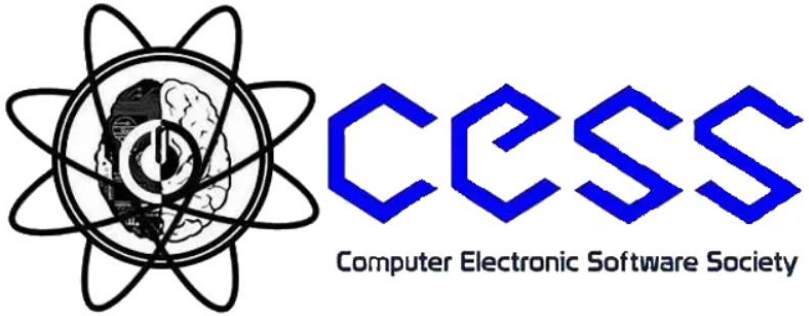

MATLAB: class 1

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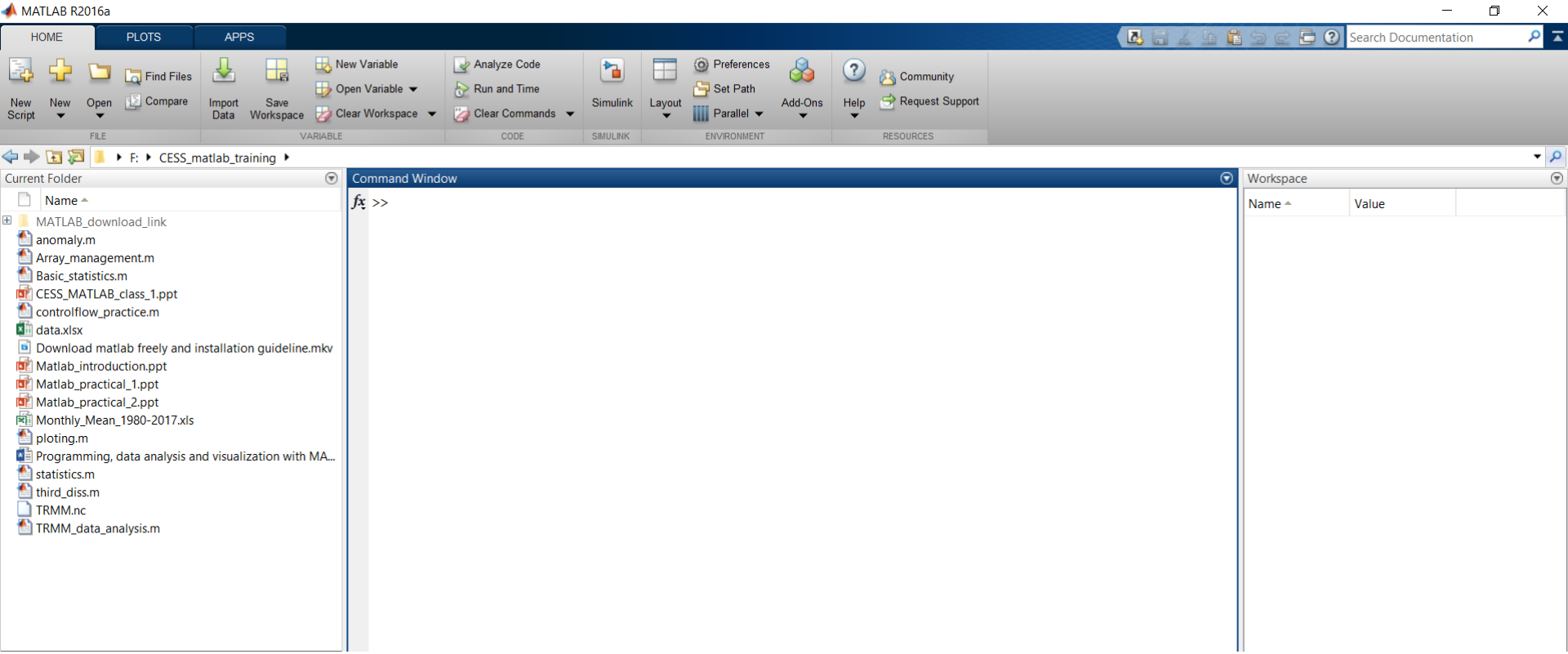
Basic MATLAB



