Bil 108

Introduction to the Scientific and Engineering Computing with MATLAB

Lecture 1

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What is MATLAB?

- MATrix LABoratory
- Numerical calculations
- Graphics
- Interactive
- Command-line or GUI

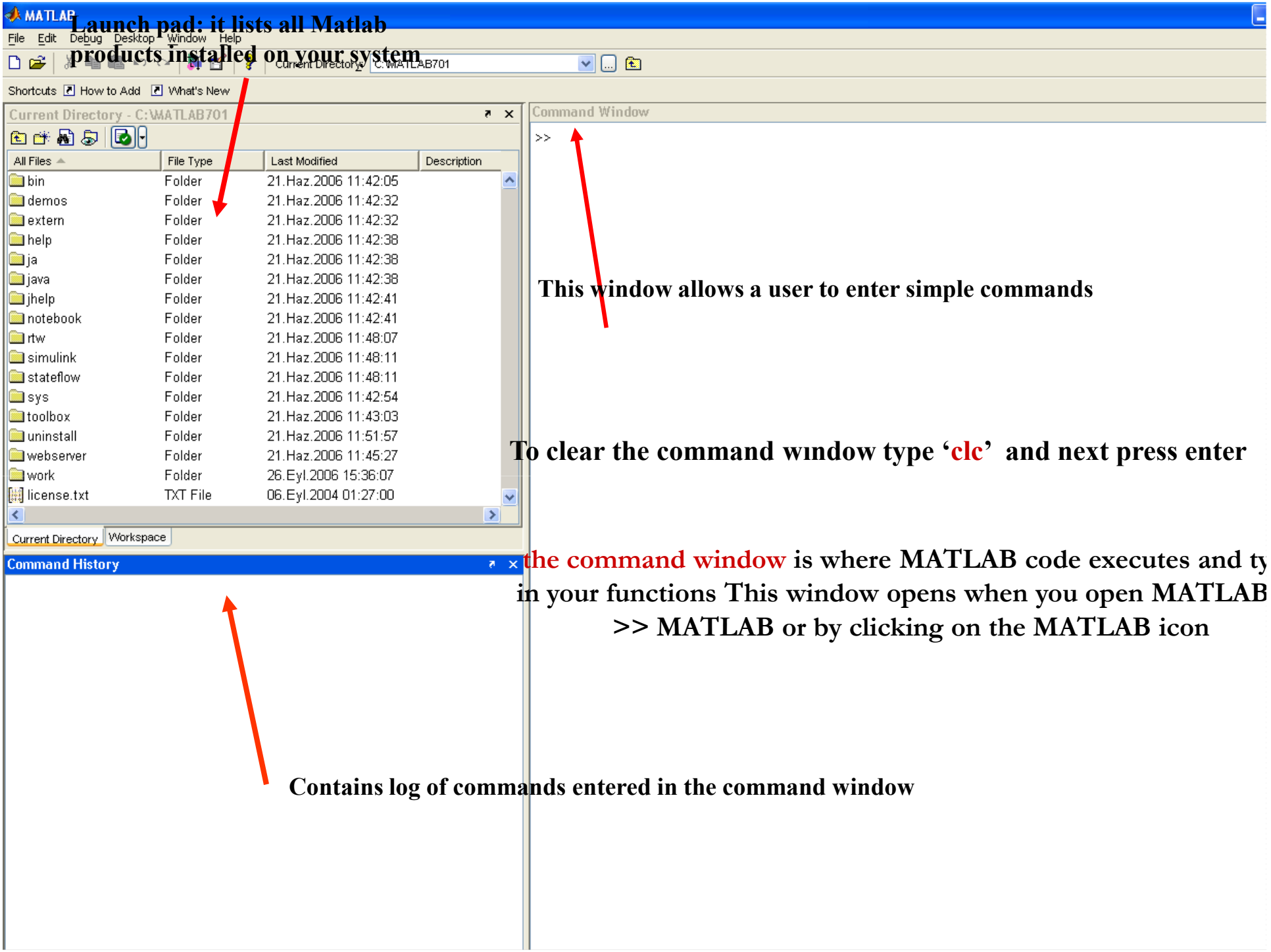
Introduction to MATLAB

MATLAB is a computer program that can be very helpful in solving the sorts of mathematical problems you will frequently encounter throughout your engineering or technology coursework.

- use built-in features of MATLAB to effortlessly solve a wide variety of numerical problems, from the very basic, such as a system of 2 equations with 2 unknowns to the more complex, such as
- factoring polynomials,
- fitting curves to data points,
- making calculations using matrices,
- performing signal processing operations such as Fourier transforms,
- building and training neural networks.

