Decision Making

Decision making structures require that the programmer specifies 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.

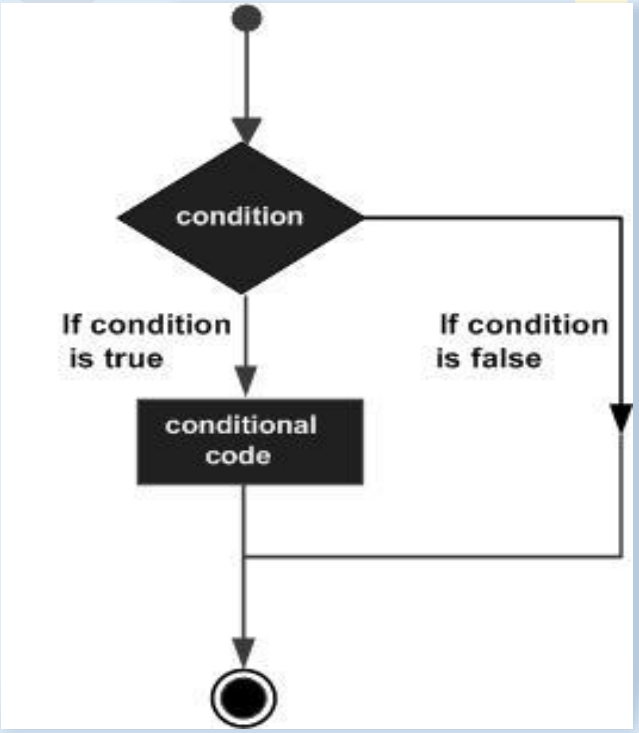
if statement

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

Syntax

```
if (condition) {
  // block of code to be executed if the condition is true
}
```

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



We learned from the Operation in previous lecture, that C supports the usual logical conditions from mathematics:

- Less than: var1 < var2
- Less than or equal to: var1<= var2
- Greater than: var1 > var2
- Greater than or equal to: var1 >= var2
- Equal to var1 == var2
- Not Equal to: var1 != var2

You can use these conditions to perform different actions for different decisions.

C has the following conditional statements:

- Use if to specify a block of code to be executed, if a specified condition is true
- Use else to specify a block of code to be executed, if the same condition is false
- Use else if to specify a new condition to test, if the first condition is false
- Use switch to specify many alternative blocks of code to be executed.

Code Example:

```
#include <stdio.h>

void 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);

}
```

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** will be executed, otherwise, the **else block** 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.

Code Example:

```
#include <stdio.h>

void main () {

    int a = 100; /* local variable definition */

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

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

```
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 */
}
```

Code Example:

```
#include <stdio.h>

void main () {

   int a = 100;   /* local variable definition */

   if( a == 10 ) {
      printf("Value of a is 10\n" );      /* if condition is true then print the following */
   } else if( a == 20 ) {
      printf("Value of a is 20\n" );      /* if else if condition is true */
   } else if( a == 30 ) {
      printf("Value of a is 30\n" );      /* if else if condition is true  */
   } else {
      printf("None of the values is matching\n" );      /* if none of the conditions is true */
   }
   printf("Exact value of a is: %d\n", a );
}
```

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

```
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.

Code Example:

```
#include <stdio.h>

void main () {

   /* local variable definition */
   char grade = 'B';

   switch(grade) {
      case 'A' :
         printf("Excellent!\n" );
         break;
      case 'B' :
         printf("Great..!\n" );
         break;

      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 );

}
```

nested switch statements

It is possible to have a switch as a 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:

```
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 */
}
```

Code Example:

```
#include <stdio.h>

void 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 );
               break;
         }
         break;
   }

   printf("Exact value of a is : %d\n", a );
   printf("Exact value of b is : %d\n", b );

}
```

The ? : Operator

We have covered **conditional operator ? :** in the 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.