Parul® University

303105104 - Computational Thinking for Structured Design-1

Parul® University

DIGITAL LEARNING CONTENT

CHAPTER-3

Conditional Flow Statements, Iterative Statements, Jumping Statements and Pointers

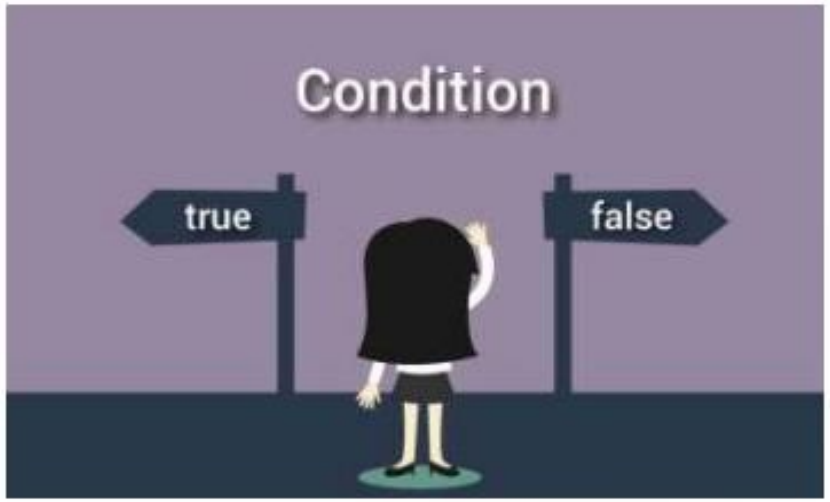
Contents

1. Conditional Flow Statements(Decision making)
2. Iterative Statements (Loops)
3. Jumping statements (break and continue statements)
4. Pointers

1. Decision Making

- **Decision making** is used to specify the order in which statements are executed.

- **Decision making in a C program using:-**
  - **if statement**
  - **if…else statement**
  - **if…else if…else statement**
  - **nested if...else statement**
  - **Switch case Statement**



1.1 if statement

```
if (testExpression)
{
   // statements
}
```

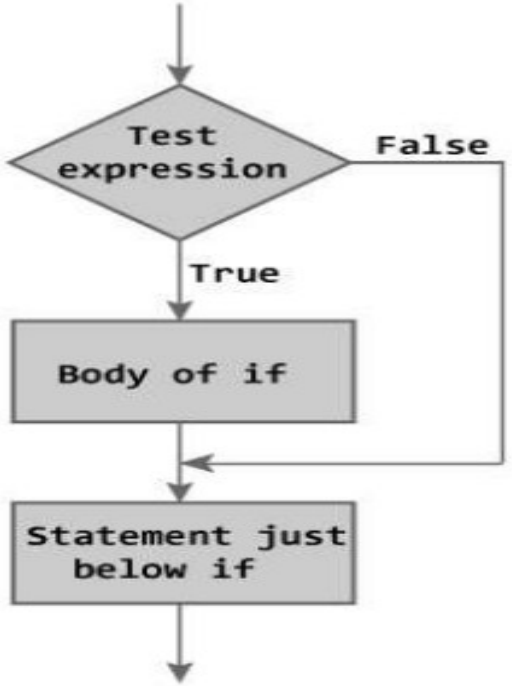


Figure: Flowchart of if Statement

Example: if statement

- Program to display only negative numbers on screen.

```
#include <stdio.h>
int main()
{
int number;
printf("Enter an integer:
");  scanf("%d",
&number);
// Test expression is true if number is less than 0
if (number < 0) {
printf("You entered %d.\n", number);
}
printf("The if statement is
easy.");  return 0;
```

1.2 if...else statement

if...else statement executes some code if the test expression is true (nonzero) and some other code if the test expression is false (0).

Syntax of if...else

```
if (test Expression)
{
        // codes inside the body of if
}
else
{
        // codes inside the body of else
}
```