Starting and Quitting

	Windows	Command line
start	click icon	type: `matlab`
stop	Menu – choose: File Exit Matlab	type: `quit`



Launch pad: it lists all Matlab products installed on your system

This window allows a user to enter simple commands

To clear the command wındow type 'clc' and next press enter

the command window is where MATLAB code executes and ty in your functions This window opens when you open MATLAB >> MATLAB or by clicking on the MATLAB icon

Contains log of commands entered in the command window

Syntax

- A *scalar* is simply just a fancy word for a number (a single value (1*1)).
- A *vector* is an ordered list of numbers (one-dimensional). In MATLAB they can be represented as a row-vector or a column-vector (1*n) or (n*1).
- A *matrix* is a rectangular array of numbers (multi-dimensional). In MATLAB, a two-dimensional matrix is defined by its number of rows and columns (n*m) or (m*n).

Expressions

- Numbers
- Operators
- Variables
- Functions

Operators

Mathematical Operators

Add		`+`
Subtract		`-`
Multiply		`*`
Divide	\ or	`/`
Power		`^`

Add a period in front of these operators to make them element-to-element operators

Transpose	`'` (single quote)
e^a	`exp(a)`
Ln(a)	`log(a)`
$\text{Log}_{10}(a)$	`log10(a)`
$\sqrt{a}$	`sqrt(a)`

- `^` power, example: `2^4` → 2^4
- Functions: `function-name(value)`
  example: `sqrt(4)` → 2

Relational Operators

Operator Name	Operator Symbol	EXAMPLE
less than	<	x<y
less than equal to	<=	a<=22
equal to	==	x==100
not equal to	~=	x~=10
greater than equal to	=>	pi=>3
greater than	>	c>100

Example:

```
x=15;
y=20;
ave=(x+y)/2;
testit=(ave>17)
```

Other Operators

Comment	%
Output Surpress	; (semicolon)

Matlab as a fancy calculator

Example1: A trigonometric identity is given by :

$$\cos^2\frac{x}{2} = \frac{\tan x + \sin x}{2\tan x}$$

Verify that the identity is correct by calculating each side of the equation, substituting x=π/5.

Example 2: Heat Transfer

- An object with an initial temperature of T_0 that is placed at time t=0 inside a chamber that has a constant temperature of T_s, will experience a temperature change according to the equation :

$$T = T_s + (T_o - T_s)e^{-kt}$$

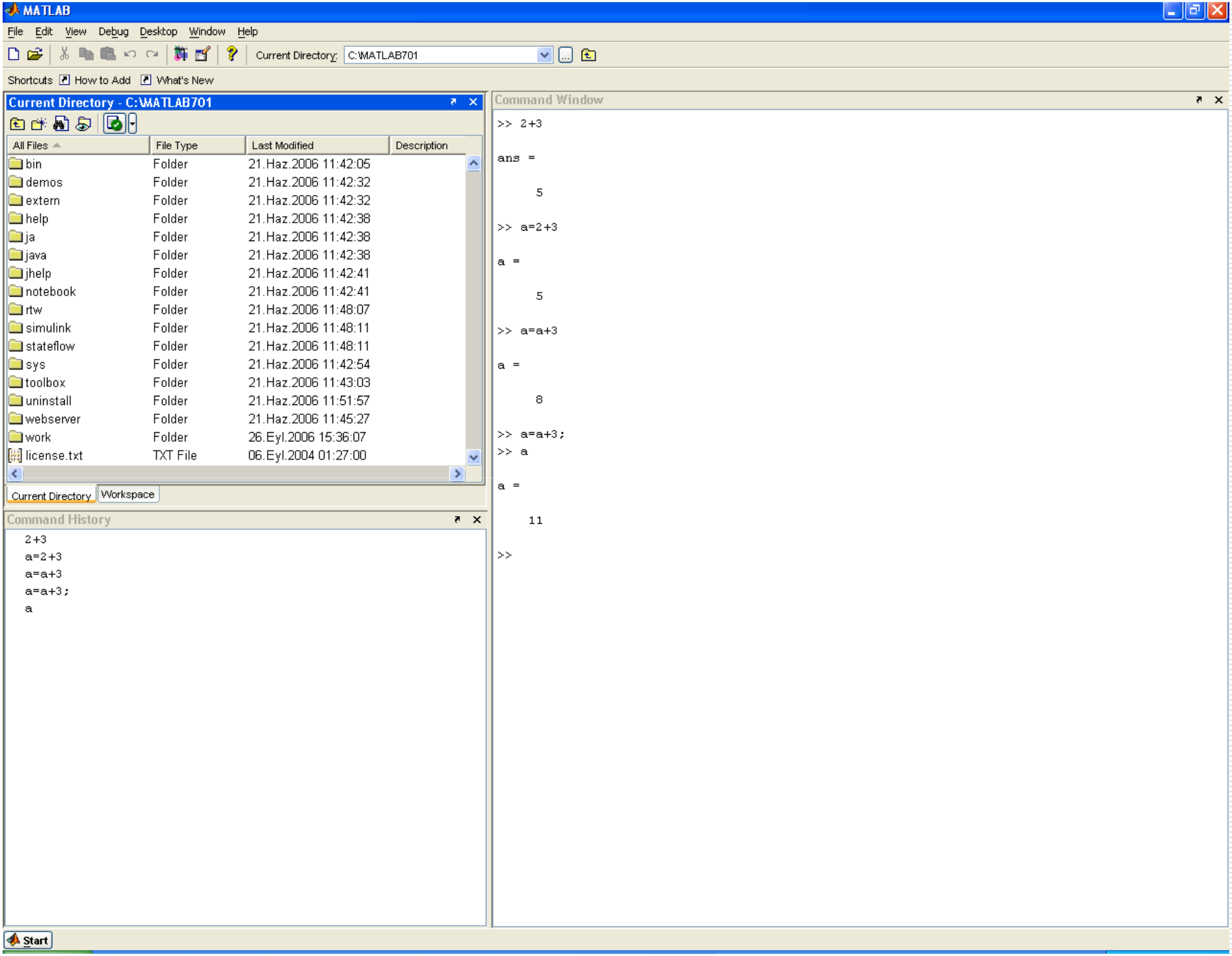
Where T is the temperature of the object at time t, and k is a constant. A soda can at a temperature of 120°F (was left in the car) is placed inside a refrigerator where the temperature is 38°F. Determine the nearest degree, the temperature of the can after three hours. Assume k=0.45.

