Programming Fundamentals

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LL 02 = Learning Level 02 – Comprehension,

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LL 02 = Learning Level 02 – Comprehension,

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Conditional Control Flow

- Conditional control flow is also referred to as **conditional logic** or **selection logic**.
- It is one of the order in which the program instructions are executed.
- Its execution order differs from the sequential logic.
- It executes the instructions on the basis of one or more conditions.
- If the conditions are satisfied it will execute the instructions else the instructions will not be executed (skipped).

Conditional Control Flow

In conditional logic:

- Statements are executed on the basis of conditions.
- If conditions are satisfied the statements are executed.
- If conditions are not satisfied the statements are skipped.

Types of Conditional Control Flow

- In programming we normally have four types of conditional/ selection control flow:

One-Way Selection

- In one-way selection there is one condition and only one possible choice available either we choose it or not.
- If the condition is satisfied we choose it, and do not choose it, if the condition is not satisfied.
- Like, the boss checks the experience of an employee and adds the bonus, if the experience is more than 2 years.
- Similarly, shopkeeper gives you a discount of 10% if you make the purchase of more than Rs. 5000.
- Both of these examples involve one-way selection.

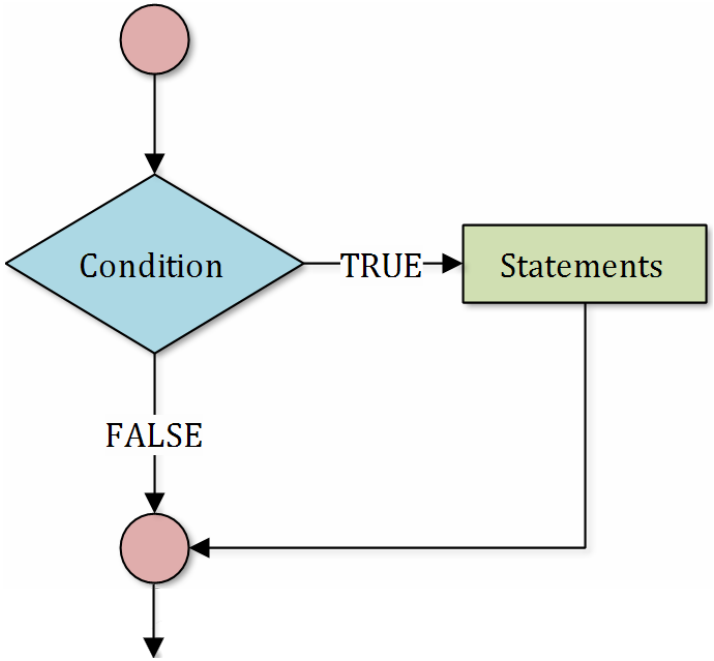
One-Way Selection

In one-way selection:

- The statements are executed if the condition is satisfied (true).
- Does nothing when condition is not satisfied (false).

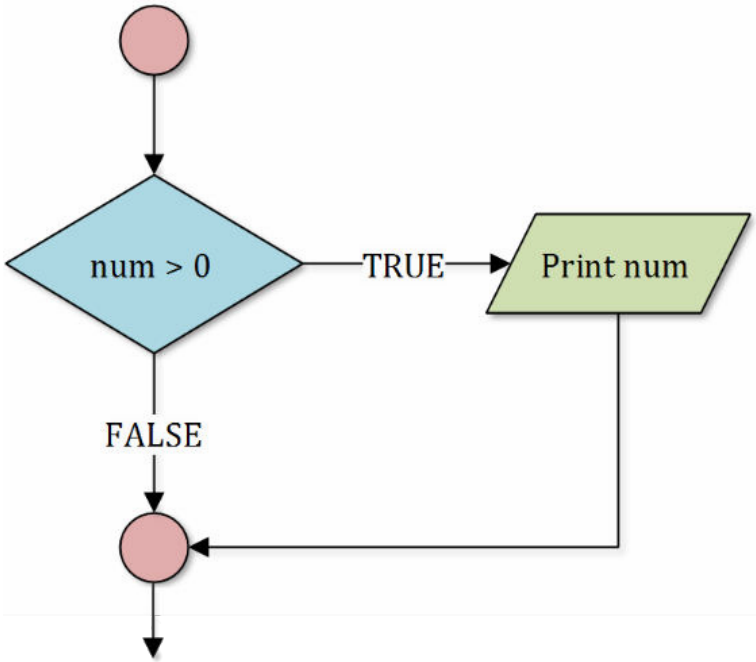
One-Way Selection – Flow Chart

Following is the flow of execution of one-way selection:



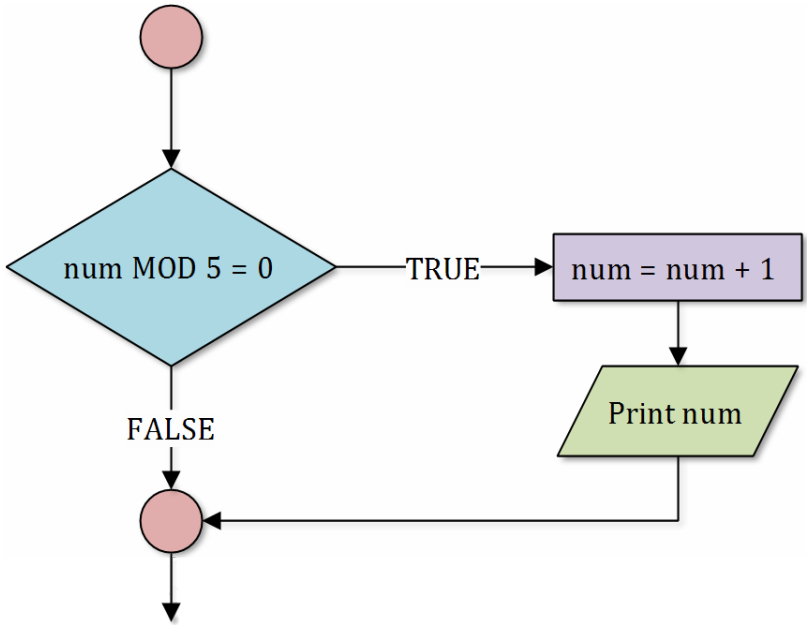
One-Way Selection - Example

Problem Statement 1: If the number is positive then display it.



One-Way Selection - Example

Problem Statement 2: If the number is multiple of 5 then add 1 to it and display the resultant number.



Two-Way Selection

- In two-way selection there is one condition and two possible choices available either we choose first one or the second one.
- If the condition is satisfied we choose first choice and the second choice if the condition is not satisfied.
- Like, the teacher checks the roll number of a student, if it is even he/she is
from section 2 otherwise he/she is from section 1.
- It is an example involving two-way selection.