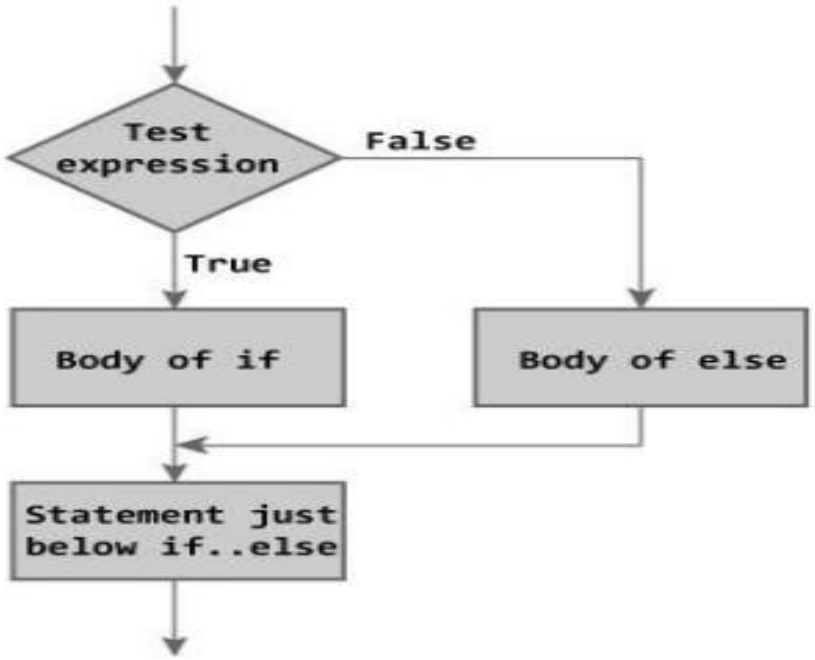


Figure: Flowchart of if...else Statement

Example: if...else statement

```
// Program to check whether an integer entered by the user is odd or even
#include <stdio.h>
int main()
{
        int number;
        printf("Enter an integer:
        ");  scanf("%d",&number);
        // True if remainder is 0
        if( number%2 == 0 )
        printf("%d is an even integer.",number);
        else
        printf("%d is an odd integer.",number);
        return 0;
}
```

1.3 if...else if....else Statement

- The if...else statement executes two different codes depending upon whether the test expression is true or false. Sometimes, a choice has to be made from more than 2 possibilities.

- The if...else if…else statement allows you to check for multiple test expressions and execute different codes for more than two conditions

Syntax of if...else if....else statement.

```
if (testExpression1) {
   // statements to be executed if testExpression1 is true
} else if(testExpression2) {
   // statements to be executed if testExpression1 is false and
testExpression2 is true
} else if (testExpression 3) {
   // statements to be executed if testExpression1 and
testExpression2 is false and testExpression3 is true
} else {
   // statements to be executed if all test expressions are false
}
```

Example: if...else if....else statement

```
// Program to relate two integers
using =, > or <
#include <stdio.h>
int main()
{
int number1, number2;
printf("Enter two integers: ");  scanf("%d
%d", &number1,&number2);
//checks if two integers are equal.
if(number1 == number2)
{
        printf("Result: %d = %d“,number1,number2);
}
```

```
//checks if number1 is greater than number2.
else if (number1 > number2)
{
printf("Result: %d > %d",
number1, number2);
}
// if both test expression is false
else {
printf("Result: %d < %d",number1, number2);
}
return 0;
}
```

1.4 Nested if else statement

- **Nested if else statement** is same like **if else statement**, where new block of if else statement is defined in existing if else statement.
- Used when need to check **more than one conditions at a time**

Syntax of Nested If else Statement

```
if(condition is true){
    if(condition is true){
        statement;
    }else{
        statement;
    }
}else{
    statement;
}
```

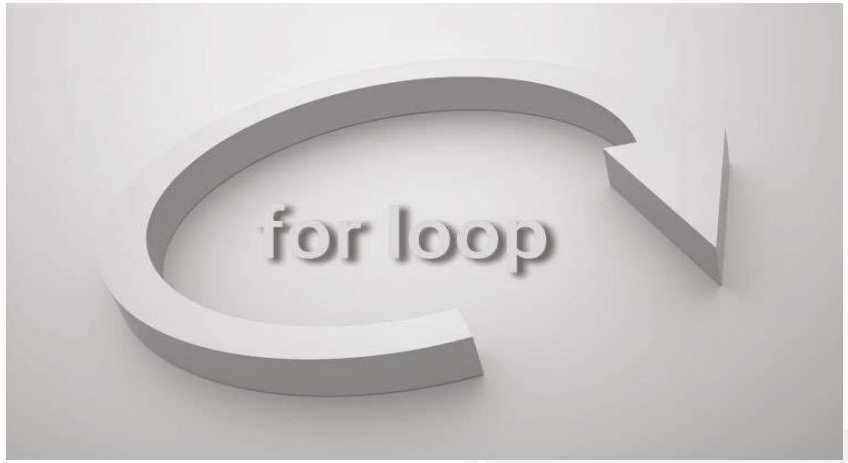
```
if (test condition - 1)
  {
    if (test condition - 2)
      {
        statement 1;
      }
    else
      {
        statement 2;
      }
  }
else
  {
    statement 3;
  }
statement x;
```

Example of Nested if else Statement

```
#include <stdio.h>
void main(){
        char username;
        int password;

        printf("Username:");
        scanf("%c",&username);
        printf("Password:");
        scanf("%d",&password);

        if(username=='a'){
                if(password==12345){
                        printf("Login successful");
                }else{
                        printf("Password is incorrect, Try again.");
                }
        }else{
                printf("Username is incorrect, Try again.");
        }
}
```

2. Loops

- **Loops** are used in programming to repeat a specific block until some end condition is met.
- **There are three loops in C programming:**
  - for loop
  - while loop
  - do...while loop
  - Nested loops



2.1 for Loop

The syntax of a for loop is:

```
for (initialization; testExpression; Increment or decrement)

{
    // codes
}
```

