Matlab Notes Part 1

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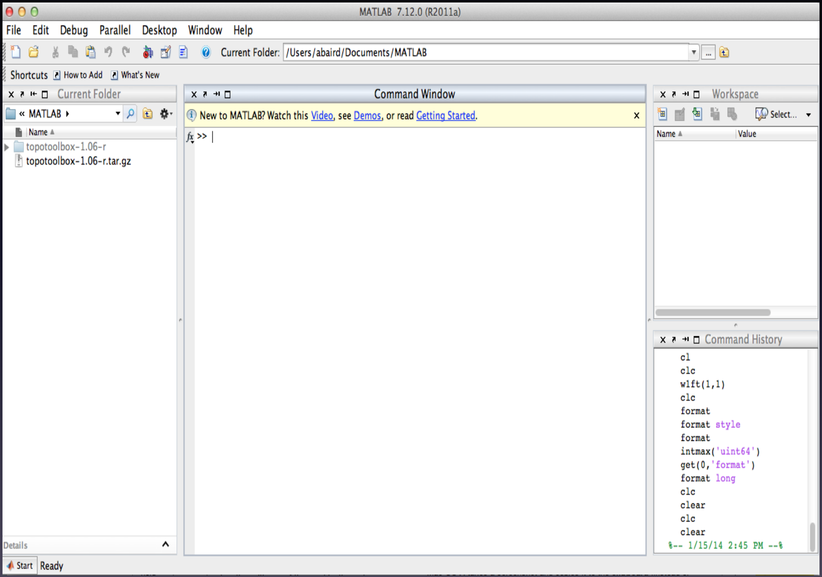
Introduction

- Matlab is a lot like a calculator!
- we can compute things like $3 \cdot 2$
- Arithmetic is preformed in order of operations (just like a calculator)
- Matrices and matrix operations are where Matlab excels
- Today we will:
  - Understand the basic Desktop environment
  - Preform basic arithmetic
  - use built in functions
  - Create matices and write our first code

Desktop Basics



Current Folder: /Users/abaird/Documents/MATLAB

Name
topotoolbox-1.06-r
topotoolbox-1.06-r.tar.gz

New to MATLAB? Watch this Video, see Demos, or read Getting Started.

```
fx >>
```

```
cl
clc
wlft(1,1)
clc
format
format style
format
intmax('uint64')
get(0,'format')
format long
clc
clear
clc
clear
%-- 1/15/14 2:45 PM --%
```

Ready

Desktop Basics

- **Current Folder**: This is where the files you are working with will be stored. Note: you can navigate from the folder you're in to any folder you desire by clicking the magnifying glass.
- **Command Window**: This is where you can calculate, receive error messages, or print output from your programs. Commands are input at the $\gg$ symbol.
    - try to calculate things right now!
- **Workspace:** This is where variables are stored and will tell you things about them (what they equal, how big a matrix is ect.)
- **Command History:** This is where the commands you've issued most recently will appear. ↑ on your keyboard will scroll through these commands.
- Refer to the text (Matlab intro) for more detailed instruction.

Troubleshooting

- Often times things won’t work.
- One **Common** problem is that a variable you thought was free is actually associated with a value.
- Try the command $\gg$ clear. This will clear all the variables in the **Workspace**.

Try and do some computing and assign variables to values.

Arrays

- Matlab = Matrix Laboratory, so do things with matrices!
- Create your first matrix!
  - $\gg a = [1234]$, Row Vector!
  - Indexing in matlab begins with 1 (**NOT** 0)
  - Add more rows: $\gg a = [1234; 2345; 3456]$
  - **Note** This also works: $\gg a = [1, 2, 3, 4; 2, 3, 4, 5; 3, 4, 5, 6]$
  - We can call values from this array:
  - $\gg a(1, 2)$
  - $\gg 2$
  - Or assign a value to a particular position:
  - $\gg a(1, 2) = 10$
  - The notation is (row, column)

Array Creating Functions

- There are ways to automatically create an array(matrix) in matlab:
    - $\gg a = zeros(3, 2)$
    - Creates an array of all zeros (this is good for data management if you want a set size for your matrix
    - $\gg a = linspace(0, 1, 100)$
    - This creates a vector which has 100 points filled in between 0 and 1.
    - $\gg a = 0 : 0.1 : 1$
    - this creates an array which has mesh width equal to 0.1
- How do we model functions in Matlab?

Array Operations

- Colon operator:
- $\gg a = [123; 234; 456]$
- The colon denotes *start*:*end*. *Note:* if you just place a colon it will select everything.
- Select the first two rows of our matrix:
  - $\gg a(1:2,:)$
  - What does $\gg a(1,:)$ do?
- We can also add to each element of the array:
  - $\gg a - a$
  - $\gg a - 10$
- We can do traditional and element wise multiplication of matrices:
  - traditional: $\gg a * a$, element wise: $\gg a. * a$
  - In a similar way you can do other things element wise to a matrix ex.: $\gg a. \wedge 3$

Discrete Functions

- In math things are continuous, in Matlab (and in computational science in general) This is not the case.
- To compute and evaluate functions we need a *Domain* and their corresponding function values *Range*
- To get a Domain in Matlab we must “discretize” our continuous domain.
- We do this by creating a “mesh width” = size of our spacing in our discretization
    - ex: $\gg x = linspace(0, 1, 10)$ what is our mesh width *dx* (x(2)-x(1))? is it always equal? Must consider this!
    - ex: $\gg x = 0 : 0.1 : 1$ what is our mesh width *dx*?

