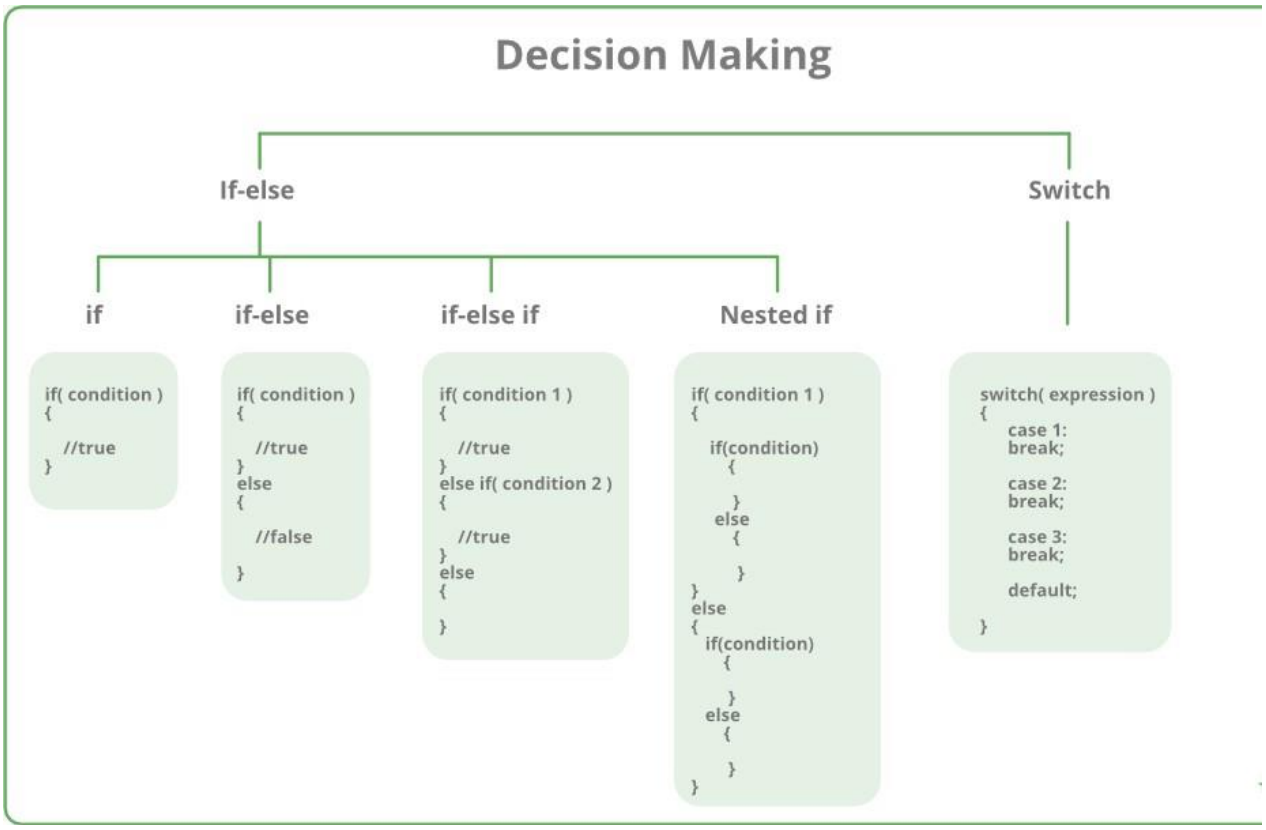
C - Decision Making

There come situations in real life when we need to make some decisions and based on these decisions, we decide what should we do next. Similar situations arise in programming also where we need to make some decisions and based on these decisions we will execute the next block of code. For example, in C if x occurs then execute y else execute z. There can also be multiple conditions like in C if x occurs then execute p, else if condition y occurs execute q, else execute r. This condition of C else-if is one of the many ways of importing multiple conditions.



Decision making statements in programming languages decides the direction of flow of program execution. Decision making statements available in C or C++ are:

1. if statement
2. if..else statements
3. nested if statements
4. if-else-if ladder
5. switch statements
6. Jump Statements:
    a. break
    b. continue
    c. goto
    d. return

if statement in C

if statement is the most simple decision making statement. It is used to decide whether a certain statement or block of statements will be executed or not i.e if a certain condition is true then a block of statement is executed otherwise not.