Flowchart of For Loop

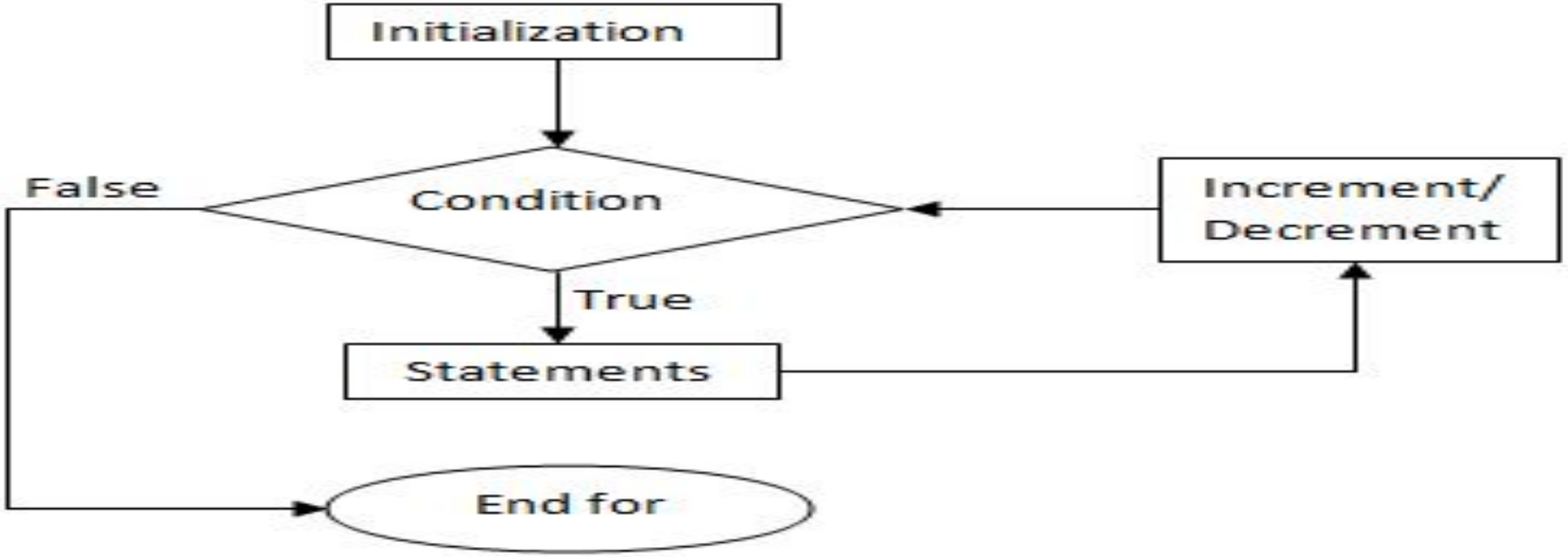


fig: Flowchart for for loop

Example: for loop

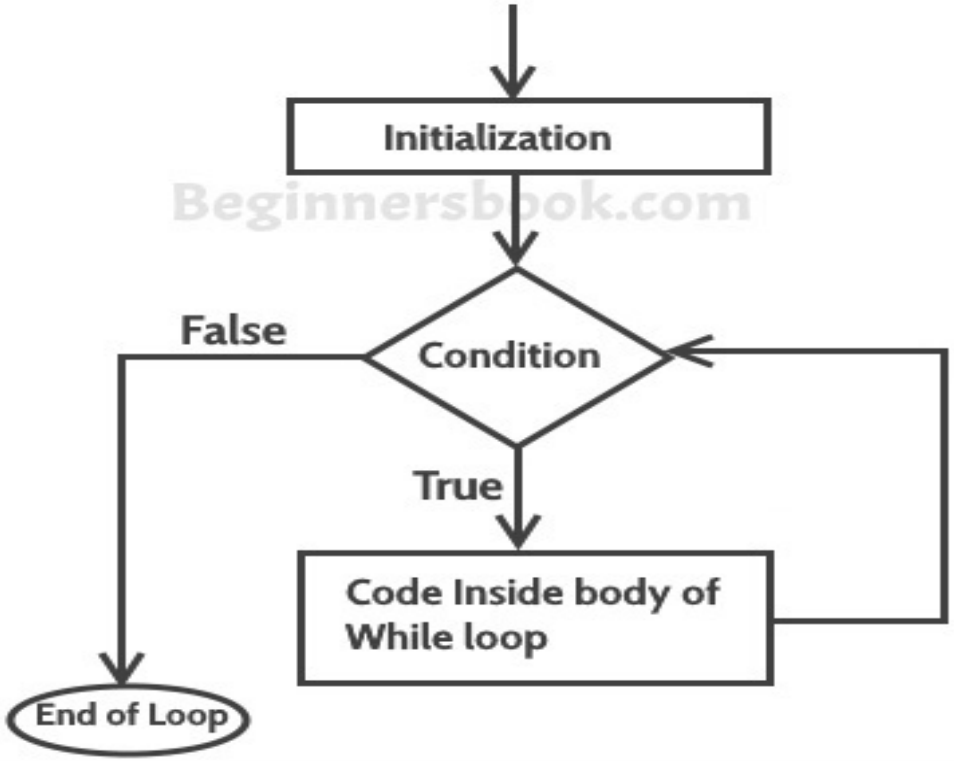
```
// Program to calculate the sum of first n natural numbers
// Positive integers 1,2,3...n are known as natural numbers

#include <stdio.h> int
main(){
    int n, count, sum = 0; printf("Enter a
    positive integer: "); scanf("%d", &n);
```

```
for(count = 1; count <= n; ++count)
    {
        sum =sum+count;
    }
    printf("Sum = %d", sum);

    return 0;

}
```