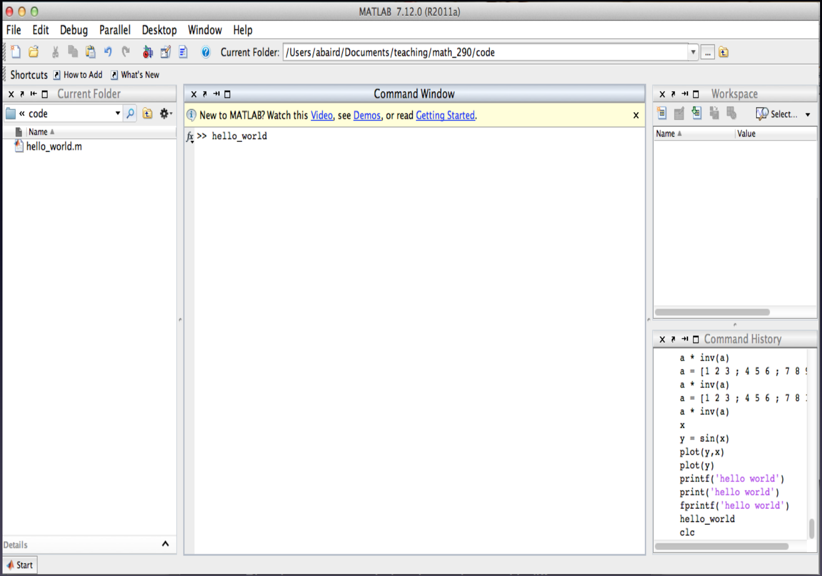
Evaluating Functions

- Now that we have a discretized version of the x-axis we can now evaluate a function!
- Matlab has many built in functions (sin, cos, tan, exp...)
- $\gg y = sin(x)$
- We now have a set of range values, how do we know that this is right? Graph?
- plot this function: $\gg plot(y)$
- In general the resolution of our function is dependent upon our mesh width
- How small is enough, how big is too big? Does any mesh width work?
- A quick and dirty estimate of the error between two arrays: $max(a - b)$ will select the max error between the arrays (infinity norm).
- Plot sin over one period and experiment with different mesh widths and their effects

Our First Program

- Matlab files are denoted by a .m at the end of the name.
- Documentation is very very important! % is how you comment lines (these will not be read by the computer)
- Notice that to run the code Matlab asks you whether to add folder to path or to change to directory, both work.
- Just type the name of the code in the command line to get the program to run.

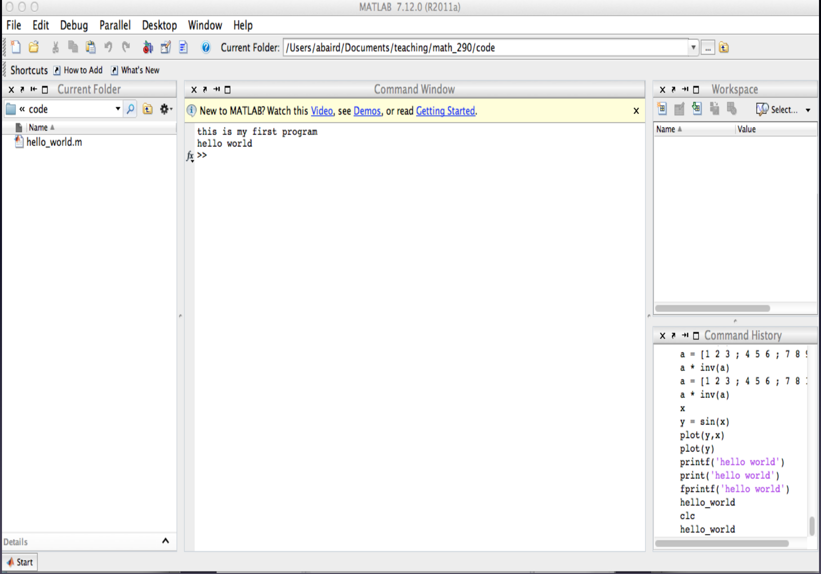
How to Run


MATLAB 7.12.0 (R2011a)
File Edit Debug Parallel Desktop Window Help
Current Folder: /Users/abaird/Documents/teaching/math_290/code
Shortcuts How to Add What's New
Current Folder
« code
Name
hello_world.m
Details
Start
Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
Workspace
Select...
Name
Value
Command History

```
>> hello_world
```

```
a * inv(a)
a = [1 2 3 ; 4 5 6 ; 7 8
a * inv(a)
a = [1 2 3 ; 4 5 6 ; 7 8
a * inv(a)
x
y = sin(x)
plot(y,x)
plot(y)
printf('hello world')
print('hello world')
fprintf('hello world')
hello_world
clc
```

Output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Workspace
Select...
Name
Value
Command History

```
this is my first program
hello world
fx >>
```

```
a = [1 2 3 ; 4 5 6 ; 7 8
a * inv(a)
a = [1 2 3 ; 4 5 6 ; 7 8
a * inv(a)
x
y = sin(x)
plot(y,x)
plot(y)
printf('hello world')
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hello_world
clc
hello_world
```

Homework

- Read sections 1-17 to 1-23
- Email me by Tuesday at 12:01am a onyen.m file which when run does the following (and is commented at the top of the file with your full name and who you worked with, if anyone):
  - Generates a figure which plots $y = sin(x) + c$ for *ten* values of c (all on the same figure).
  - Generates the figure in section 1-23.