Syntax:

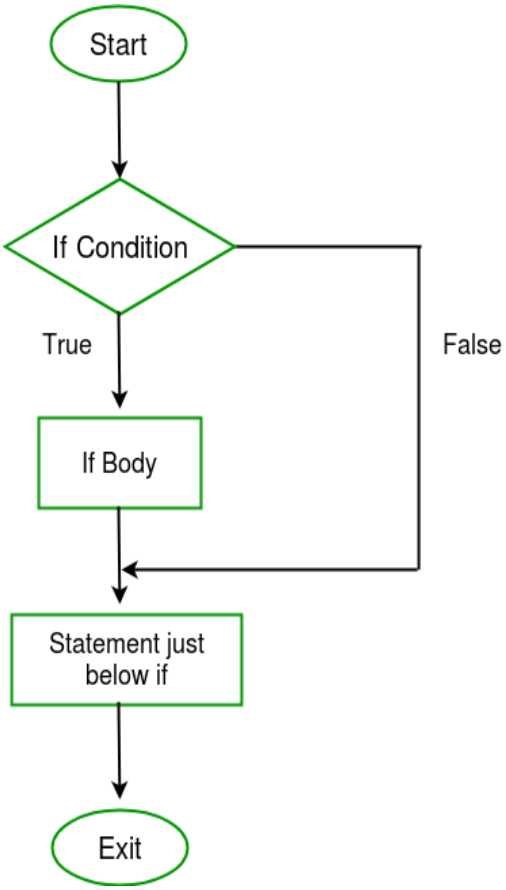
```
if(condition)
{
   // Statements to execute if
   // condition is true
}
```

Here, **condition** after evaluation will be either true or false. C if statement accepts boolean values – if the value is true then it will execute the block of statements below it otherwise not. If we do not provide the curly braces '{' and '}' after if(condition) then by default if statement will consider the first immediately below statement to be inside its block.

Example:

```
if(condition)
   statement1;
   statement2;

// Here if the condition is true, if block
// will consider only statement1 to be inside
// its block.
```

Flowchart




```
// C program to illustrate If statement
#include <stdio.h>

int main() {
    int i = 10;

    if (i > 15)
    {
       printf("10 is less than 15");
    }

    printf("I am Not in if");
}
```

Output:

```
I am Not in if
```

As the condition present in the if statement is false. So, the block below the if statement is not executed.

if-else in C

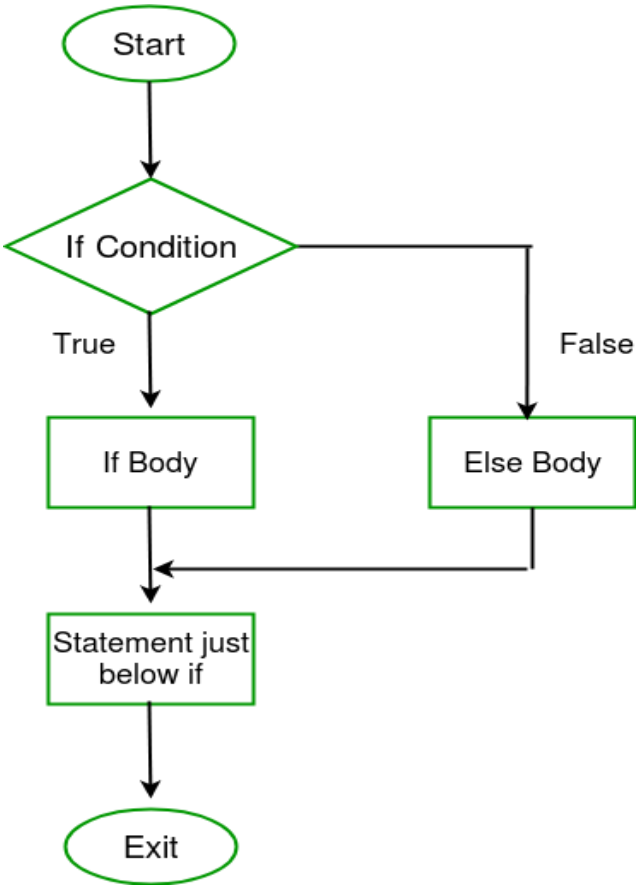
The *if* statement alone tells us that if a condition is true it will execute a block of statements and if the condition is false it won't. But what if we want to do something else if the condition is false. Here comes the

C *else* statement. We can use the *else* statement with *if* statement to execute a block of code when the condition is false.

