MATLAB Tutorial 03

ENME 303 Computational Methods for Engineers

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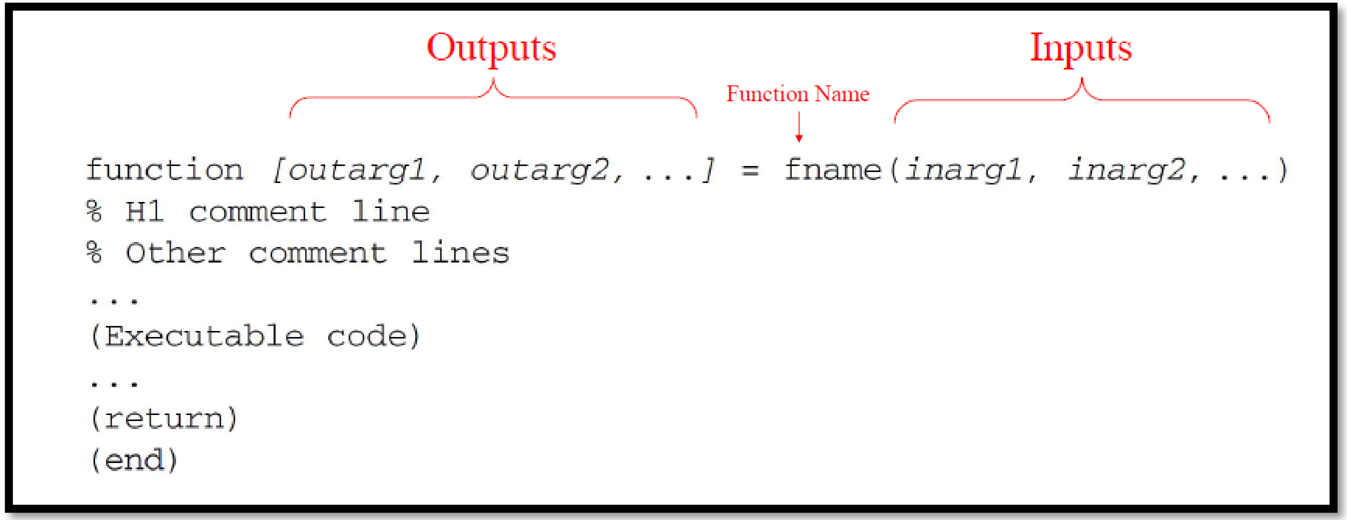
Ways to Define Functions in MATLAB

- Function in a Script File
  - Function with One Output
  - Function with Multiple Outputs
- Function at the end of a Script File
- Multiple Functions in a Function File
- Anonymous Functions

Function in a Script

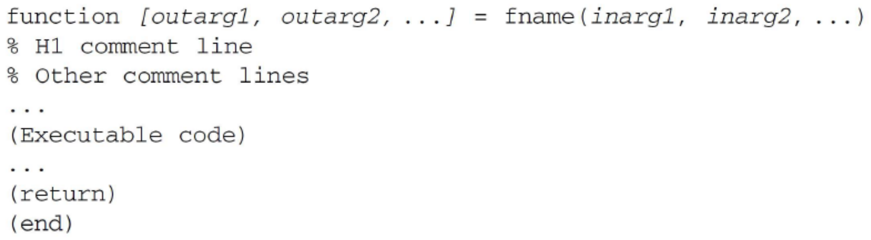
- Each ordinary MATLAB function should be placed in a file with the same name (including capitalization) as the function along with the file extension ".m". For example, if a function is named My_fun, that function should be placed in a file named My_fun.m.



```
function [outarg1, outarg2, ...] = fname(inarg1, inarg2, ...)
% H1 comment line
% Other comment lines
...
(Executable code)
...
(return)
(end)
```

