

MA2252 Introduction to Computing

Lecture 5: Functions

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Learning outcomes

- Basic understanding of functions
- Create your own functions
- Using Comments in programming
- Understand Function Workspace

Function definition

A function in MATLAB is a sequence of instructions that takes some input and gives the desired output.

Some familiar examples:

- $\sin(x)$
- $\text{sqrt}(x)$
- $\text{linspace}(a,b,n)$

x is input variable
 $\text{sqrt}(4) = 2$
 $x = 4$

$y = \text{sqrt}(x)$

$y = 2$

lines of code
in a sequence

input: you give
values to
input variables

Note: Unlike in Mathematics, a function in MATLAB can have multiple outputs!

output: you get some
values of
output variables

Building a function

A function's code is written in the EDITOR window.

The code is built in three parts:

- Header
- Body
- End statement

Header

Construction:

`function` [output variables] = function_name(input variables)

function [n] = mysum(a, b)

Header includes:

- name of function
- lists of input variables
- lists of output variables

Building a function (contd.)

Header examples:

- `function [sum] = myfun1(n)`
- `function [sum] = myfun2(a,d,n)`
- `function [sum,a_n] = myfun3(a,d,n)`
 $\downarrow a+(n-1)d$

Note: Function name must start with a letter, contain alphanumeric characters or underscore.

$$\begin{aligned} 1, 2, 3, \dots, n \quad \text{Sum} &= \frac{n(n+1)}{2} \\ \text{Sum} &= 1 + 2 + \dots + n \\ \text{Sum} &= n + (n-1) + \dots + 2 + 1 \\ \hline 2 \times \text{Sum} &= (n+1) + (n+1) + \dots + (n+1) \\ &= n \times (n+1) \\ \text{Sum} &= \frac{n(n+1)}{2} \end{aligned}$$

$$\text{Sum} = \frac{n}{2} [2a + (n-1)d] \quad \underbrace{a, a+d, a+2d, \dots, a+(n-1)d}_{n \text{ terms}}$$

Body

Group of statements or lines of code written to perform the desired task.

Body examples:

- $\text{sum} = n * (n + 1) / 2;$

- $\text{sum} = (n / 2) * (2 * a + (n - 1) * d);$

- $\text{sum} = (n / 2) * (2 * a + (n - 1) * d);$
 $a_n = a + (n - 1) * d;$

myfun1()

→ myfun2()

→ myfun3()

End statement

The end statement is written using `end` keyword which

- denotes end of function
- is placed after the body

Building a function (contd.)

A sample function:

```
function [sum,a_n] = myfun3(a,d,n)
```

```
sum=(n/2)*(2*a + (n-1)*d);
```

```
a_n=a+(n-1)*d;
```

```
end
```

Demo

Saving a function file

- Use 'Ctrl+S' or 'Save' button in EDITOR menu to save the function file.
- Always save the function file with the function name.
- If using MATLAB online, save your function in the current directory.
- Function files are saved as .m file files.

Calling a function

- To call/use the function, type

~~function~~ [output variables] = function_name(input variables' values)

in the command window and press 'Enter'.

- Example:

sum, a-n

2, 4, 6, 8, 10, 12, 20

~~sum~~ SUM

= ~~50~~ 110

myfun3

~~function~~ [SUM, A_N] = ~~function_name~~(2, 2, 10)

A_N = 20

Demo

Comments

Comments are text in the .m file that MATLAB doesn't execute.

MATLAB ignores comments

Comments are used

- to help you and others understand your code.
- to add additional information e.g. author name, date, notes.

To comment: Use % symbol or press 'Ctrl + r'.

To uncomment: Use 'Ctrl + Shift + r'.

→ command + /

command + t → works in both (online & offline)
← Ctrl + t → doesn't work in MATLAB online

Demo

Function Workspace

A function workspace contains variables which were used to create that function.

Example: The function workspace of `myfun3()` contains the variables `sum`, `a_n`, `a`, `d` and `n`.



Note: A function workspace does not share variables with command window workspace and vice-versa.

↓ This is because there is no overlap, confusion & also users have their freedom to name their variable

Activity 1

Define the function myfun3() as mentioned before. Type the following in MATLAB command window:

```
>> a=3;
```

```
>> d=4;
```

```
>> n=7;
```

```
>> [SUM,A_N]=myfun3(1,1,10);
```

function [sum, a_n]
= myfun3(a,d,n)
sum = $\frac{n}{2} [2*a + (n-1)*d]$;
a_n = $a + (n-1)*d$;

$$\frac{n(n+1)}{2} = \frac{10 \times 11}{2} = 55 \text{ end}$$

What should be the final values of a,d and n?

Student 1 a=1, d=1, n=10, sum=55
Student 2 a=3, d=4, n=7

Activity 2

→ using clear all
in command
window

Clear all the stored variables. Now, type the following in MATLAB command window:

```
>> sum=1;  
>> a_n=1;  
>> [SUM,A_N]=myfun3(1,1,10);
```

→ in command
window
workspace

What should be the final values of sum and a_n?

In variable names, lower & upper
case matters!

End of Lecture 5

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