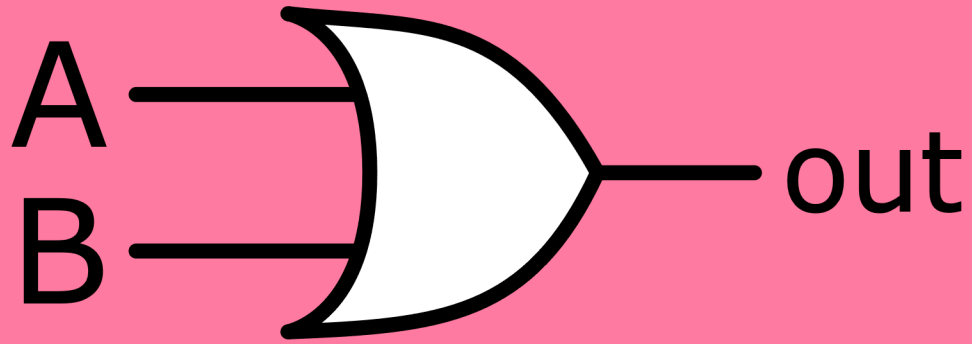
Boolean Operators

How can we ask the computer a question:

- Is equal to ==
- Is greater than >
- Is less than <
- Is NOT equal to ~=
- The OR operator ||
- The AND operator &&

Boolean Operators

Two very special operators: **AND** and **OR**



Boolean Operators

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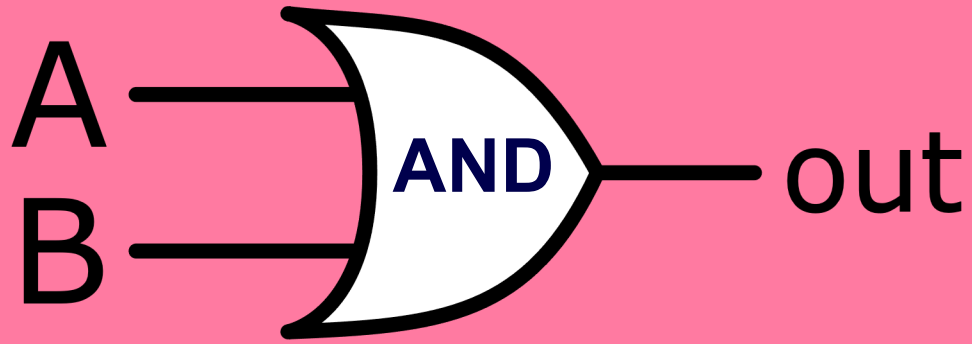

Boolean Operators

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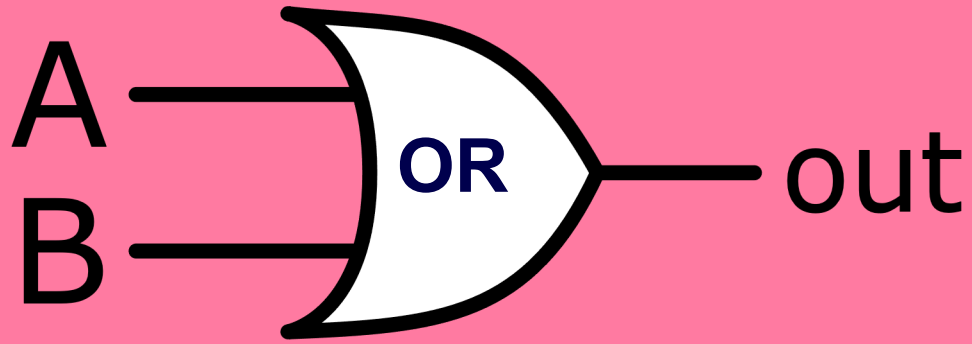


Integers

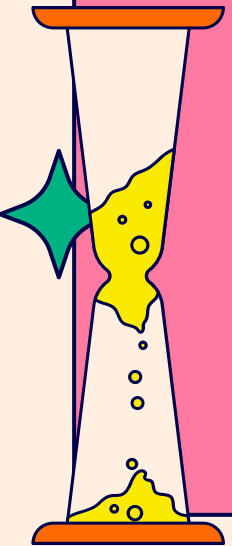
Variable type to hold numeric information:

int(8-64) — real integer value

double— decimal number

unit8/16/32 — stores info in 1, 2 etc bytes

complex numbers — numbers with real and imaginary values



Char and Strings

Holds information concerning words/ text

char — single or array of alpha-numeric symbols ‘ ‘

string — array of text “ ”

for most purposes it does not matter which you use

Char and Strings differences

secret_message = ['a' ; 'ab' ; 'abc']

secret_message = ["a" ; "ab" ; "abc"]

word= 'abc' ; word(2)

word= "abc" ; word{1}(2)

** these differences have to do with how char and strings are stored in memory

String Operators

contains()	looks for a pattern within a string or array of strings
strrep()	replaces a pattern with a new string
strfind()	find indexes of pattern in string
replace()	replaces string pattern with new string
strcat()	concatenates two strings
split()	splits strings according to delimiter
strcmp()	compares two strings

Data Structures

Arrays

One dimensional list of variables of the **SAME** type

Matrices

Two-dimensional matrix of variables of the **SAME** type

Multi-dimensional Matrix

Like a matrix but with 3+ dimensions

Matrix Operations

Defining arrays and matrices:

ALL VARIABLES MUST BE OF THE SAME TYPE

a= [1 2 3; 4 5 6; 7 8 9]

words= ['abc'; 'def'; 'ghi']

z = zeros(5,1)

n=ones(10,5);

Matrix Operations

Basic matrix operations:

n + 10 (adds 10 to each value in the matrix)

a *2 (multiply each element of matrix by 2)

a' (transpose of a matrix)

a.*a (element wise multiplication)

n*z (matrix multiplication resulting in 10 by 1 matrix)

Matrix Operations

Basic matrix operations:

It is important to note that operators that have a '.'

ahead preform ELEMENTWISE operations so

a.*b ~= a*b

Matrix Operations

Array and Matrix Indexing

a= [1 2 3; 4 5 6; 7 8 9];

Get the first element:	a(1,1)
Get second element of first row:	a(1,2)
Get first row:	a(1, :)
Get first column:	a(: ,1)
Get first three elements of the second row:	a(2, 1:3)

Note: you can index by multiples e.g. 1:2:100

Matrix Operations

Matrix manipulation:

zeros: create a matrix of all zeros

ones: create a matrix of all ones

eye: create identify matrix

size: returns matrix dimensions

eig: evaluates eigenvalues and eigenvectors

det: returns determinant of matrix

inv: returns inverse of matrix

Matrix Operations

Reshape is a useful function to transform any sized matrix into a different shape

Reshape(X, [new dimensions])

Note that the new dimensions need to be consistent with the previous ones

i.e., dim1*dim2*dim3 == newdim1*newdim2 etc..

I/O introduction

As we have seen we can load .mat data files with **load()**

For other types of data we can use MATLAB's import tools

Simple text files can be read with **csvread()** or **tdfread()** these only accept numeric values. Refer to **readtable()** for strings or mixed type .csv files

** note that MATLAB after 2019 recommends **readmatrix()**

RESOURCES

- https://www.mathworks.com/
- https://stackoverflow.com
- Mastering MATLAB
- Analyzing Neural Time Series Data