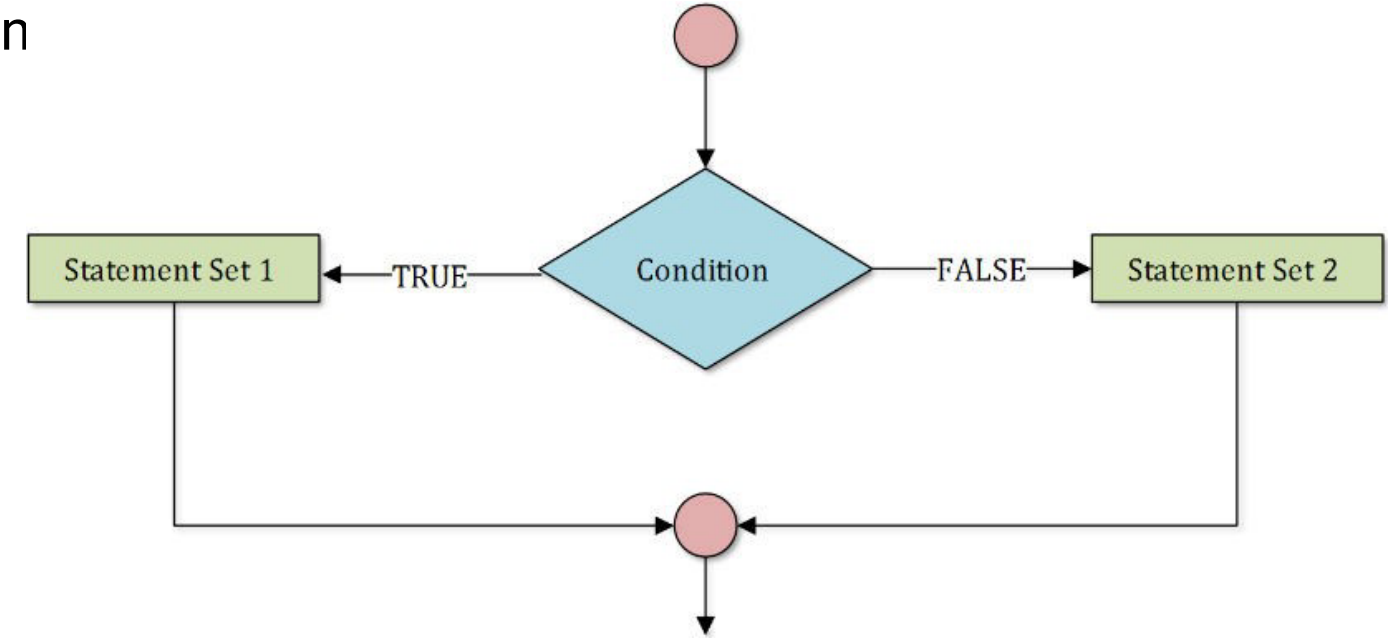
Two-Way Selection

In two-way selection:

- If the condition is satisfied (true), the 1st set of statements is executed.
- If the condition is not satisfied (false), the 2nd set of statements is executed.

