ENGR 105: Introduction to Scientific Computing

Function vs. Scripts, Functions as Black Boxes, Interacting with Functions and Scripts, Discussion on Complexity, Variables, and Arrays

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Additional resources for Essential Matlab

- M-files for the 4th ed. of Essential Matlab are located at: http://www.elsevierdirect.com/v2/companion.jsp?ISBN=9780123748836
- May or may not match with examples in 5th ed.
- I recently inquired with publisher to find out if files specific to 5th edition exist

Digital Version of Essential Matlab

- Do not contact anyone about availability of the digital edition - I will do this
- May be available today...or tomorrow!
- You can access it at: http://www.sciencedirect.com/science/book/9780123943989#ancpt005

Upcoming quizzes and HW

Lab quiz #1

- Wednesday 9/11
- Covers lecture slides up to 9/9, Ch. 1 and 2 of Essential Matlab, and "All I need to know...I learned in kindergarten"
- Taken at the beginning of lab - 10 min. time limit
- No Googling, looking up answers, using MATLAB during the quiz
- May NOT be taken before the start of lab
- Primarily multiple choice

Homework comments

HW #1

- Due by 11:59 pm on Wednesday 9/11
- Follow submission instructions

HW #1 / Problem #1

- You should produce an array of the same dimensions as the example provided
- The random numbers in your example...will be random!

Problem 1 (10 pts): Consider the following array of random numbers constructed in MATLAB with a *for* loop

```
for jj = 1:20
    randArr(jj) = rand;
end
```

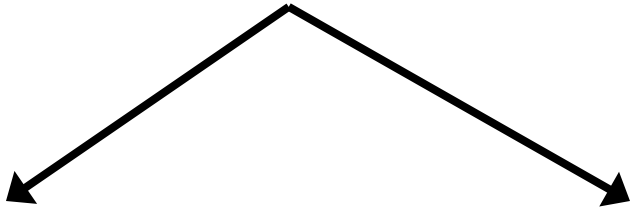
where `rand` assigns a random number.

Produce an array of random numbers, `randArr2`, with the same dimensions as in the example above but using a single line of code and without the use of a for loop. Helpful hint: check the MATLAB help section for `rand`.

Random question for candy

Functions vs. scripts

M-file: any set of instructions stored in a MATLAB file



Function

```
function d = myFunFunction(a,b,c)
% Takes scalar values a, b, and c,
modifies and sums the values

% Modifying the input values
var1 = 2*a;
var2 = b^2;
var3 = sqrt(c);

% Calculating the output
d = var1 + var2 + var3;
```

Script

```
% Define values of scalars a, b, and
c
a = 1;
b = 2;
c = 15;

% Modifying the scalar values a, b,
and c
var1 = 2*a;
var2 = b^2;
var3 = sqrt(c);

% Calculating the sum of the modified
scalar values
d = var1 + var2 + var3;
```

Commonalities between functions and scripts

- Both stored in M-files
- Both modified using the "Editor" window
- Standalone pieces of code
- Can be called from the command window or other functions

Why use scripts?

What is a Matlab "script"

- MATLAB M-file where all variables, constants, etc. are called within the file

Why develop code with a "script"

- You may want to develop multiple lines of code to solve a problem
- Consistently typing that code into the command window can become laborious / doesn't "save" your code
- You can rapidly comment out and adjust syntax to debug your code

Why use functions?

What is a function?

- A MATLAB M-file that starts with `function`
- Generally, you need to pass information into the function and the function returns one to several results

Why use functions?

- The function serves as a black box of code
- Its functionality has been tested / verified and it can be called at any time without questioning the output
- Long, complicated computations can be broken into multiple, smaller pieces of code

How to specify / use a function

Establishing a function requires a specific syntax

- For a single output and input

```
function output = myFunc(input)
```

- For multiple outputs and inputs

```
function [output1,output2,output3] =
myFunc(input1,input2,input3)
```

*Note: this would be on a single line

Naming / saving a function

- Must start with a letter from the alphabet (a through z)
- The name used to save the function needs to be the function name

Interacting with a function

How do I "call" a function

- Initiate function execution from the command line - make sure you include the inputs! (DEMO)
- Functions can be called from other functions (DEMO)

I called a function - where did my variables go?

