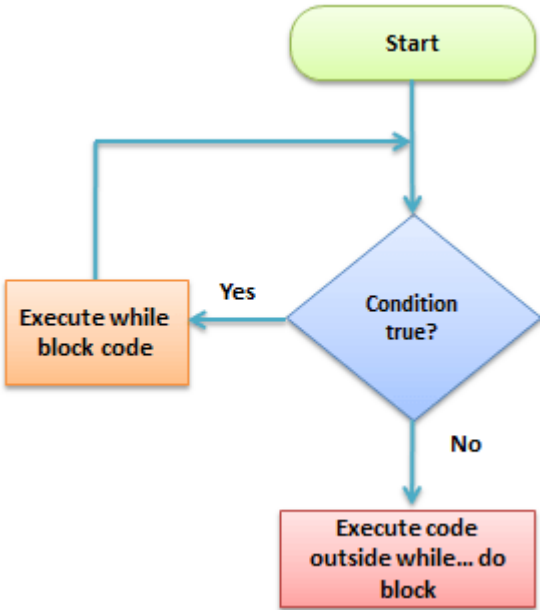
What are Loops?
A **Loop** executes the sequence of statements many times until the stated condition becomes false. A loop consists of two parts, a body of a loop and a control statement. The control statement is a combination of some conditions that direct the body of the loop to execute until the specified condition becomes false. The purpose of the loop is to repeat the same code a number of times.

Types of Loops
Depending upon the position of a control statement in a program, a loop is classified into two types:
1. Entry controlled loop
2. Exit controlled loop

In an **entry controlled loop,** a condition is checked before executing the body of a loop. It is also called as a pre-checking loop.

In an **exit controlled loop**, a condition is checked after executing the body of a loop. It is also called as a post-checking loop.



The control conditions must be well defined and specified otherwise the loop will execute an infinite number of times. The loop that does not stop executing and processes the statements number of times is called as an **infinite loop**. An infinite loop is also called as an "**Endless loop**." Following are some characteristics of an infinite loop:

1. No termination condition is specified.

2. The specified conditions never meet.

The specified condition determines whether to execute the loop body or not.
'C' programming language provides us with three types of loop constructs:

1. The while loop

2. The do-while loop

3. The for loop

While Loop

A while loop is the most straightforward looping structure. The basic format of while loop is as follows:

```
while (condition)
{
        statements;
}
```

It is an entry-controlled loop. In while loop, a condition is evaluated before processing a body of the loop. If a condition is true then and only then the body of a loop is executed. After the body of a loop is executed then control again goes back at the beginning, and the condition is checked if it is true, the same process is executed until the condition becomes false. Once the condition becomes false, the control goes out of the loop.

After exiting the loop, the control goes to the statements which are immediately after the loop. The body of a loop can contain more than one statement. If it contains only one statement, then the curly braces are not compulsory. It is a good practice though to use the curly braces even we have a single statement in the body.

In while loop, if the condition is not true, then the body of a loop will not be executed, not even once.

Do-While loop

A do-while loop is similar to the while loop except that the condition is always executed after the body of a loop. It is also called an exit-controlled loop.

The basic format of while loop is as follows:

```
 Do
{
  statements
} while (expression);
```

As we saw in a while loop, the body is executed if and only if the condition is true. In some cases, we have to execute a body of the loop at least once even if the condition is false. This type of operation can be achieved by using a do-while loop.

In the do-while loop, the body of a loop is always executed at least once. After the body is executed, then it checks the condition. If the condition is true, then it will again execute the body of a loop otherwise control is transferred out of the loop.

Similar to the while loop, once the control goes out of the loop the statements which are immediately after the loop is executed.

The critical difference between the while and do-while loop is that in while loop the while is written at the beginning. In do-while loop, the while condition is written at the end and terminates with a semi-colon (;)

For loop

A for loop is a more efficient loop structure in 'C' programming. The general structure of for loop is as follows:

```

for (initial value; condition; incrementation or decrementation )
{
  statements;
}
```

- The initial value of the for loop is performed only once.
- The condition is a Boolean expression that tests and compares the counter to a fixed value after each iteration, stopping the for loop when false is returned.

- The incrementation/decrementation increases (or decreases) the counter by a set value.

Break Statement

1. It is used to come out of the loop instantly. When a break statement is encountered inside a loop, the control directly comes out of loop and the loop gets terminated. It is used with if statement, whenever used inside loop.
2. This can also be used in switch case control structure. Whenever it is encountered in switch-case block, the control comes out of the switch-case(see the example below).

Continue Statement

The **continue statement** is used inside loops. When a continue statement is encountered inside a loop, control jumps to the beginning of the loop for next iteration, skipping the execution of statements inside the body of loop for the current iteration.

Switch Case Statement

he switch statement allows us to execute one code block among many alternatives. You can do the same thing with the `if...else..if` ladder. However, the syntax of the `switch` statement is much easier to read and write.

Syntax of switch...case

```
switch (expression)
{
   case constant1:
     // statements
     break;

   case constant2:
     // statements
     break;
   .
   .
   .
   default:
     // default statements
}
```

How does the switch statement work?

The `expression` is evaluated once and compared with the values of each `case` label.

- If there is a match, the corresponding statements after the matching label are executed. For example, if the value of the expression is equal to `constant2`, statements after `case constant2:` are executed until `break` is encountered.
- If there is no match, the default statements are executed. If we do not use `break`, all statements after the matching label are executed. By the way, the `default` clause inside the `switch` statement is optional.

```
// Program to create a simple calculator
#include <stdio.h>

void main()
{
    char operator;
    double n1, n2;

    printf("Enter an operator (+, -, *, /): ");
    scanf("%c", &operator);
    printf("Enter two operands: ");
    scanf("%lf %lf",&n1, &n2);

    switch(operator)
    {
        case '+':
            printf("%.1lf + %.1lf = %.1lf",n1, n2, n1+n2);
            break;

        case '-':
            printf("%.1lf - %.1lf = %.1lf",n1, n2, n1-n2);
            break;

        case '*':
            printf("%.1lf * %.1lf = %.1lf",n1, n2, n1*n2);
            break;

        case '/':
            printf("%.1lf / %.1lf = %.1lf",n1, n2, n1/n2);
            break;

        // operator doesn't match any case constant +, -, *, /
        default:
            printf("Error! operator is not correct");
    }


}
```