2.2 while loop

The syntax of a while loop is:

```
while (testExpression)
{
   //codes
}
```



Example: while loop

```
/ Program to find factorial of
a number

// For a positive integer n, factorial = 1*2*3...n


#include<stdio.h

>  int main(){

    int number; long factorial;
    printf("Enter an integer: ");

    scanf("%d",&number);

    factorial =1;
```

```
// loop terminates when number is less than
  or  equal to 0

   while (number > 0) {

     // factorial = factorial*number;

       factorial *= number;

       --number;

   }
   printf("Factorial= %lld", factorial);

   return 0;
```

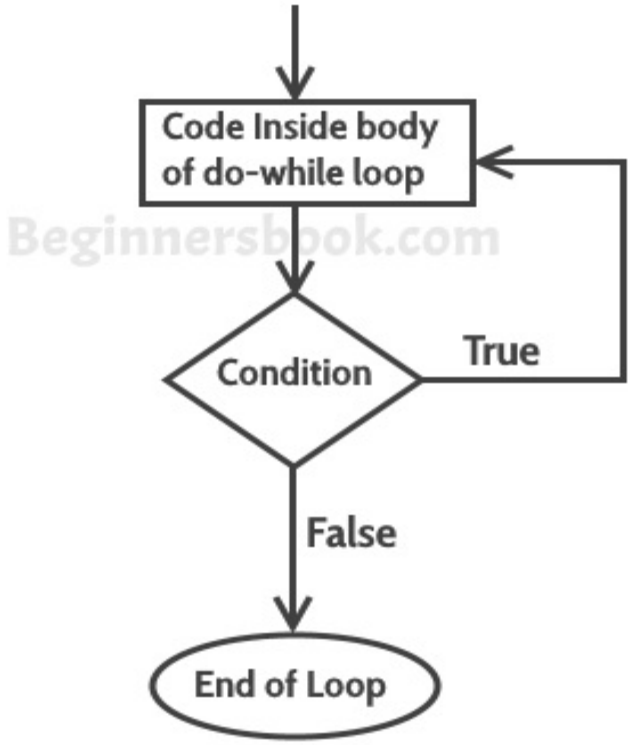
2.3 do...while loop

- **The do..while loop** is similar to the **while loop** with one important difference.

- **The body of do...while loop** is executed once, before checking the testexpression.
- The do...while loop is executed at least once.

do...while loop Syntax

```
do
{
  // codes
}
while (testExpression);
```



Example: do...while loop

```
// Program to add numbers until user enters zero
#include <stdio.h>
int main() {
    double number, sum = 0;
    // loop body is executed at least once
    do{
        printf("Enter a number: ");
        scanf("%lf", &number); sum
        += number;
    }while(number != 0.0);
    printf("Sum %.2lf",sum); return 0;}
```

2.4 Nested loops

Defining loop within another loop is called nested loops

```
for ( init; condition; increment )
{
  for ( init; condition;
    increment )
  {
            statement(s);
    // inner loop
  }

  statement(s);// outer loop
}
```

2.4 Nestedloops (Con..)

- **Syntax while loop**

```
while(condition)
{

  while(condition)
  {

  statement(s);
  }

  statement(s);
}
```

3. Break And Continue Statement

- What is BREAK meant?
- What is CONTINUE meant?

Syntax of if...else if....else statement.

- **The break statement** terminates the loop immediately when it is encountered.
- The break statement is used with **decision making statement such as if...else**.
- **Syntax of break statement**