Unless cleared, variables will persist for "scripts", but not for functions

- Whatever happens in a function, stays in a function
- For instance, a variable, myVar, could be invoked in myFunction1 and resulting in myOut, which is returned to another function, say myFunction2 - this function could also use myVar without retaining "memory" of myVar as invoked in myFunction1
- DEMO - retention of workspace variables for a "script" but not for a function

Inspecting variables in a function

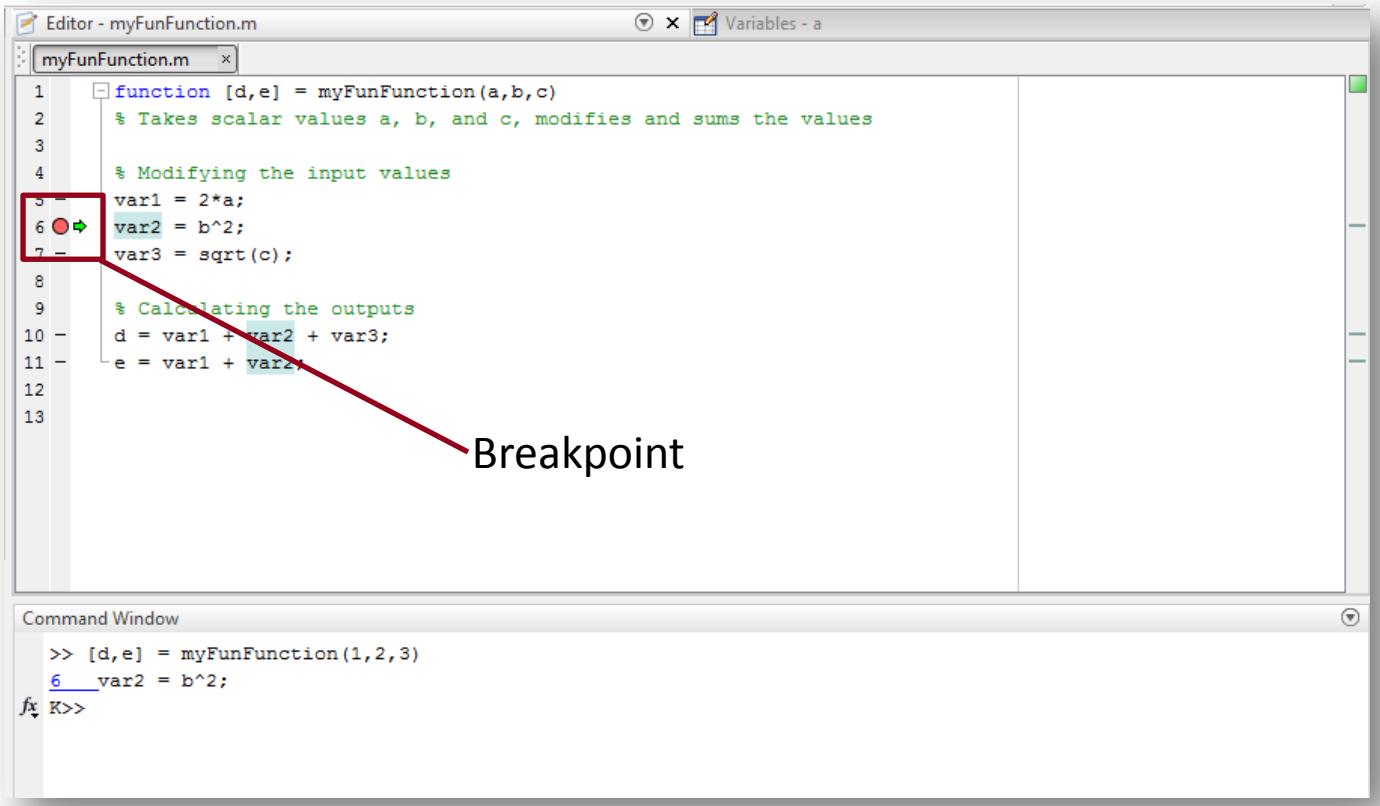
Option #1: Enable command line output (do not suppress output using ";")

- For instance, a function has the following line of code

```
var1 = 2*x+3*y+z^2  % Result will print to
the command line
var1 = 2*x+3*y+z^2; % Result will NOT print
to the command line
```

Inspecting variables in a function

Option #2: Enable a breakpoint



Cleaning up your MATLAB workspace and command line

Variables held in memory can be cleared using the `clear` command or by manually by selecting and deleting variables

- Do NOT invoke the `clear` command within a "function"
- `clear` can be called within a "script" or from the command line

The command window may be cleared using the `clc` command

Commenting functions / scripts

The general rule is at least one comment for every three lines of code

- Proper commenting helps others understand, add to, or debug your code
- Proper commenting helps the instructors grade your assignments

Commenting / uncommenting large swaths of code

- Highlight a selection or place your cursor on a line and press "ctrl+r" to comment a section or line of code, respectively
- "ctrl+t" uncomments the code

Solving real problems - start from simple and build to complex

In class discussion

Interacting with variables and arrays

In class discussion