

## MATLAB Marina: Iteration, while loops

### Student Learning Objectives

After completing this module, one should:

1. Be able to explain the operation of a while loop.
2. Be able to use while loops to iteratively execute blocks of statements.

### Terms

iteration, loop, sentinel

### MATLAB Functions, Keywords, and Operators

while, end

### While Loops

While loops are event controlled loops and are used when the number of repetitions for the operations in the loop body is not known. For loops are counter controlled loops and the loop body is repeated a set number of times,

### While Statements

A `while` statement (while loop) operates according to the flowchart of Figure 1a. The general syntax of a `while` statement is shown in Figure 1b.

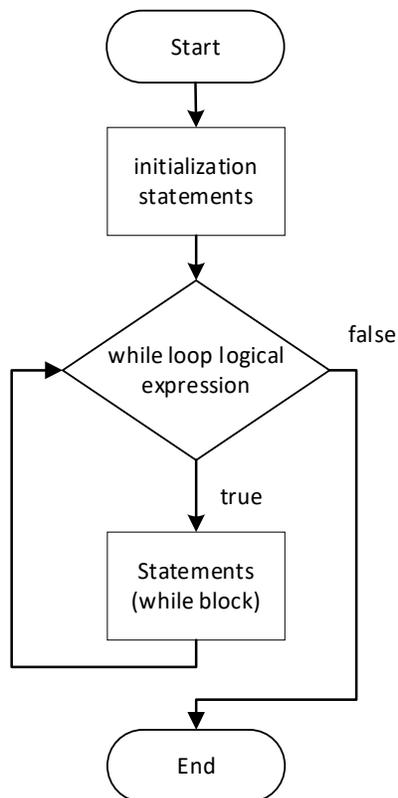


Figure 1a. while Statement Flowchart

---

```
initialization statements
while (logical expression)
    statements to be executed while logical expression is true
end
```

---

Figure 1b. General Form of while Statement

The `while` statement is characterized by loop expression and a block of statements to execute. The expression should be a logical expression that evaluates to a scalar Boolean. While statements are sentinel-controlled loops and will execute the block of statements as long as the result of the loop control logic expression is true. The number of times the while loop body will be executed is not known at the start of the loop. Note that `while` statements must be terminated with the `end` keyword.

The `while` statement operates as follows:

- The initialization statement(s) set up needed starting conditions such as initialize the variables used on the loop control logical expression. Generally, the initialization sets up conditions that allow the logical expression to evaluate to true so the while loop is entered although there are cases for which the loop is never entered.
- The loop control expression is evaluated.
- The statements between the `while` and `end` keywords are executed if the logic expression evaluates to true. The loop is ended if the expression evaluates to false.
- This is repeated from the second step until the expression evaluates to false.

Variables used in the loop control expression must be initialized before the while loop and the variables used in the control expression should be updated in the while loop body otherwise an infinite loop may occur. It is possible to never execute the while loop body since the while loop logical expression test is performed first.

### Counting using a While Statement

The MATLAB program of Figure 2 shows counting from 2 to 20 by 2s using a `while` loop.

---

```
% counting from 2 to 20 by 2s
clear; clc;
count = 2;
while (count <= 20)
    fprintf('%d ', count);
    count = count + 2;
end
fprintf('\n');
```

---

Figure 2. MATLAB Program to Count from 2 to 20 by 2s

Before the while loop, the initial count is set to 2. The variable `count` is the controlling variable in the loop control logic expression. The loop counts from 2 to 20 as follows:

- The while loop control expression, `count <= 20`, is evaluated. For the first iteration, `count = 2` and `2 <= 20` is true.
- The loop body is executed since the control expression evaluated to true. In this example the loop body is a print statement and an update of the count.
- For all subsequent iterations, the loop control expression is evaluated for the current value of count (4 for the second iteration, 6 for the third iteration, and so on) and as long as the count is 20 or less, the loop body statements are executed.
- This is continued until the variable `count` is 22 and the loop control logical expression is false.

Once the loop is finished, the variable `count` will hold 22; the last value it was assigned in the loop body.

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