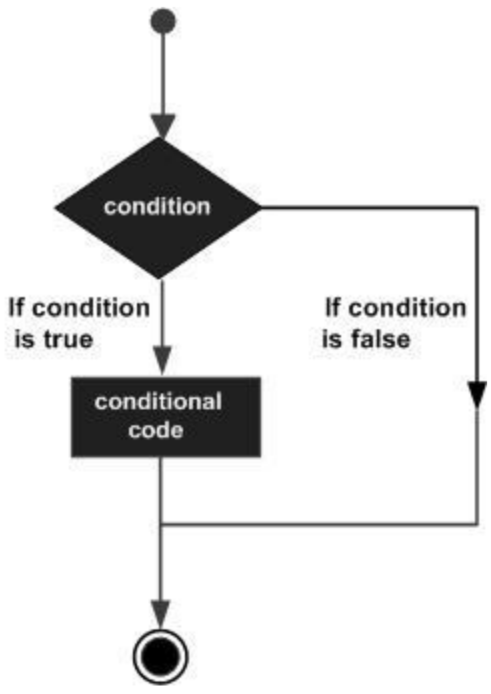
CHAPTER

10

Decision Making in C

Decision making structures require that the programmer specify one or more conditions to be evaluated or tested by the program, along with a statement or statements to be executed if the condition is determined to be true, and optionally, other statements to be executed if the condition is determined to be false.

Following is the general form of a typical decision making structure found in most of the programming languages:



C programming language assumes any non-zero and non-null values as true, and if it is either zero or null, then it is assumed as false value. C programming language provides following types of decision making statements.

if statement

An **if** statement consists of a boolean expression followed by one or more statements.

Syntax

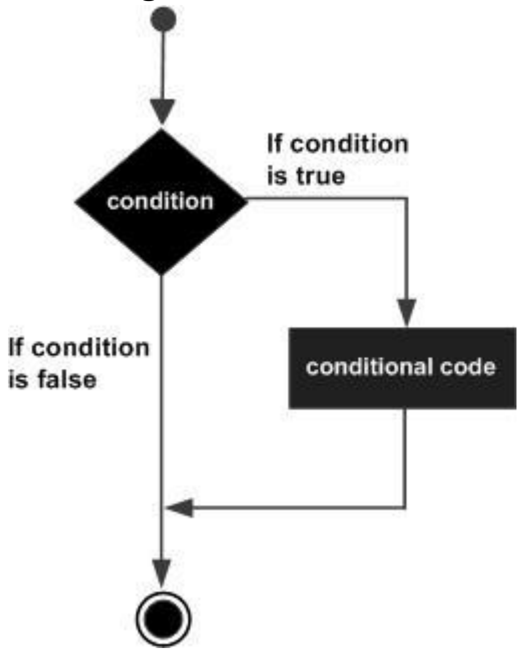
The syntax of an if statement in C programming language is:

```
if(boolean_expression)
{
   /* statement(s) will execute if the boolean expression is true */
}
```

If the **boolean** expression evaluates to **true,** then the block of code inside the **if** statement will be executed. If **boolean** expression evaluates to **false,** then the first set of code after the end of the **if** statement (after the closing curly brace) will be executed.

C programming language assumes any **non-zero** and **non-null** values as **true** and if it is either **zero** or **null** then it is assumed as **false** value.

Flow Diagram



Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   int a = 10;
```

```
    /* check the boolean condition using if statement */
    if( a < 20 )
    {
        /* if condition is true then print the following */
        printf("a is less than 20\n" );
    }
    printf("value of a is : %d\n", a);

    return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
a is less than 20;

value of a is : 10
```

if...else statement

An **if** statement can be followed by an optional **else** statement, which executes when the boolean expression is **false**.

Syntax

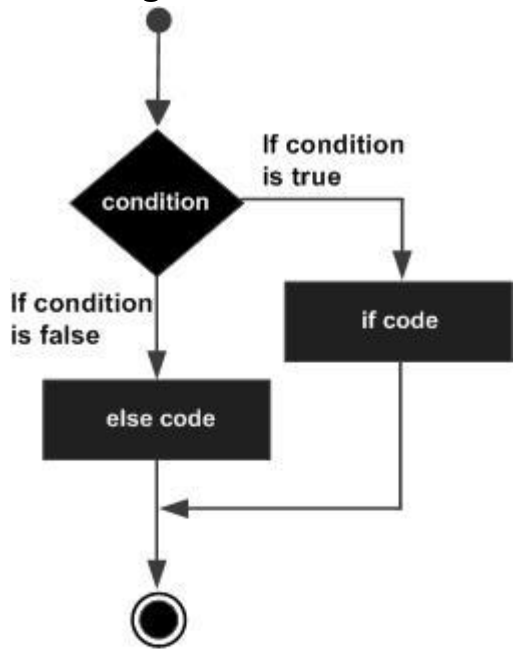
The syntax of an **if...else** statement in C programming language is:

