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MATLAB

m-files basics: function

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M-files

- ASCII text files that contain sequences of MATLAB commands (.m file extension)
- 2 kinds of M-files:
  - **script files** - automate long sequences of commands
  - **function files** - extend MATLAB by developing new commands
- Can be created in MATLAB editor or an editor of your choice

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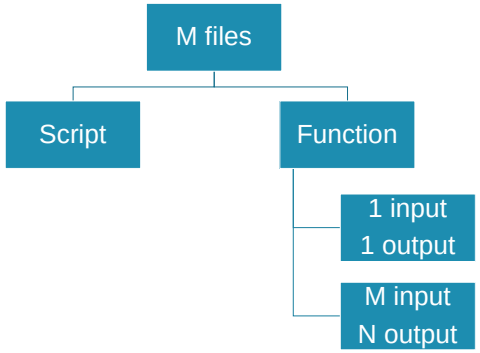

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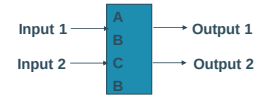
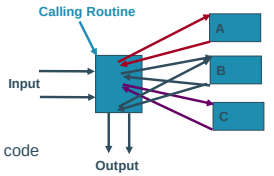
Why functions?

- Decompose the problem
  - Break a large block of code into several smaller functions
  - Reduce complexity of the overall code
  - Isolate complex operations
- Reuse
  - Avoid duplicate code
- Encapsulation
  - Local variables
  - Easier to develop in a team
- Maintenance
  - Make debugging and error isolation easier
  - Limit the effect of changes to specific sections of the code





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Automate?

- MATLAB Command prompt: enter commands to be executed immediately
  - You can see what you've done but it must be re-entered at the command prompt to be recalculated
  - Only the results (variables) are retained in the MATLAB workspace
- Calculate surface of a triangle

```
>> b = 5;
>> h = 3;
>> a = 0.5*(b * h)
```

  - What if you want to enter different values for b and h?
- *File: geometric_object_v1.m*
- *File: geometric_object_v2.m*
- *File: geometric_object_v3.m*

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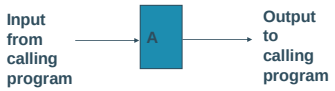
Function

- function: a module that
  - takes in input,
  - does something with it,
  - produces output.
- The inner details of the function and its variables are hidden from the user.
- The user only deals with input and output.
  - Functions can have X inputs and Y outputs
  - Functions can call other functions
  - Functions can make a call to themselves

"Black Box"



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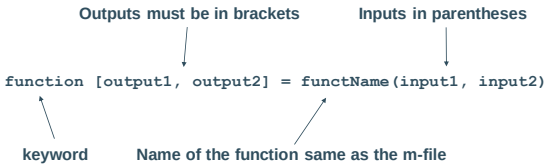
Function Declaration



Note:
use of [] and ()
functions will end on one of two conditions (you do not use an "end" statement to end them)
1) There are no more commands to execute
2) A end statement is encountered … advisable

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Function: Naming Convention

- Starts with a character, ends with the extension .m
- Can contain: character, number and _
- Although function names can be of any length, MATLAB uses only the first N characters of the name (where N is the number returned by the function `namelengthmax`)
- Do not use a variable with the same name as a generic MATLAB function or command, it can make command unusable

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Function: specific

- First line starts with keyword **function**
- Code is built in memory at **first** call
- Variables are stored in a workspace internal to the function
  Variables in a function file are by default local. However, you can declare a variable to be global if you wish.
- Can accept input arguments and return output arguments
- useful for extending the MATLAB language for your application.
  Function files provide extensibility to MATLAB. You can create new functions specific to your problem which will then have the same status as other MATLAB functions.

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Function

- Ingredients:
  - Function definition
  - H1-line
  - Help text
  - Body
  - Comments

```
function f = fact(n)                    Function definition line
% Compute a factorial value.           H1 line
% FACT(N) returns the factorial of N,   Help text
% usually denoted by N!

% Put simply, FACT(N) is PROD(1:N).     Comment
f = prod(1:n);                          Function body
```

- Function definition

```
function y = function_name(x)
```

  - function: key word
  - y: output argument (Results must be stored in variable(s) with the same name as the output arguments)
  - function_name: function name
  - x: input argument

```
function printresult(x) or function [] = printresult(x)
function [x, y, z] = sphere(theta, phi, rho)
```

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Summary: Function vs Script

script

- execute a series of MATLAB statements.
- no arguments.
- operates on data in workspace
  - Data can already be in workspace
  - Leaves the data in the workspace
- scripts share the workspace they are called from.
- scripts are useful for tasks that don't change.
- *File: script_as_function.m*

function

- can accept input arguments and return output arguments.
- internal variables local to function by default.
- useful for extending functionality of MATLAB (create your own functions).
- functions are much more flexible.

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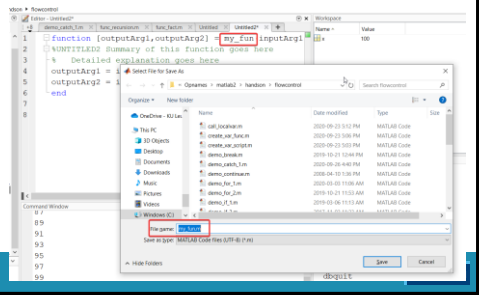
Save a function

- The file name needs to be the same as the function name



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