Creating Variables

- Variables are a fundamental concept in MATLAB,
- In anything more than a trivial problem, you will use variables to store parameters and results of calculations for later use.
- Naming your variables is a personal thing; for simple work you might use the standard x, y, a, b, etc.,
- Names are also case sensitive, so X is a different variable to x
- Up to 31 characters (alphanumeric)
- Cannot start with a number
- Cannot use punctuations other than (_)

Built-in Variables

Special Variable	Description
ans	default variable name for results
beep	make sound
pi	mathematical constant
eps	smallest number that can be subtracted from 0 to make a negative
inf	infinity
NaN	not a number
i (or) j	imaginary number
realmin, realmax	smallest & largest positive real numbers
bitmax	largest positive integer
nargin, nargout	number of function in (or) out variables
date	Represents the current date


MATLAB
File Edit View Debug Desktop Window Help
Current Directory: C:\MATLAB701
Shortcuts How to Add What's New
Current Directory - C:\MATLAB701
All Files File Type Last Modified Description
bin Folder 21.Haz.2006 11:42:05
demos Folder 21.Haz.2006 11:42:32
extern Folder 21.Haz.2006 11:42:32
help Folder 21.Haz.2006 11:42:38
ja Folder 21.Haz.2006 11:42:38
java Folder 21.Haz.2006 11:42:38
jhelp Folder 21.Haz.2006 11:42:41
notebook Folder 21.Haz.2006 11:42:41
rtw Folder 21.Haz.2006 11:48:07
simulink Folder 21.Haz.2006 11:48:11
stateflow Folder 21.Haz.2006 11:48:11
sys Folder 21.Haz.2006 11:42:54
toolbox Folder 21.Haz.2006 11:43:03
uninstall Folder 21.Haz.2006 11:51:57
webserver Folder 21.Haz.2006 11:45:27
work Folder 26.Eyl.2006 15:36:07
license.txt TXT File 06.Eyl.2004 01:27:00
Current Directory
Workspace
Command History
2+3
a=2+3
a=a+3
a=a+3;
a
Command Window
>> 2+3
ans =
5
>> a=2+3
a =
5
>> a=a+3
a =
8
>> a=a+3;
>> a
a =
11
>>
Start