```
if(boolean_expression)
{
   /* statement(s) will execute if the boolean expression is true */
}
else
{
  /* statement(s) will execute if the boolean expression is false */
}
```

If the **boolean** expression evaluates to **true,** then the if block of code will be executed, otherwise **else** block of code will be executed.

C programming language assumes any **non-zero** and **non-null** values as **true** and if it is either **zero** or **null** then it is assumed as **false** value.

Flow Diagram



Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   int a = 100;

   /* check the boolean condition */
   if( a < 20 )
   {
       /* if condition is true then print the following */
       printf("a is less than 20\n" );
   }
   else
   {
       /* if condition is false then print the following */
       printf("a is not less than 20\n" );
   }
   printf("value of a is : %d\n", a);

   return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
a is not less than 20;

value of a is : 100
```

The if...else if...else Statement

An **if** statement can be followed by an optional **else if...else** statement, which is very useful to test various conditions using single **if...else if** statement.

When using **if , else if , else** statements there are few points to keep in mind:

- An **if** can have zero or one else's and it must come after any **else if's**.
- An **if** can have zero to many **else if's** and they must come before the **else**.
- Once an **else if** succeeds, none of the remaining **else if's** or **else's** will be tested.

Syntax

The syntax of an **if...else if...else** statement in C programming language is:

```
if(boolean_expression 1)
{
   /* Executes when the boolean expression 1 is true */
}
else if( boolean_expression 2)
{
   /* Executes when the boolean expression 2 is true */
}
else if( boolean_expression 3)
{
   /* Executes when the boolean expression 3 is true */
}
else
{
   /* executes when the none of the above condition is true */
}
```

Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   int a = 100;

   /* check the boolean condition */
   if( a == 10 )
   {
       /* if condition is true then print the following */
       printf("Value of a is 10\n" );
   }
   else if( a == 20 )
   {
       /* if else if condition is true */
       printf("Value of a is 20\n" );
```

```
    }
    else if( a == 30 )
    {
        /* if else if condition is true  */
        printf("Value of a is 30\n" );
    }
    else
    {
        /* if none of the conditions is true */
        printf("None of the values is matching\n" );
    }
    printf("Exact value of a is: %d\n", a );

    return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
None of the values is matching

Exact value of a is: 100
```

Nested if statements

It is always legal in C programming to **nest if-else** statements, which means you can use one **if** or **else if** statement inside another **if** or **else if** statement(s).

Syntax

The syntax for a **nested if** statement is as follows:

```
if( boolean_expression 1)
{
   /* Executes when the boolean expression 1 is true */
   if(boolean_expression 2)
   {
      /* Executes when the boolean expression 2 is true */
   }
}
```

You can nest else **if...else** in the similar way as you have **nested if** statement.

Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   int a = 100;
   int b = 200;

   /* check the boolean condition */
   if( a == 100 )
   {
       /* if condition is true then check the following */
       if( b == 200 )
       {
          /* if condition is true then print the following */
          printf("Value of a is 100 and b is 200\n" );
       }
   }
   printf("Exact value of a is : %d\n", a );
   printf("Exact value of b is : %d\n", b );

   return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
Value of a is 100 and b is 200

Exact value of a is : 100

Exact value of b is : 200
```

switch statement

A **switch** statement allows a variable to be tested for equality against a list of values. Each value is called a case, and the variable being switched on is checked for each switch case.