Function in a Script

- A function is invoked by naming it in an expression together with a list of actual arguments. A function can be invoked by typing its name directly in the Command Window or by including it in a script file or another function.



```
function [outarg1, outarg2, ...] = fname(inarg1, inarg2, ...)
% H1 comment line
% Other comment lines
...
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(return)
(end)
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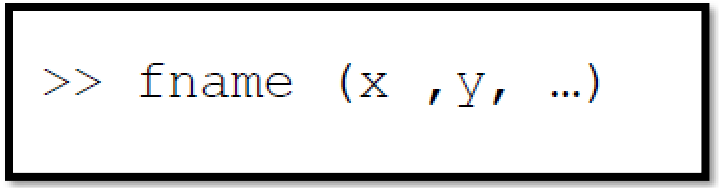


```
>> fname (x ,y, …)
```

Function with One Output

Define a function in a file named calculateAverage.m

```
function ave = calculateAverage(x)
    ave = sum(x(:))/numel(x);
end
```

Invoking the function in a script saved in the same directory as the function file.

```
z = 1:99;
ave = calculateAverage(z)
```

```
ave =
    50
```

Function with Multiple Outputs

Define a function in a file named stat.m

```
function [m,s] = stat(x)
    n = length(x);
    m = sum(x)/n;
    s = sqrt(sum((x-m).^2/n));
end
```

Invoking the function in a script saved in the same directory as the function file.

```
values = [12.7, 45.4, 98.9, 26.6, 53.1];
[ave,stdev] = stat(values)
```

```
ave =
   47.3400
stdev =
   29.4124
```

Function at the end of a Script File

Defining and invoking the function in the same script.

```
clc; clear

x = 2*pi/3;
y = myIntegrand(x);


function y = myIntegrand(x)
    y = sin(x).^3;
end
```

```
y =

   0.649519052838329
```

Multiple Functions in a Function File

Define two functions in a file named stat2.m, where the first function calls the second.

Note that function avg is a local function. Local functions are only available to other functions within the same file.

```
function [m,s] = stat2(x)
    n = length(x);
    m = avg(x,n);
    s = sqrt(sum((x-m).^2/n));
end

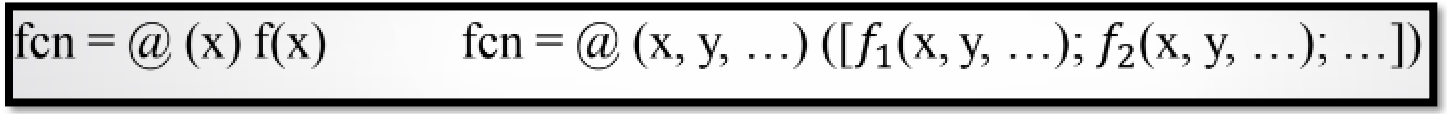
function m = avg(x,n)
    m = sum(x)/n;
end
```

```
values = [12.7, 45.4, 98.9, 26.6, 53.1];
[ave,stdev] = stat2(values)
```

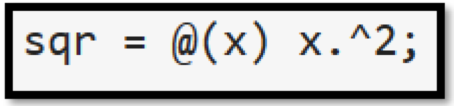
```
ave =
   47.3400
stdev =
   29.4124
```

Anonymous Functions

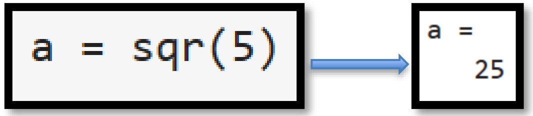
Anonymous functions allow you to define a function without creating a program file, as long as the function consists of a single statement. A common application of anonymous functions is to define a mathematical expression, and then evaluate that expression over a range of values.



$\text{fcn} = @\,(x)\ f(x) \qquad \text{fcn} = @\,(x, y, \ldots)\ ([f_1(x, y, \ldots);\ f_2(x, y, \ldots);\ \ldots])$



```
sqr = @(x) x.^2;
```



```
a = sqr(5)
```

```
a =
   25
```

Thanks!