Basic commands

To clear any variable

>> *clear var_name*

To clear all of them

>> clc

Listing Variables

who

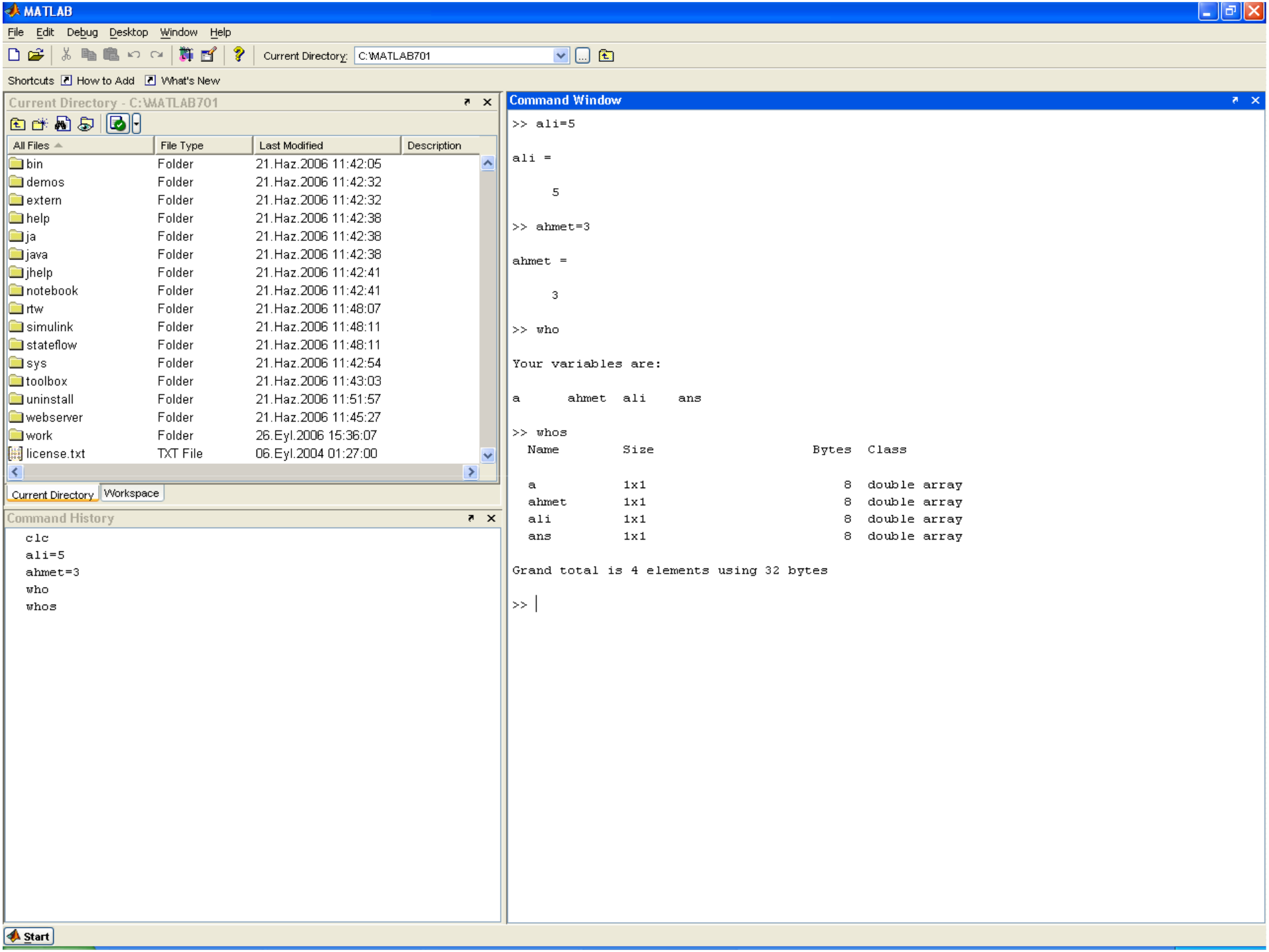
whos

Saving Variables

save file_name

Loading Variables

load file_name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license.txt TXT File 06.Eyl.2004 01:27:00
Current Directory Workspace
Command History
clc
ali=5
ahmet=3
who
whos
Command Window
>> ali=5
ali =
5
>> ahmet=3
ahmet =
3
>> who
Your variables are:
a ahmet ali ans
>> whos
Name Size Bytes Class
a 1x1 8 double array
ahmet 1x1 8 double array
ali 1x1 8 double array
ans 1x1 8 double array
Grand total is 4 elements using 32 bytes
>>
Start

Matlab Files

- The Workspace can be saved to a data file
  - extension is .mat (ex: hello.mat)
  - binary form
  - .mat files can be reloaded by using open from file menu

Functions

- A function has a input arguments and usually has a output arguments. Two types of functions are present in Matlab.

- Built-in functions
- Your own functions (.m files)

- MATLAB offers a wealth of built-in math functions that can be quite helpful for many computational problems

- Elementary MATLAB functions (**`help elfun`**)
  - Trigonometric functions
  - Exponential functions
  - Complex functions
  - Rounding and remainder functions

- Specialized MATLAB functions (**`help specfun`**)
  - Specialized math functions
  - Number theoretic functions
  - Coordinate transformations