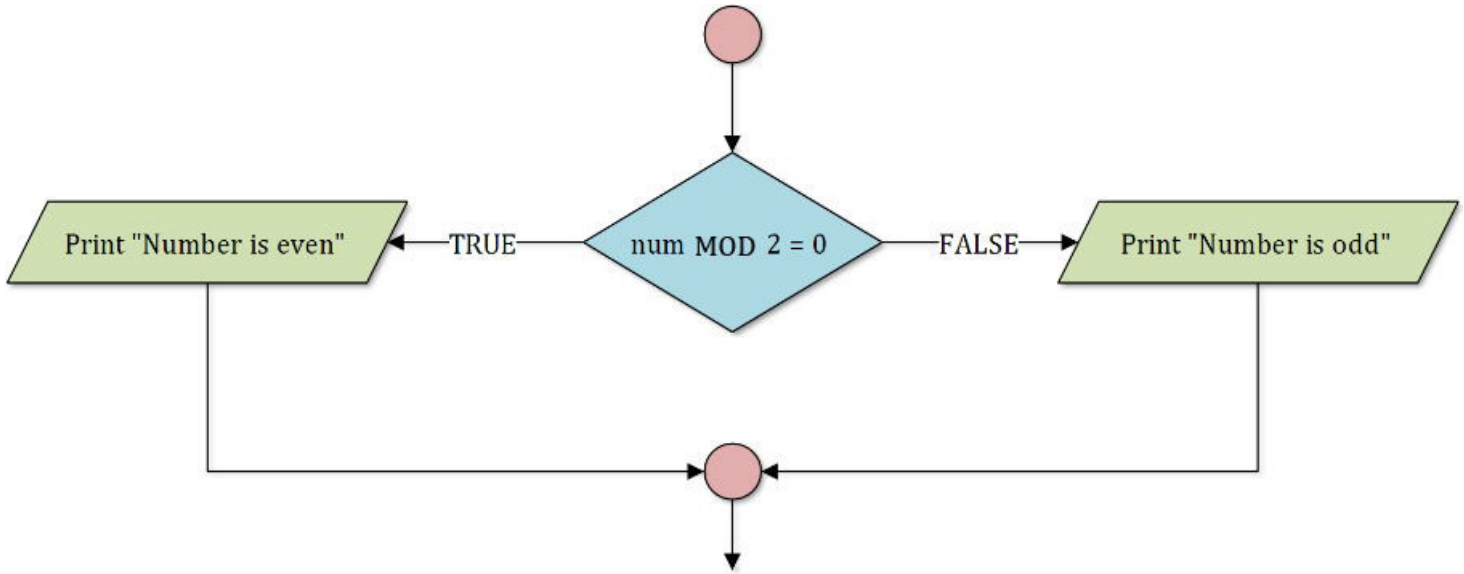
Two-Way Selection – Flow Chart

Following is the flow of execution of two-way selection



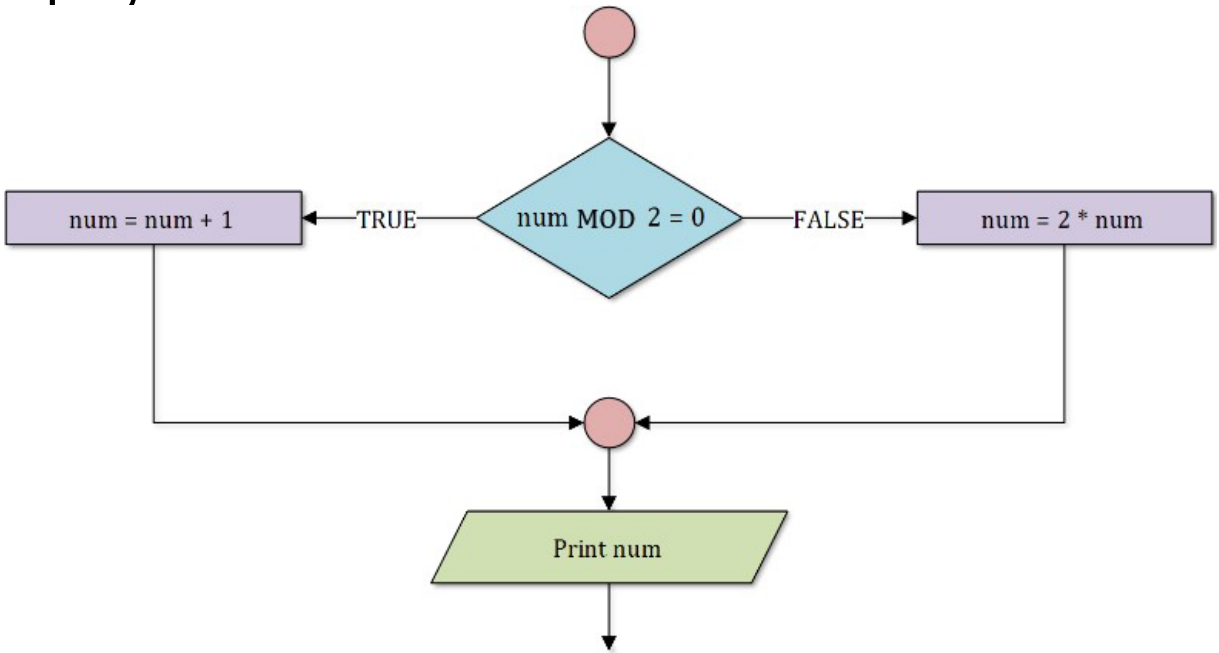
Two-Way Selection - Example

Problem Statement 1: If the number is even, display “Number is even” else display “Number is odd”.



Two-Way Selection - Example

Problem Statement 2: If the number is even, make it odd else double it and finally display the number.



Multi-Way Selection

- Multi-way selection is series of two-way selections.
- In multi-way selection there are multiple conditions and multiple possible choices

available, we choose any one of them.

- Either all the conditions will not be satisfied or at maximum any one of the condition can be satisfied. But at the end we can only choose one of the choice.
- Like, a person checks the age of the three persons to determine who is elder amongst them? If the age of first person, is greater than second and third, then person 1 is elder; otherwise if the age of second person, is greater than first and third, then person 2 is elder; otherwise person 3 is elder.
- It is an example involving multi-way selection.