Basic MATLAB

Command Window

```
>> help
HELP topics:

matlab\datafun                - Data analysis and Fourier transforms.
matlab\datatypes              - Data types and structures.
matlab\elfun                  - Elementary math functions.
matlab\elmat                  - Elementary matrices and matrix manipulation.
matlab\funfun                 - Function functions and ODE solvers.
matlab\general                - General purpose commands.
matlab\iofun                  - File input and output.
matlab\lang                   - Programming language constructs.
matlab\matfun                 - Matrix functions - numerical linear algebra.
matlab\ops                    - Operators and special characters.
matlab\polyfun                - Interpolation and polynomials.
matlab\randfun                - Random matrices and random streams.
matlab\sparfun                - Sparse matrices.
matlab\specfun                - Specialized math functions.
matlab\strfun                 - Character strings.
matlab\timefun                - Time and dates.
matlabhdlcoder\matlabhdlcoder - (No table of contents file)
matlabxl\matlabxl             - (No table of contents file)
matlab\demos                  - Examples.
matlab\graph2d                - Two dimensional graphs.
matlab\graph3d                - Three dimensional graphs.
matlab\graphics               - Handle Graphics.
graphics\obsolete             - (No table of contents file)
matlab\plottools              - Graphical plot editing tools
matlab\scribe                 - Annotation and Plot Editing.
scribe\obsolete               - (No table of contents file)
matlab\specgraph              - Specialized graphs.
matlab\uitools                - Graphical user interface components and tools
```

Arithmetic Operators

Symbol	Role
+	Addition
-	Subtraction
.*	Element-wise multiplication
*	Matrix multiplication
./	Element-wise right division
/	Matrix right division
.\	Element-wise left division
\	Matrix left division (also known as *backslash*)
.^	Element-wise power
^	Matrix power
.'	Transpose

Relational Operators

Symbol	Role	(Equivalent, Fortran, NCL, Python)
==	Equal to	eq
~=	Not equal to	ne
>	Greater than	gt
>=	Greater than or equal to	ge
<	Less than	lt
<=	Less than or equal to	le

Logical Operators

Symbol	Role	(Equivalent, Fortran, NCL, Python)
&	Logical AND	and
|	Logical OR	or
~	Logical NOT	not

Special Characters

Symbol	Symbol Name	Role
...	ellipsis	Line continuation
,	Comma	Separator
:	Colon	▪ Vector creation ▪ Indexing ▪ For-loop iteration
;	Semicolon	▪ Signify end of row ▪ Suppress output of code line
( )	Parentheses	▪ Operator precedence ▪ Function argument enclosure ▪ Indexing

Special Characters

Symbol	Symbol Name	Role
[ ]	Square brackets	▪ Array construction ▪ Array concatenation ▪ Empty matrix and array element deletion ▪ Multiple output argument assignment
{ }	Curly brackets	Cell array assignment and contents
%	Percent	▪ Comment ▪ Conversion specifier
'	Single quotes	Character array constructor
""	Double quotes	String constructor
=	Equal sign	Assignment

Special Characters (sprintf, fprintf)

Symbol	Effect on Text
''	Single quotation mark
%%	Single percent sign
\\	Single backslash
\a	Alarm
\b	Backspace
\f	Form feed
\n	New line
\r	Carriage return
\t	Horizontal tab
\v	Vertical tab

Precedence

- Parentheses ()
- Transpose (.'), power (.^), matrix power (^)
- Power with unary minus (.^-)
- Unary plus (+), unary minus (-), logical negation (~)
- Multiplication (.*), right division (./), left division (.\), matrix multiplication (*),
- matrix right division (/), matrix left division (\)
- Addition (+), subtraction (-)
- Colon operator (:)
- Less than (<), less than or equal to (<=), greater than (>), greater than or equal to (>=), equal to (==), not equal to (~=)
- Element-wise AND (&)
- Element-wise OR (|)

Data type

How much memory or space will take by computer

- Integer
- Float
- Double
- String (non-numeric)
- Logical (non-numeric)

Integer

X =1

Float

specify the number of digits after the decimal point

Y = 1.6

Double (real number)