Syntax:

```
if (condition)
{
    // Executes this block if
    // condition is true
}
else
{
    // Executes this block if
    // condition is false
}
```

Flowchart:



Example:

```
// C program to illustrate If statement
#include <stdio.h>

int main() {
    int i = 20;
```

```
    if (i < 15)
        printf("i is smaller than 15");
    else
        printf("i is greater than 15");

    return 0;
}
```

Output:

```
i is greater than 15
```

The block of code following the *else* statement is executed as the condition present in the *if* statement is false.

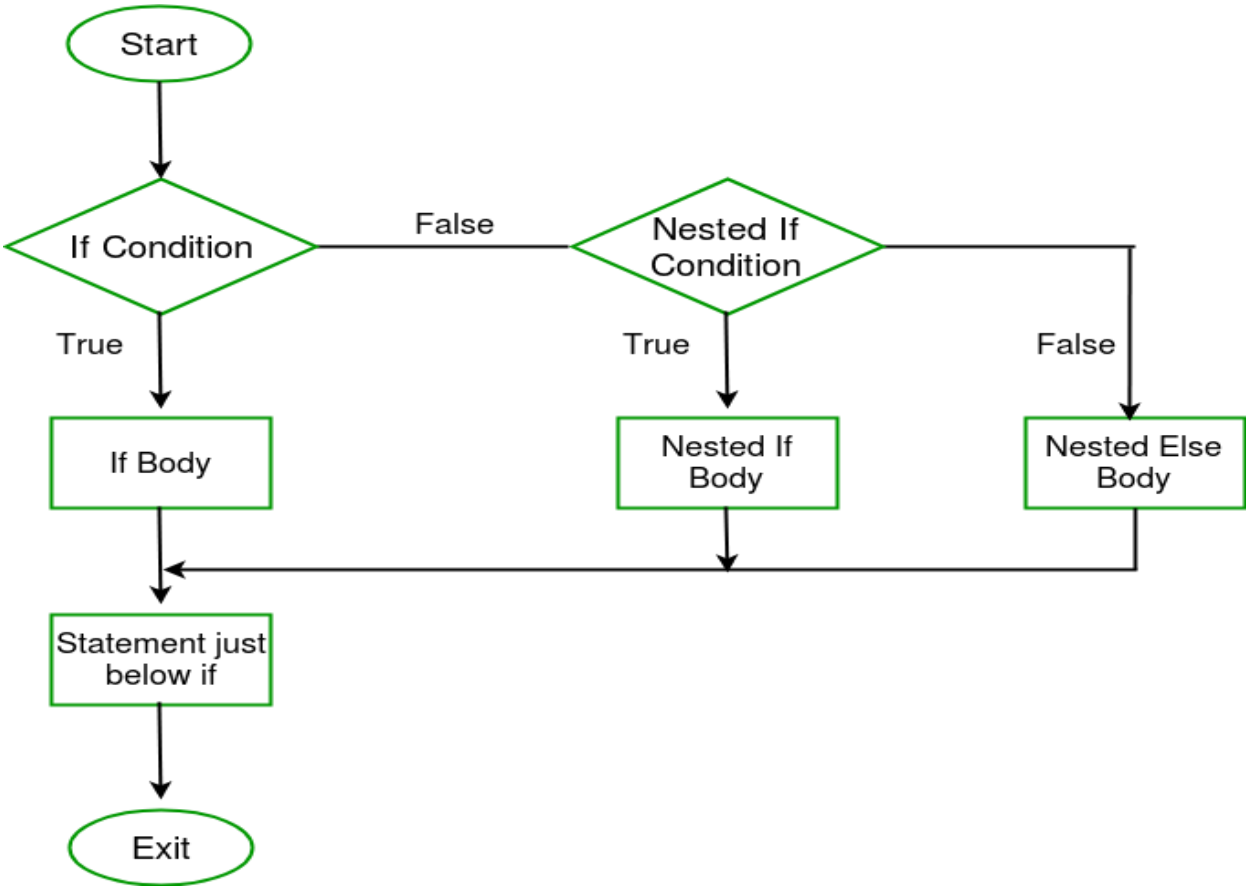
nested-if in C

A nested if in C is an if statement that is the target of another if statement. Nested if statements means an if statement inside another if statement. Yes, both C and C++ allows us to nested if statements within if statements, i.e, we can place an if statement inside another if statement.