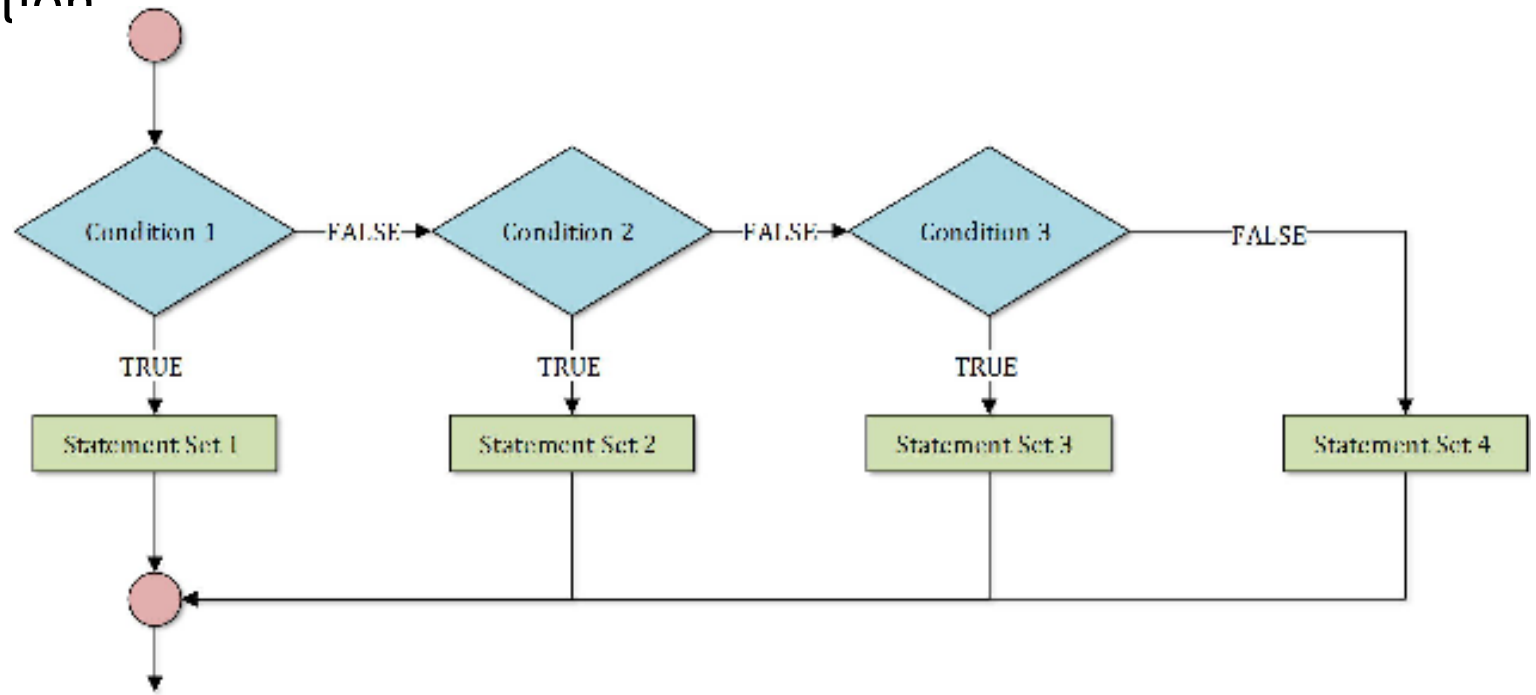
Multi-Way Selection

In multi-way selection:

- If the 1st condition is satisfied (true), the 1st set of statements is executed.
- If the 1st condition is not satisfied (false), then we check for 2nd condition.
- If the 2nd condition is satisfied (true), the 2nd set of statements is executed.
- If the 2nd condition is not satisfied (false), then we check for 3rd condition.
- And the process continues up to nth condition.
- If the nth condition is satisfied (true), the nth set of statements is executed.
- If the nth condition is not satisfied (false), then (n+1)th set of statements is executed.