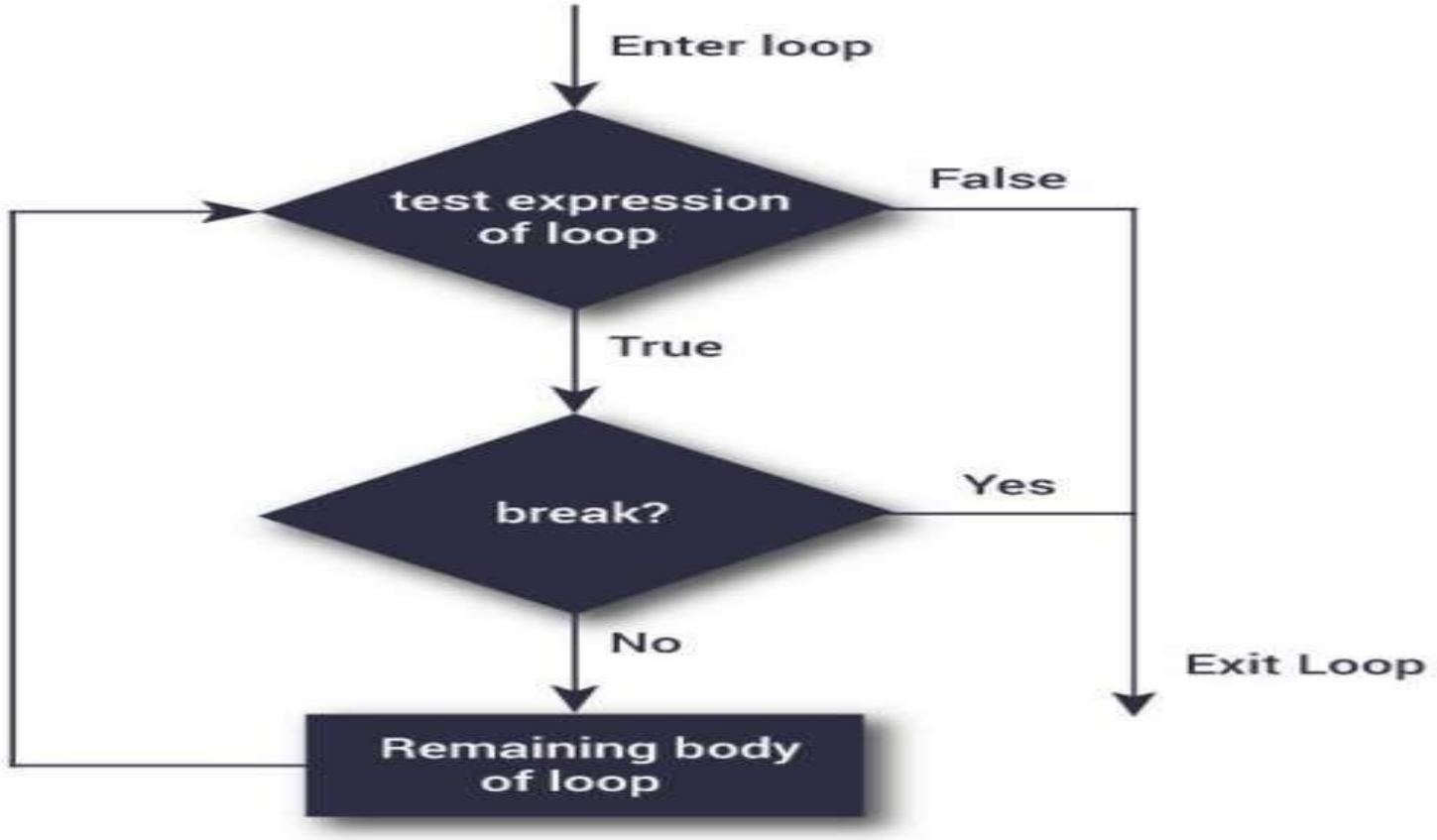
break;

How break statement works?

```
while (test Expression)
{
        // codes
        if (condition for break)
        {
                break;
        }
        // codes
}
```

```
for (init, condition, update)
{
        // codes
        if (condition for break)
        {
                break;
        }
        // codes
}
```

Flowchart Of Break Statement



Example: break statement

```
// Program to calculate the sum  of
maximum of 10 numbers
// Calculates sum until user enters
positive number
 # include <stdio.h>

int main() {

    int i;
    double number, sum = 0.0;

    for(i=1; i <= 10; ++i) {

        printf("Enter a n%d: ",i);

        scanf("%lf",&number);
```