Syntax:

```
if (condition1)
{
   // Executes when condition1 is true
   if (condition2)
   {
      // Executes when condition2 is true
   }
}
```

Flowchart



Example:

```
// C program to illustrate nested-if statement
#include <stdio.h>

int main() {
    int i = 10;

    if (i == 10)
    {
        // First if statement
        if (i < 15)
           printf("i is smaller than 15\n");

        // Nested - if statement
        // Will only be executed if statement above
        // is true
        if (i < 12)
            printf("i is smaller than 12 too\n");
        else
            printf("i is greater than 15");
    }

    return 0;
}
```

Output:

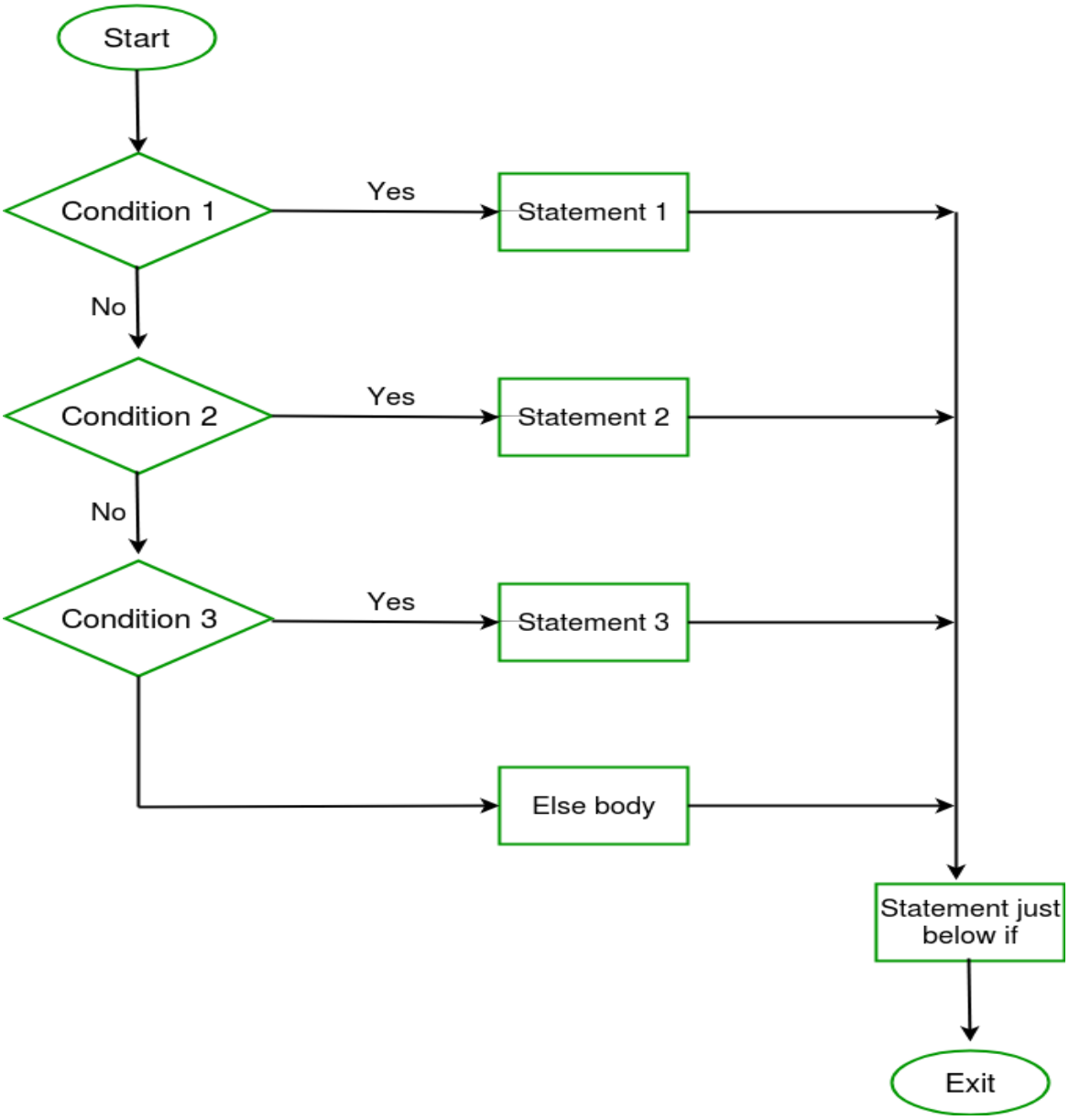
```
i is smaller than 15

i is smaller than 12 too
```