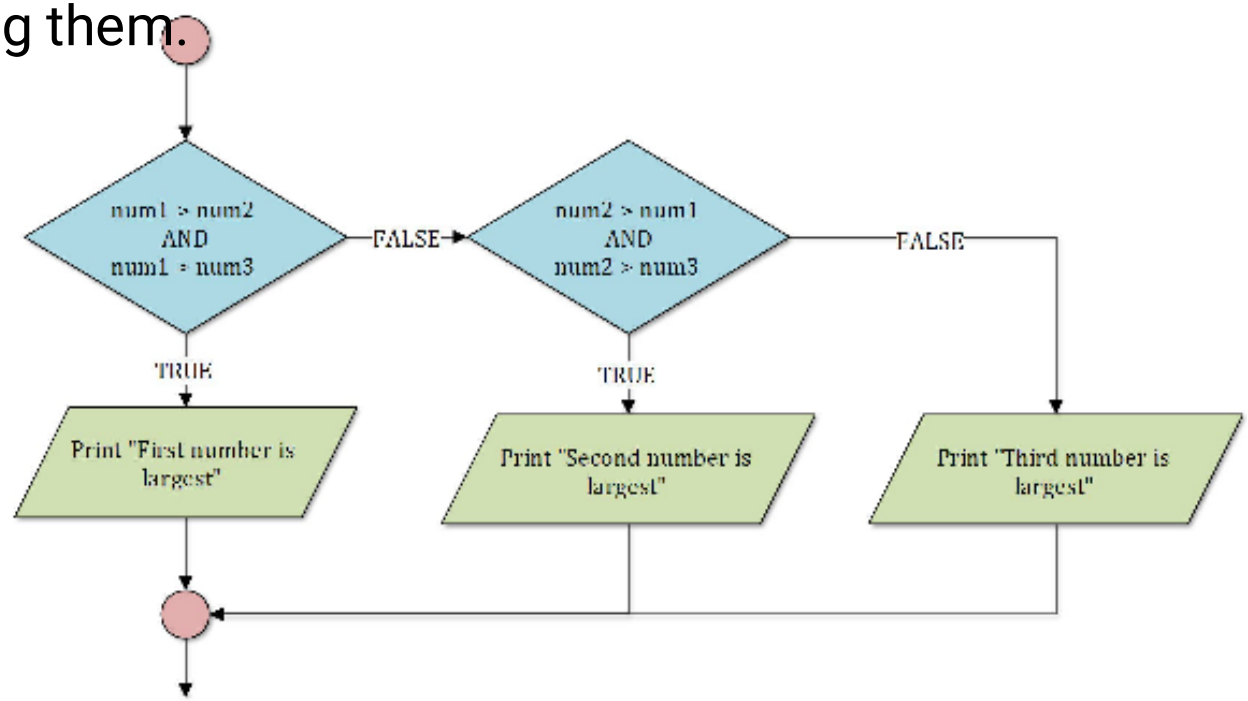
Multi-Way Selection – Flow Chart

Following is the flow of execution of multi-way (4-way) selection:



Multi-Way Selection – Example

Problem Statement: Compare three numbers and display which number is largest among them.



Choice-Way Selection

- Choice-way selection is the simplest form of multi-way selection.
- In choice-way selection there is no any condition to be checked. You are provided with multiple options and given a choice to select only one of the option among them.
- Every option is associated with different statement set. When you select a choice it is matched with all of the options, one of the option will be matched and corresponding statement set will be executed.

Choice-Way Selection

- Like, a teacher gives remarks to a student according to the marks he/ she gets out of 5. He sets the remarks criteria as:

Marks	Remarks
0	Very Bad
1	Not Satisfactory
2	Slightly Satisfactory
3	Satisfactory
4	Good
5	Excellent