Can be fractional or integer

Z = -5,-3,0,3,5

String

Ripa, Jalal, Jara

Logical

True, False

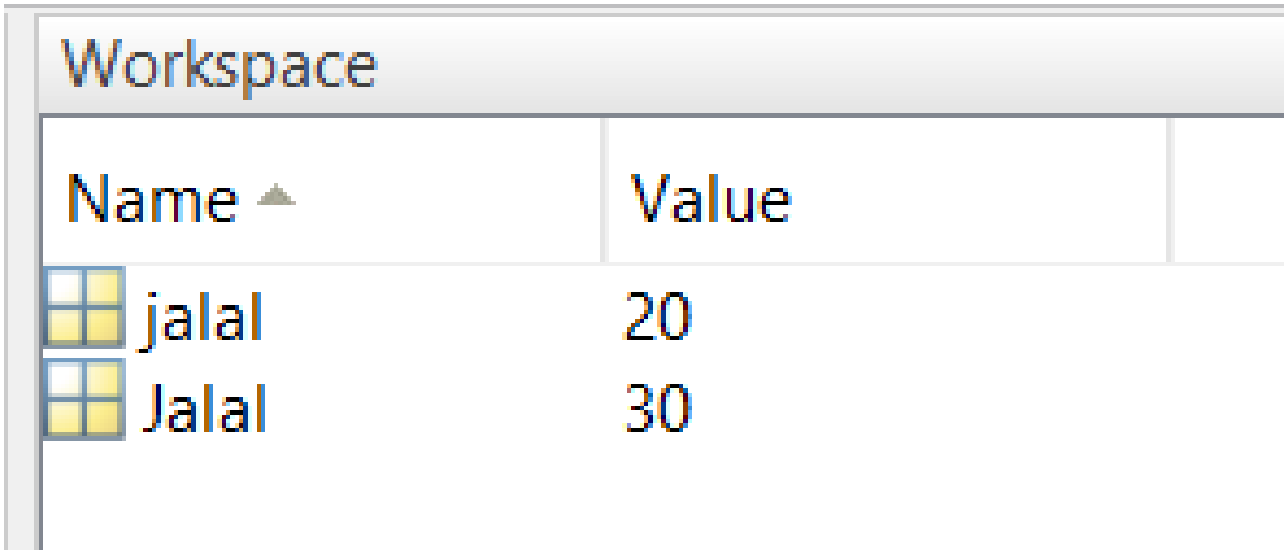
Variables

- A name given to a storage area that our programs can manipulate

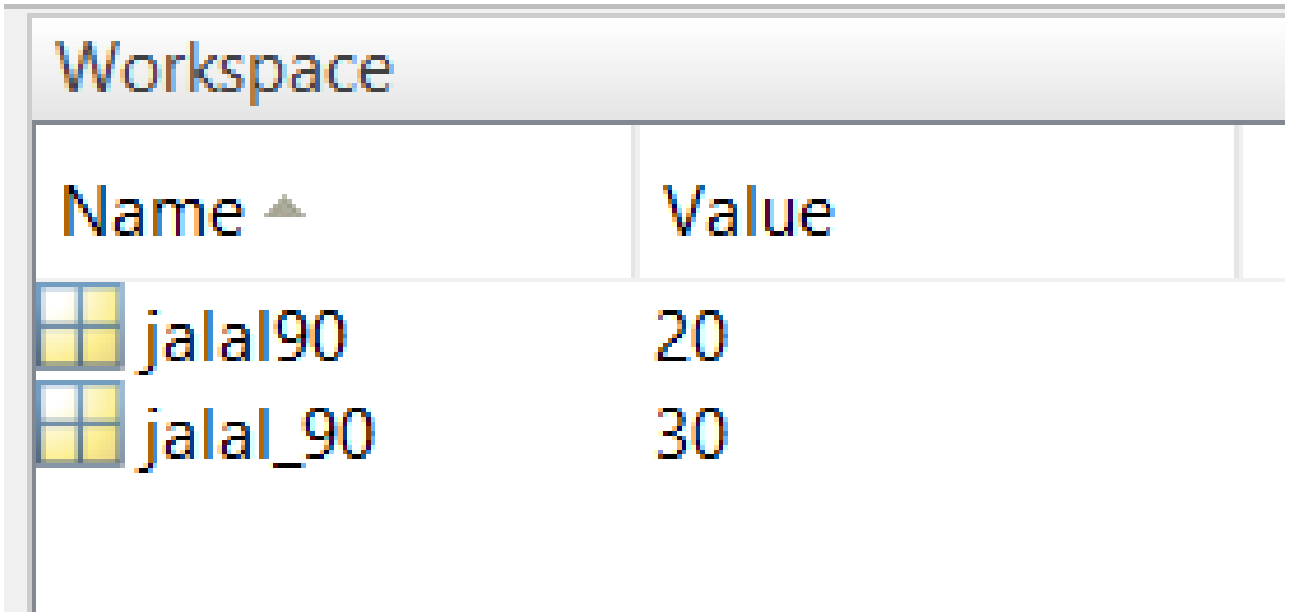
- Matlab is case sensitive

```
>>A=3;
>>a=2;
```