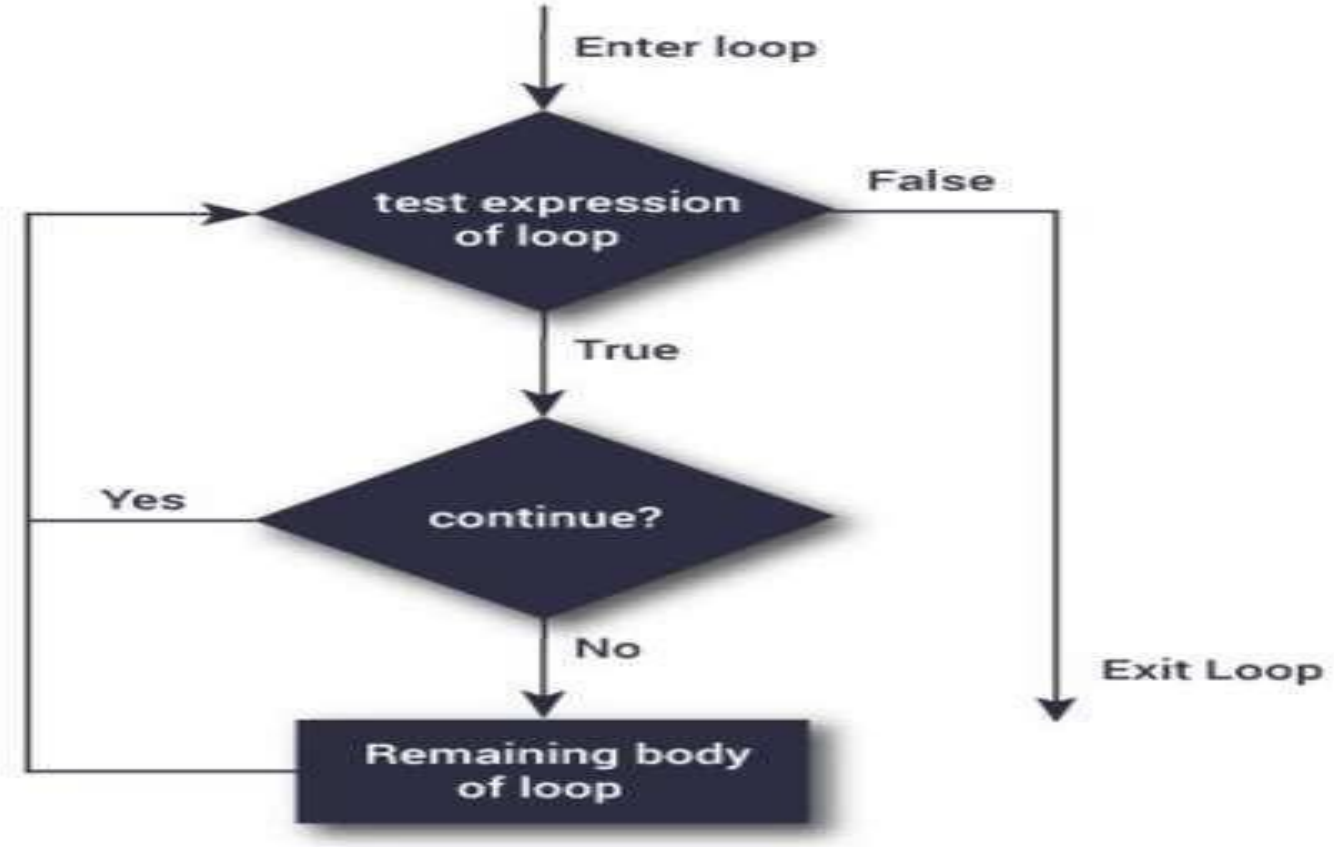
```
// If user enters negative number,
loop is terminated
if(number < 0.0) {

        break;

    }
   // sum = sum + number;

    sum += number;

}
printf("Sum = %.2lf",sum);
return 0;
}
```

3.2 Continue Statement

- **The continue statement** skips some statements inside the loop.
- The continue statement is used with **decision making stateme such as if...else**.
- **Syntax of continue Statement**

```
continue;
```

Flowchart of Continue Statement



How Continue Statement Works?

```
while (test Expression)
{
        // codes
        if (condition for continue)
        {
                continue;
        }
        // codes
}
```

```
for (init, condition, update)
{
        // codes
        if (condition for continue)
        {
                continue;
        }
        // codes
}
```

Example: continue statement

```
// Program to calculate sum of
maximum of 10 numbers
// Negative numbers are skipped
from calculation
# include <stdio.h>
int main(){
    int i;
    double number, sum = 0.0;
    for(i=1; i <= 10; ++i) {
        printf("Enter a n%d: ",i);
        scanf("%lf",&number);
```

```
// If user enters negative number,
loop is terminated
        if(number < 0.0) {
            continue;
        }
        // sum = sum + number;
        sum += number;
    }
    printf("Sum = %.2lf",sum);
    return 0;
}
```

3.2. Switch

- The **if...else if…else statement** allows you to execute a block code among many alternatives. If you are checking on the value of a single variable in **if...else if…else statement**, it is better to use **switch statement**.

