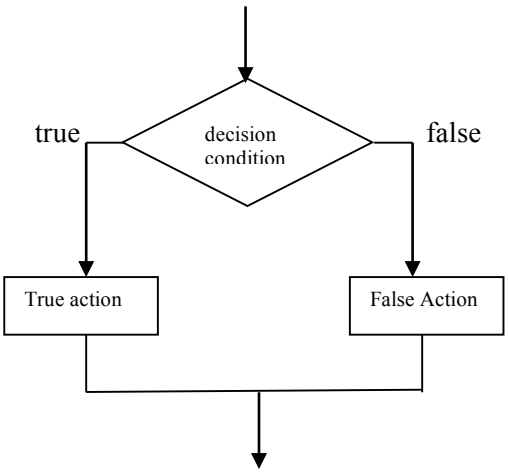
Decision Statement

- **Two way selection (if /else)**



Syntax:

```
if  (condition)
    true statement;
else
    false statement;
```

- Example:

  If a patient is male and is above 55 years old, his risk of having heart disease is 0.55, otherwise, the risk of heart disease is 0.25

```
if  ((gender == 'm') && (age > 55))
    risk = 0.55;
else
    risk = 0.25;
```

Notes:

1. Put the entire logical expression in a pair of parenthesis ( )
2. Every action statement ends with,
3. Do not put semicolon ; after the if and else parts of the statement,
4. The action statement can be any statement (even another if/else statement, or null statement)
5. The true and/or false action can contain multiple statements, e.g., compound statement

- **if statement with null else statement (else statement empty)**

```
if  (condition)
    true statement;
```

```
int  smallerInt, largerInt;
int   temp;

cout << "Please enter two integer values";
cin >> smallerInt   >> largerInt;
if  (smallerInt > largerInt)
{
        temp = smallerInt;
        smallerInt = largerInt;
        largerInt = temp;
}

cout<< largerInt << ">=" smallerInt << endl;
```

// Question: Can you change the values of two variables without additional variable, i.e., temp?

- **if / else statement with compound action statement**

```
if   (condition)
{
     statement1;
      …..
     statement N;
}
else
{
     statement1;
     …..
     statement M;
}
```

- **action statement is an if / else statement**

The medical insurance premium is sometimes calculated based on customer's age

```
Age <= 26        premium   = $10/month
26 < age < 55    premium   = $23/month
age >=55         premium   = $40/month
```

as true action statement

```
if   (age < 55)
{
    if (age <= 26)
         premium = 10.0;
    else
         premium = 23.0;
}
else
     premium = 40.0;
```

as false action statement

```
if (age >= 55)
    premium = 40.0;
else
{
     if (age > 26)
        premium = 23.0
     else
        premium = 10.0;
}
```

Often, when the false action statement is an if/else statement, it is coded using ***Multi-way if statement, (aka if / else if / else*** statement), as the following:

```
if (age >= 65)
    premium = 40.0;
else if (age >= 55)
    premium = 23.0;
else if (age >= 21)
    premium = 16.5;
else if (age >=0)
    premium = 10.0;
else
{
    premium = 0.0;
    cout << "Incorrect age value."<<endl;
}
```

- **Dangling else problem: which if does the "else" go with?**

```
if (average >=60)
        if (average < 70.0)
                cout << "Passing but marginal"<< endl
else
        cout << "Failing" << endl;
```

- **What is the difference between the following two C++ decision statements?**

```
if (age < 2)
   cout << "Admission is free" << endl;
if (age < 12)
   cout << "Children pays half price." <<
endl;
if (age < 18)
   cout << "students get 20% off." << endl;
if (age < 55)
   cout << "pay full price." << endl;
if (age >=55)
   cout << "senior pays half price." << endl;
```

```
if (age < 2)
   cout << "Admission is free" << endl;
else if (age < 12)
   cout << "Children pays half price." <<
endl;
else if (age < 18)
   cout << "students get 20% off." << endl;
else if (age < 55)
   cout << "pay full price." << endl;
else
   cout << "senior pays half price." << endl;
```

- **What about these two C++ decision statements?**

```
if (age < 2)
   cout << "Admission is free" << endl;
else if (age < 12)
   cout << "Children pays half price." << endl;
else if (age < 18)
   cout << "students get 20% off." << endl;
else if (age < 55)
   cout << "pay full price." << endl;
else
   cout << "senior pays half price." << endl;
```

```
if (age < 2)
   cout << "Admission is free" << endl;
else if (age>=2 && age < 12)
   cout << "Children pays half price." << endl;
else if (age >=12 && age < 18)
   cout << "students get 20% off." << endl;
else if (age>=18 && age < 55)
   cout << "pay full price." << endl;
else if (age >=55)
   cout << "senior pays half price." << endl;
```

- **Practice problems:**

1. Write a C++ decision statement that computes the pay for an employee, given the employee's pay rate and number of hours he worked. If the employee works more than 40 hours, the additional hours is paid at 1.5 of his original hourly pay rate.
2. Write an branching statement that calculates and returns the amount of the water bill for a customer whose type is 'H' for home use, 'C' for commercial use, and 'I' for industrial use. The rates are as follows:

Type	Rate
H	$5.00 plus 0.0005 per gallon water used
C	$1000.00 for first 4 million gallons and $0.00025 per additional gallon
I	$1000.00 if usage is 4 million gallons or less; $2000.00 for usage over 4 million but less than 10 million gallons; and $3500.00 for use of 10 million or more gallons

Print error message and stop the program if there is an error in the input arguments (e.g., an illegal type or a negative usage.)