if-else-if ladder in C

Here, a user can decide among multiple options. The C if statements are executed from the top down. As soon as one of the conditions controlling the if is true, the statement associated with that if is executed, and the rest of the C else-if ladder is bypassed. If none of the conditions are true, then the final else statement will be executed.

Syntax:

```
if (condition)
    statement;
else if (condition)
    statement;
.
.
else
    statement;
```



Example:

```
// C program to illustrate nested-if statement
#include <stdio.h>

int main() {
    int i = 20;

    if (i == 10)
        printf("i is 10");
    else if (i == 15)
        printf("i is 15");
    else if (i == 20)
        printf("i is 20");
    else
        printf("i is not present");
}
```

Output:

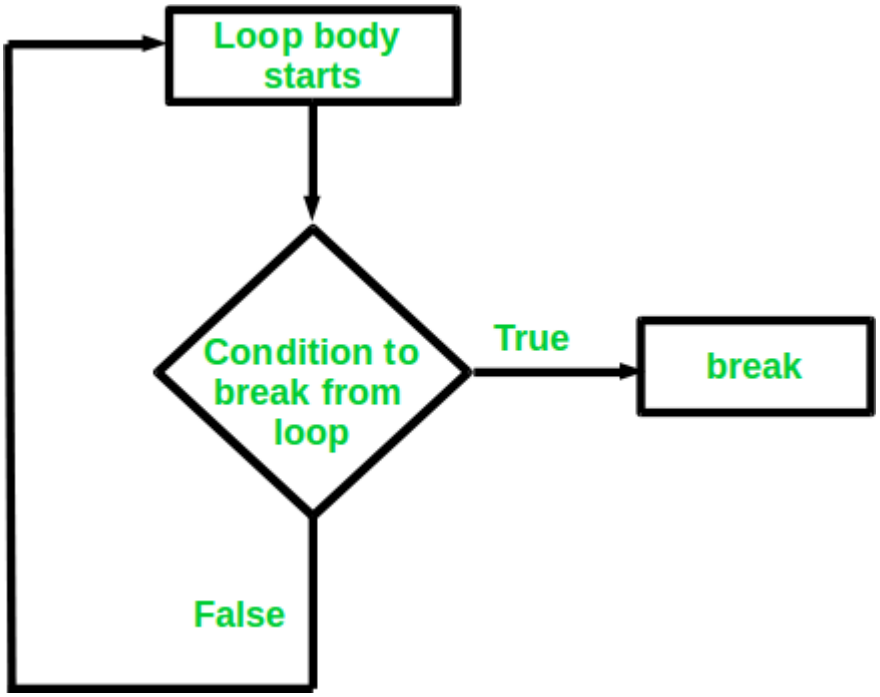
```
i is 20
```

Jump Statements in C

These statements are used in C orC++ for unconditional flow of control through out the funtions in a program. They support four type of jump statements:

1. **C break:** This loop control statement is used to terminate the loop. As soon as the break statement is encountered from within a loop, the loop iterations stops there and control returns from the loop immediately to the first statement after the loop.
   Syntax:
2. `break;`

   Basically break statements are used in the situations when we are not sure about the actual number of iterations for the loop or we want to terminate the loop based on some condition.