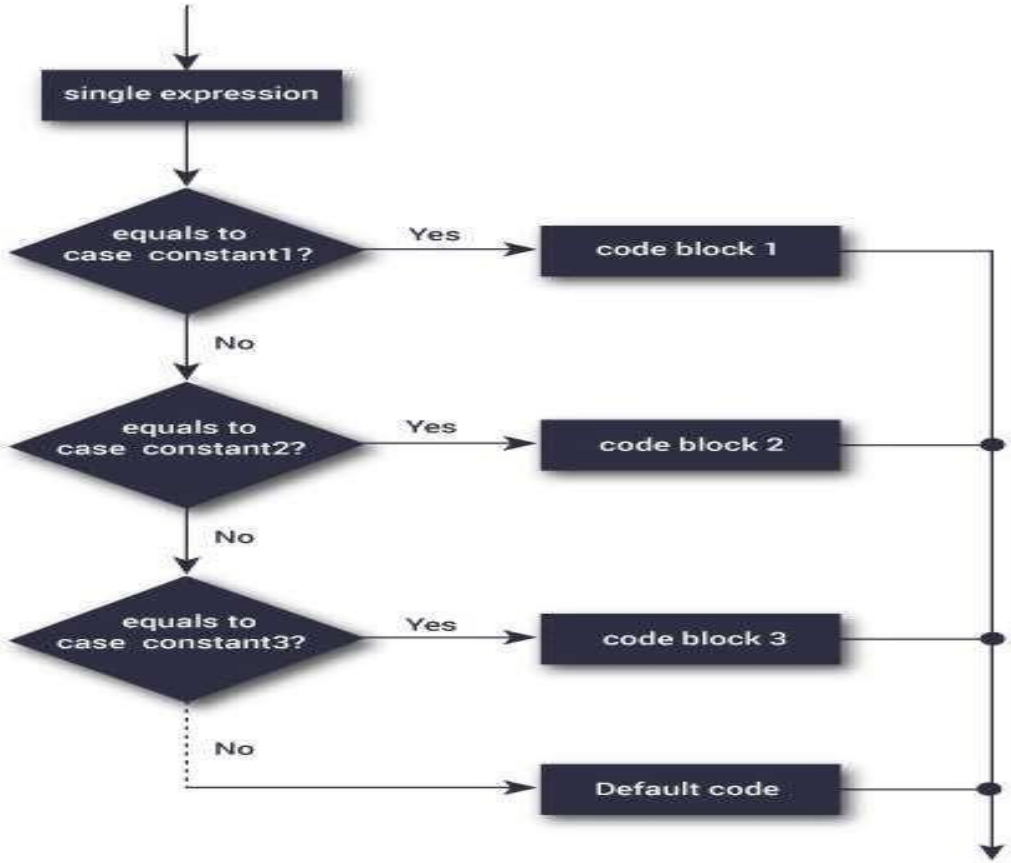
- **The switch statement** is often faster than nested if...else **(not always)**.

  Also, the syntax of switch statement is cleaner and easy to understand.

Syntax of switch...case

```
switch (n){
    case constant1:
        // code to be executed if n is equal to constant1;
        break;
    case constant2:
        // code to be executed if n is equal to
        constant2;  break;
        ....
    default:
        // code to be executed if n doesn't match any constant
    }
```

Switch Statement Flowchart



Example: switch Statement

```
// Program to create a simple calculator

// Performs addition, subtraction, multiplication or division
  depending the input from user

  # include <stdio.h>

  int main() {

      char operator;

      double firstNumber,secondNumber;
      printf("Enter an operator (+, -, *,): ");

      scanf("%c", &operator);  printf("Enter

      two operands: ");


      scanf("%lf %lf",&firstNumber, &secondNumber);
```

Syntax of if...else if....else statement.

```
switch(operator) {
        case '+':
            printf("%.1lf + %.1lf = %.1lf",firstNumber, secondNumber, firstNumber+secondNumber);
            break;

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

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

        case '/':
            printf("%.1lf / %.1lf = %.1lf",firstNumber, secondNumber, firstNumber/firstNumber); break;
        // operator is doesn't match any case constant (+, -, *,

        /)  default:
```

3.3 goto

- The goto statement is used to **alter** the normal sequence of a C program.

Syntax of goto Statement

```
goto label;
… .. …
… .. …
… .. …
label:
statement;
```

What is Label?

- **The label** is an identifier. When **goto statement** is encountered, control of the program jumps to **label:** and starts executing the code.

```
goto label;
... .. ...
... .. ...

label:
... .. ...
... .. ...
```

Example: goto Statement

// Program to calculate the sum and average of maximum of 5 number
// If user enters negative number, the sum and average of previously entered positive number is displayed

```
# include <stdio.h>

int main(){

    const int maxInput = 5; int i;  double

    number, average, sum=0.0;

for(i=1; i<=maxInput; ++i){

        printf("%d. Enter a number: ", i);
        scanf("%lf",&number);
```

Example: goto Statement

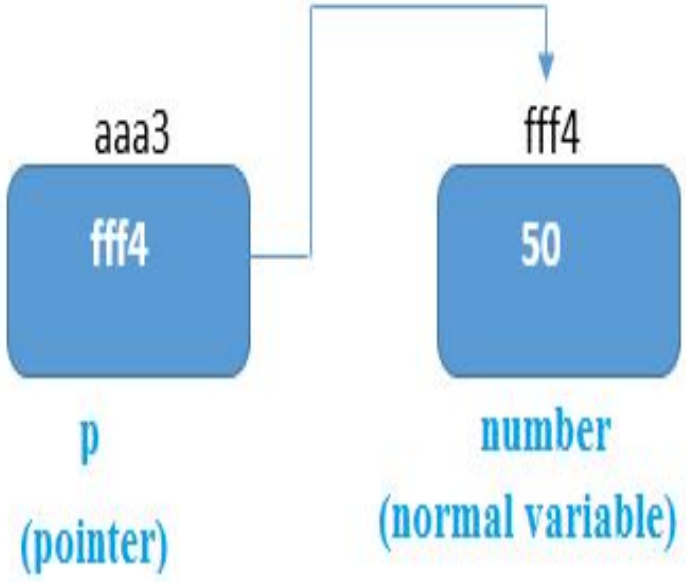
```
// If user enters negative number, flow of program moves to label jump
    if(number < 0.0)
        goto jump;


    sum += number; // sum = sum+number;
}
Jump:
average=sum/(i-1);
printf("Sum = %.2f\n", sum);
printf("Average = %.2f", average);
return 0; }
```

4. Pointer

The pointer is derived data type in C. Pointer is variable which stores the memory address of another variable. This variable can be of type int, char, array, function, or any other pointer.