A≠a



- We can use both numbers and underscore in variable names



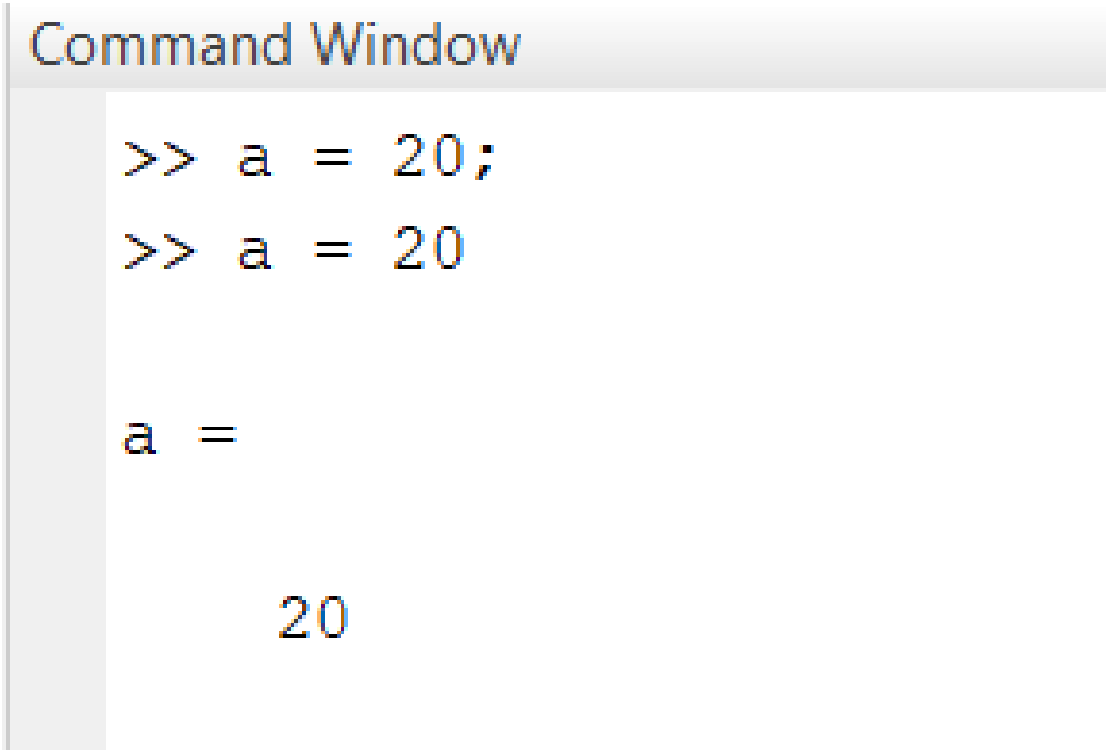
- string (text) variables enclosed in single quotes.

```
>> Jalal = 'Founder and Director of Research Society'

Jalal =

Founder and Director of Research Society
```

- to clear a variable from memory

```
>> clear
>>
```

- Matlab will “echo” commands unless a semi-colon is used



Vectors

column vectors

$$a = \begin{Bmatrix} 1 \\ 2 \\ 3 \end{Bmatrix}$$

```
>>a=[1;2;3]
>>a
a =
     1
     2
     3
```

use semi-colon
to separate rows

row vectors

$$a = \begin{Bmatrix} 1 & 2 & 3 \end{Bmatrix}$$

```
>>a=[1,2,3]
>>a
a =
   1    2    3
```

use comma
to separate columns

Math representation	Matlab interpretation	
$z = y^x$	`>>z=y^x;`	
$y = e^x$	`>>y=exp(x);`	
$y = \ln(x)$	`>>y=log(x);`	
$y = \log(x)$	`>>y=log10(x)`	
$y = \sin(x)$ $y = \sin^{-1}(x)$	`>>y=sin(x);`	`>>y=asin(x);`
$y = \cos(x)$ $y = \cos^{-1}(x)$	`>>y=cos(x);`	`>>y=acos(x);`
$y = \tan(x)$ $y = \tan^{-1}(x)$	`>>y=tan(x);`	`>>y=atan(x);`

- Only matrices of the same dimension can be added and subtracted
- For multiplication, the inner dimensions must be the same

$$\mathbf{A}=\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{bmatrix} \qquad \mathbf{B}=\begin{bmatrix}2 & 3 & 4\\ 5 & 6 & 7\end{bmatrix} \qquad \mathbf{C}=\begin{bmatrix}4 & 5\\ 6 & 7\\ 8 & 9\end{bmatrix}$$

No error

```
>>D=A+B;
>>D=A-B;
```

Error

```
>>D=A+C;
>>D=A*B;
```

Left(\) and Right(/) Matrix “division”

Math representation	Matlab interpretation
$\mathbf{C} = \mathbf{A}^{-1}\mathbf{B}$	`>>C=A\B;`
$\mathbf{C} = \mathbf{B}\mathbf{A}^{-1}$	`>>C=B/A;`

Matrix Transpose

Math representation

$$\mathbf{C} = \mathbf{A}^{T}$$

Matlab interpretation

```
>>C=A';
```

Thank You