Example:

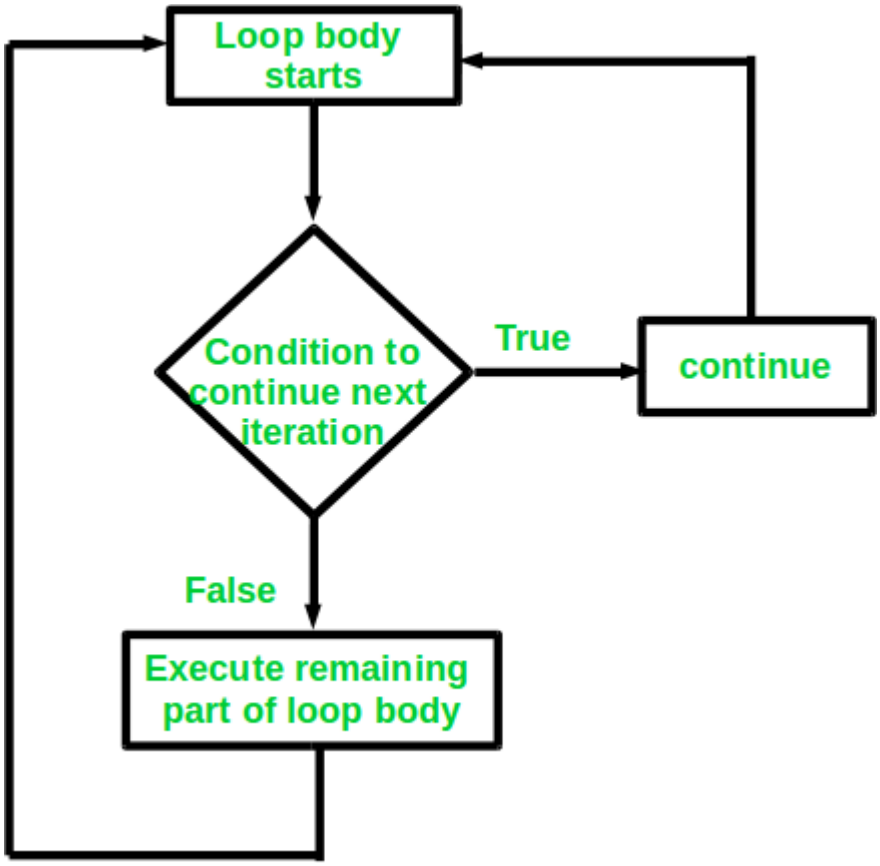
```
// C program to illustrate
// Linear Search

#include <stdio.h>

void findElement(int arr[], int size, int key)
{
    // loop to traverse array and search for key
    for (int i = 0; i < size; i++) {
        if (arr[i] == key) {
```

```
            printf("Element found at position: %d", (i +
1));
            break;
        }
    }
}

int main() {
    int arr[] = { 1, 2, 3, 4, 5, 6 };

    // no of elements
    int n = 6;

    // key to be searched
    int key = 3;

    // Calling function to find the key
    findElement(arr, n, key);

    return 0;
}
```

Output:

```
Element found at position: 3
```

3. **C continue:** This loop control statement is just like the break statement. The *continue* statement is opposite to that of break *statement*, instead of terminating the loop, it forces to execute the next iteration of the loop.
   As the name suggest the continue statement forces the loop to continue or execute the next iteration. When the continue statement is executed in the loop, the code inside the loop following the continue statement will be skipped and next iteration of the loop will begin.
   Syntax:
4.
```
continue;
```