Declaring pointer
Syntax
  data_type *pt_name;

example
int number=50;
int *p;
p=&number;//stores the address of number variable

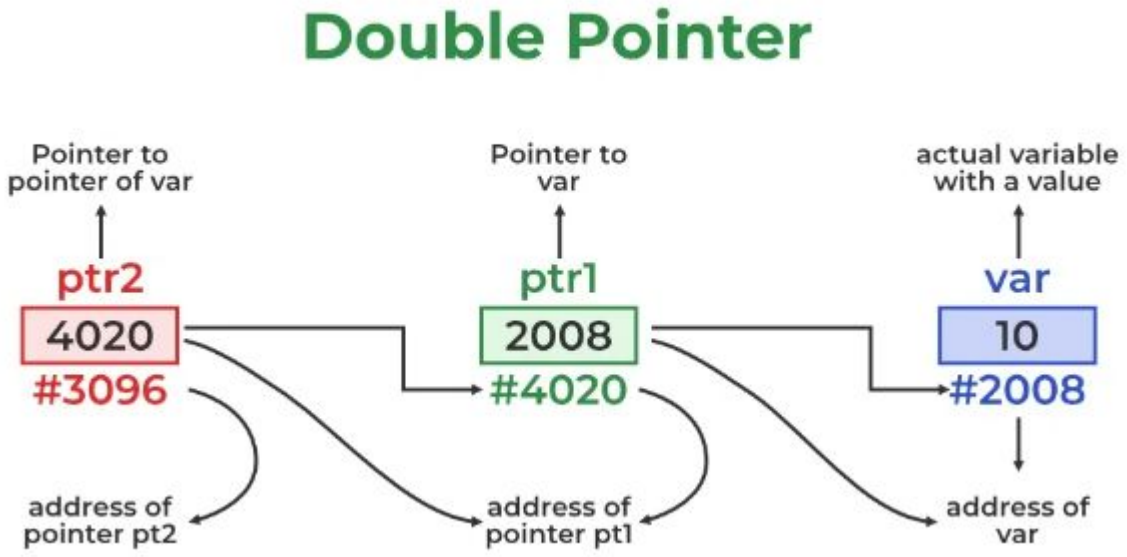


Pointer(Continue..)

Pointer can be typed or an untyped pointer points to an particular variable type such as an integer. An Untyped pointer points to any data type

Double Pointer

The pointer to a pointer in C is used when we want to store the address of another pointer. The first pointer is used to store the address of the variable. And the second pointer is used to store the address of the first pointer. That is why they are also known as ***double-pointers***



Double Pointer(continue..)

Declaration of Pointer to a Pointer in C

Syntax

```
data_type  **name_of_variable = & normal_pointer_variable;
```

Example

```
int val = 5;
int *ptr = &val;    // storing address of val to pointer ptr.
int **d_ptr = &ptr; // pointer to a pointer declared
                    // which is pointing to an integer.
```

Triple Pointer

A triple-pointer is a pointer that points to a memory location where a double-pointer is being stored. The triple-pointer itself is just one pointer.

Ex. int *** is a pointer, that points to the value of a double pointer, which in turn points to the value of a single pointer, which points to the value of an int.

Syntax :

Data_type ***variable_Name ;

Example :

int ***r ;

r => This is **double pointer variable** and not normal variable

NULL Pointer

The Null Pointer is the pointer that does not point to any location.

We can create a null pointer by assigning the null value at the time of pointer declaration.

This method is useful when you do not assign any address to the pointer. A null pointer always contains value 0.

Syntax of Null Pointer

```
type pointer_name = NULL;
type pointer_name = 0;

// declaring null pointer
   int* ptr = NULL;
```

Void Pointer

It is a pointer that has no associated data type with it. A void pointer can hold addresses of any type and can be typecast to any type.

It is also called a generic pointer and does not have any standard data type.

It is created by using the keyword void.

void *p = NULL; //void pointer

Wild Pointer

Wild pointers are also called uninitialized pointers. Because they point to some arbitrary memory location and may cause a program to crash or behave badly.

This type of C pointer is not efficient. Because they may point to some unknown memory location which may cause problems in our program. This may lead to the crashing of the program.

example

```
#include <stdio.h>
int main()
{
  int *p; //wild pointer
  printf("%d",*p);
  return 0;
}
```

Const Pointer

A constant pointer in C cannot change the address of the variable to which it is pointing, i.e., the address will remain constant.

Syntax of Constant Pointer

<type of pointer> *const <name of pointer>;

Example

```
int *const ptr;
Int a =1, b=2;
ptr=&a;
ptr=&b;
```

Compiler will show error while assigning ptr=&b, because ptr is const pointer which points to fixed location


Thank
You