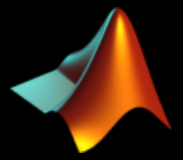

Programming with MATLAB

For-loops

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For-loops *aka* iterations

With a *for-loop* you can repeat an operation several times

```
for a = 1:10
    disp(a)
end

% The variable a is a "counter" that instructs Matlab how many times to
% display the value of a
% No matter whether you write a = 1:10 or a = 11:20 or a = 1111:1120,
% the loop will be executed 10 times
```

For-loops *aka* iterations

Another example

```
for v = 2:2:10
    disp(v)
end

% The loop will be executed 5 times, because there are 5 elements
% in the vector 2:2:10
%
% Do not forget to always close the loop with an end
```

For-loops *aka* iterations

Another example

```
for v = 1:3
    v = v + 2;
end

% In the first iteration, the counter v will be equal to 1
% In the next line, v will be equal to v+2, so 1 + 2, so v = 3
% Once the loop reaches the end, v will be set back to 2
% So, in the second iteration, v has a value of 2, and therefore is then set
% to v = 2 + 2 = 4
```

Debug a for-loop

Let's do the loop execution in slow motion

```
for v = 1:3
    v = v + 2;
    keyboard
end

% The function keyboard returns the control back to the user (to you)
% In other words, it temporarily interrupts the execution and waits
% from you to type in a command
% This will be reflected in a K before the prompt on your command
% window (K>>)
% You can now evaluate a variable. Type v to see the current value of v
% Type dbcont or dbquit to resume or quit execution, respectively
```

Debug generally

Use *keyboard* to debug also other programs

```
v = 18;
if v > 10
    keyboard
    disp('I am here')
else
     disp('sorry')
end

% Will the keyboard be activated in this example?
% If yes, will you get any message on your command window before
%          interruption of the execution?
% If yes, what will this message be?
```

Debug generally

Calculate the sum of the first 10 natural numbers

```
mysum = 0;
for z = 1:10
    keyboard
    mysum = z + mysum;
    keyboard
end

% The variable mysum is defined as zero before the loop in order to help
%          us assign in there the values of z one after each other
% Use keyboard to observe the value of z and of mysum in each iteration.
% Do this step-by-step and play around with different values of z
```

Let's now *print* something

Use *fprintf* to present formattable stuff on the command window

```
for v = 1:3
    fprintf('the value of our variable is: %d\n', v)
end

% The %d is a placeholder: We instruct Matlab to place a variable at this
%           position. The d indicates that we want to place a double (number)
% Which number? The one mentioned right after the quotes (here, v)
% The statement /n instructs Matlab to introduce a new line after the text
% What happens if we do not specify a variable after the quotes?
% The placeholder will become invalid and Matlab will ignore everything after
%           the invalid placeholder. Try these out.

% Look for help to explore more options:
% help fprintf
% Also: help sprintf
```

Back to for-loops

Create the temperature example

```
rng(1)
temperature = randi([-2 15], 1, 14);

for day = 1:length(temperature)
    if temperature(day) >= 1
        disp('temperature is positive')
    elseif temperature(day) == 0
        disp('temperature is zero')
    else
        disp('temperature is negative')
    end
end
```

Back to for-loops

Add keyboards to observe how the loop behaves. For example:

```
for day = 1:length(temperature)
    temperature(day)        % present this variable
    keyboard        % stop the program and think about what you see
    if temperature(day) >= 1
        disp('temperature is positive')
    elseif temperature(day) == 0
        disp('temperature is zero')
    else
        disp('temperature is negative')
    end
end
```

A more complex scenario

Add keyboards to observe how this nested loop behaves. Which loop is executed first? What should the result be?

```
for a = 1:10
    for b = 1:8
        c(a, b) = a + b;
    end
end
```

What will happen if you set a = 2:10, instead to a = 1:10? Think about it first, then try it out.

Have fun!