Example:

```
// C program to explain the use
// of continue statement
#include <stdio.h>

int main() {
    // loop from 1 to 10
    for (int i = 1; i <= 10; i++) {

        // If i is equals to 6,
        // continue to next iteration
        // without printing
        if (i == 6)
            continue;

        else
            // otherwise print the value of i
            printf("%d ", i);
    }

    return 0;
}
```

Output:

```
1 2 3 4 5 7 8 9 10
```

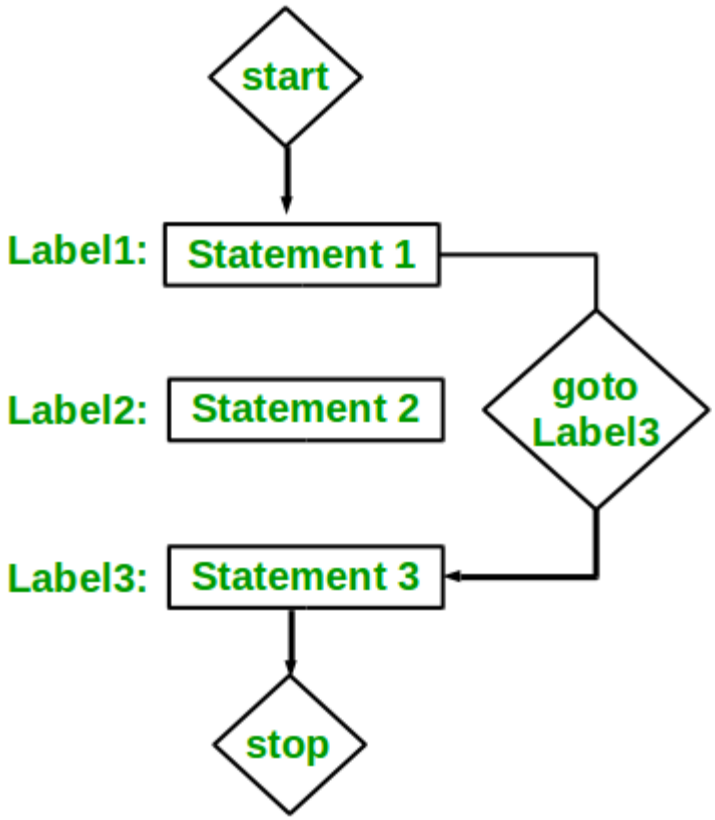
5. **C goto:** The goto statement in C/C++ also referred to as unconditional jump statement can be used to jump from one point to another within a

function.

Syntax:

```
Syntax1      |   Syntax2
-----------------------------
goto label;  |    label:
.            |    .
 .           |    .
 .           |    .
label:       |    goto label;
```

In the above syntax, the first line tells the compiler to go to or jump to the statement marked as a label. Here label is a user-defined identifier which indicates the target statement. The statement immediately followed after 'label:' is the destination statement. The 'label:' can also appear before the 'goto label;' statement in the above syntax.



Below are some examples on how to use goto statement:

Examples:

```
// C program to print numbers
// from 1 to 10 using goto statement
#include <stdio.h>

// function to print numbers from 1 to 10
```

```
void printNumbers()
{
    int n = 1;
label:
    printf("%d ",n);
    n++;
    if (n <= 10)
        goto label;
}

// Driver program to test above function
int main() {
    printNumbers();
    return 0;
}
```

Output:

```
1 2 3 4 5 6 7 8 9 10
```

13. **C return:** The return in C or C++ returns the flow of the execution to the function from where it is called. This statement does not mandatorily need any conditional statements. As soon as the statement is executed, the flow of the program stops immediately and return the control from where it was called. The return statement may or may not return anything for a void function, but for a non-void function, a return value is must be returned.

Syntax:

```
return[expression];
```

Example:

```
// C code to illustrate return
// statement
#include <stdio.h>

// non-void return type
// function to calculate sum
int SUM(int a, int b)
{
    int s1 = a + b;
    return s1;
}

// returns void
// function to print
void Print(int s2)
{
    printf("The sum is %d", s2);
    return;
}

int main()
```

```
{
    int num1 = 10;
    int num2 = 10;
    int sum_of = SUM(num1, num2);
    Print(sum_of);
    return 0;
}
```

Output:

```
The sum is 20
```