Syntax

The syntax for a **switch** statement in C programming language is as follows:

```
switch(expression){
    case constant-expression  :
       statement(s);
       break; /* optional */
    case constant-expression  :
       statement(s);
       break; /* optional */

    /* you can have any number of case statements */
    default : /* Optional */
       statement(s);
}
```

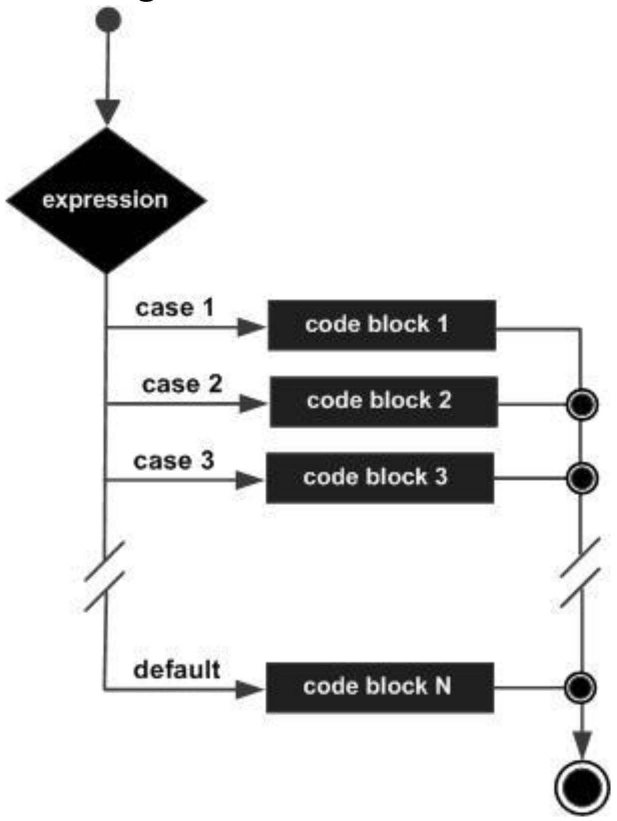
The following rules apply to a **switch** statement:

- The **expression** used in a **switch** statement must have an integral or enumerated type, or be of a class type in which the class has a single conversion function to an integral or enumerated type.

- You can have any number of case statements within a switch. Each case is followed by the value to be compared to and a colon.

- The **constant-expression** for a case must be the same data type as the variable in the switch, and it must be a constant or a literal.
- When the variable being switched on is equal to a case, the statements following that case will execute until a **break** statement is reached.
- When a **break** statement is reached, the switch terminates, and the flow of control jumps to the next line following the switch statement.
- Not every case needs to contain a **break**. If no **break** appears, the flow of control will *fall through* to subsequent cases until a break is reached.
- A **switch** statement can have an optional **default** case, which must appear at the end of the switch. The default case can be used for performing a task when none of the cases is true. No **break** is needed in the default case.

Flow Diagram



Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   char grade = 'B';

   switch(grade)
   {
   case 'A' :
      printf("Excellent!\n" );
      break;
   case 'B' :
   case 'C' :
      printf("Well done\n" );
      break;
   case 'D' :
      printf("You passed\n" );
      break;
   case 'F' :
      printf("Better try again\n" );
      break;
   default :
      printf("Invalid grade\n" );
   }
   printf("Your grade is  %c\n", grade );

   return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
Well done

Your grade is B
```

Nested switch statements

It is possible to have a **switch** as part of the statement sequence of an **outer switch**. Even if the case constants of the inner and outer switch contain common values, no conflicts will arise.

Syntax

The syntax for a **nested switch** statement is as follows:

```
switch(ch1) {
   case 'A':
      printf("This A is part of outer switch" );
      switch(ch2) {
         case 'A':
            printf("This A is part of inner switch" );
            break;
         case 'B': /* case code */
      }
      break;
   case 'B': /* case code */
}
```

Example

```
#include <stdio.h>

int main ()
{
   /* local variable definition */
   int a = 100;
   int b = 200;

   switch(a) {
      case 100:
         printf("This is part of outer switch\n", a );
         switch(b) {
            case 200:
               printf("This is part of inner switch\n", a );
         }
   }
   printf("Exact value of a is : %d\n", a );
   printf("Exact value of b is : %d\n", b );

   return 0;
}
```

When the above code is compiled and executed, it produces the following result:

```
This is part of outer switch

This is part of inner switch

Exact value of a is : 100

Exact value of b is : 200
```

The ? : Operator

We have covered conditional operator **? :** in previous chapter which can be used to replace **if...else** statements. It has the following general form:

```
Exp1 ? Exp2 : Exp3;
```

Where Exp1, Exp2, and Exp3 are expressions. Notice the use and placement of the colon.

The value of a ? expression is determined like this: Exp1 is evaluated. If it is **true**, then Exp2 is evaluated and becomes the value of the entire **?** expression. If Exp1 is **false**, then Exp3 is evaluated and its value becomes the value of the expression.