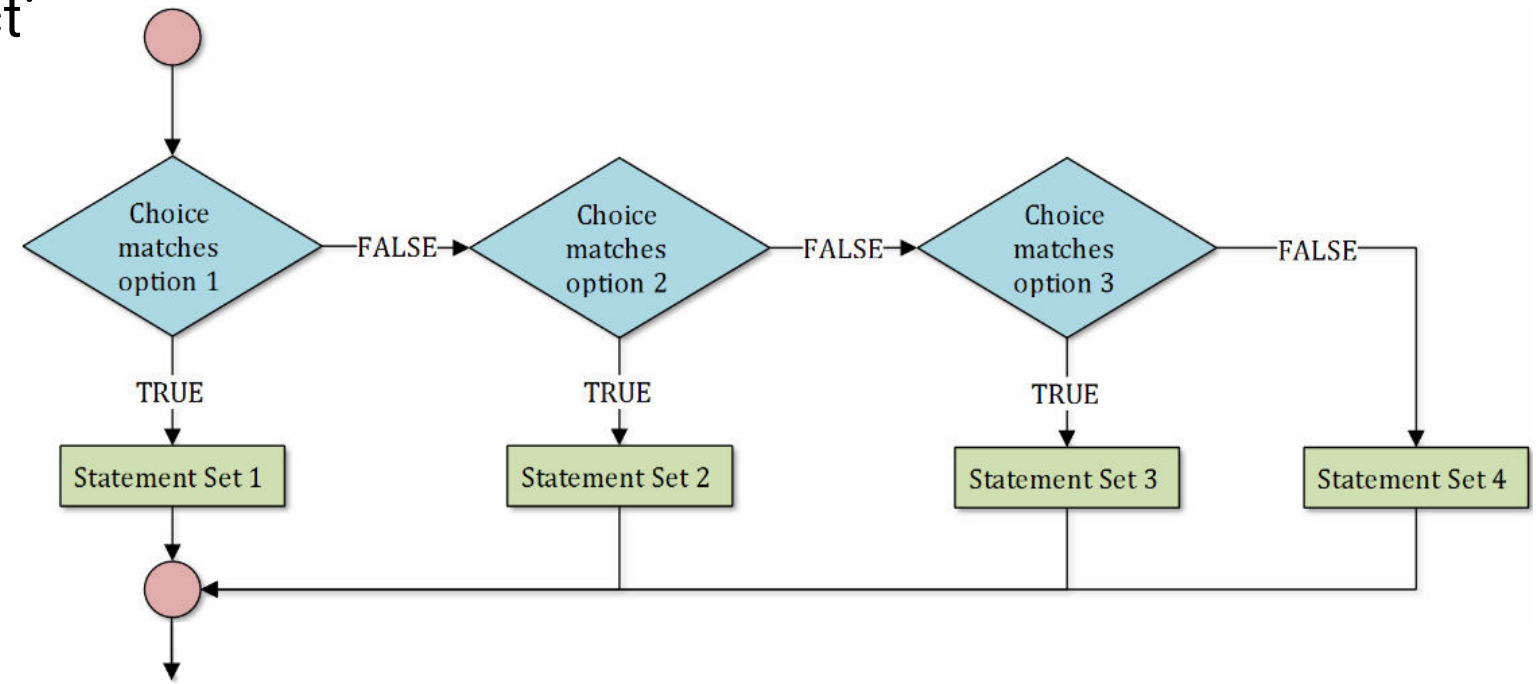
Choice-Way Selection

In choice-way selection:

- We make a choice.
- If choice matches with 1st option, the 1st statement set is executed.
- If choice matches with 2nd option, the 2nd statement set is executed.
- If choice matches with 3rd option, the 3rd statement set is executed.
- And the process continues up to nth option.

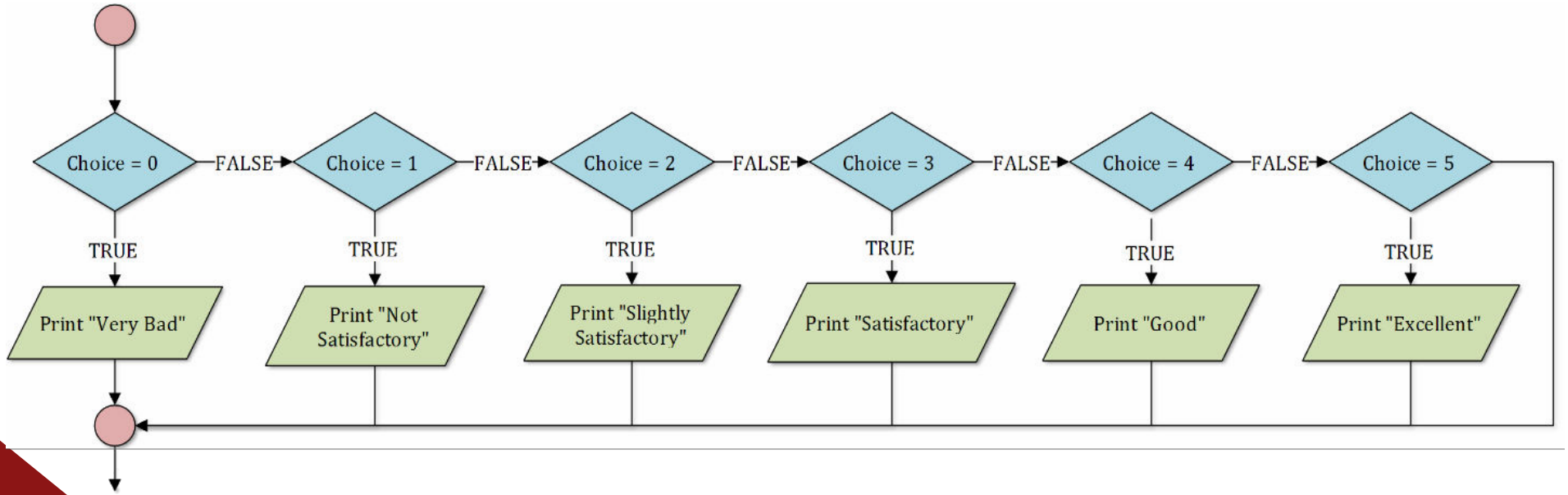
Choice-Way Selection – Flow Chart

Following is the flow of execution of choice-way (4-way) select



Choice-Way Selection – Example

Problem Statement: Give remarks to the student according to the marks he/she gets out of 5 in the sessional test.



Conditional Control Structures in C++

- Conditional control structures are used to execute set of statements on the

basis of one or more conditions.

- The statements that are needed to be executed conditionally are placed with

in the conditional structures and one or more conditions are specified.

- The conditional control structures implement the conditional/selection logic in C++.

if Statement in C++

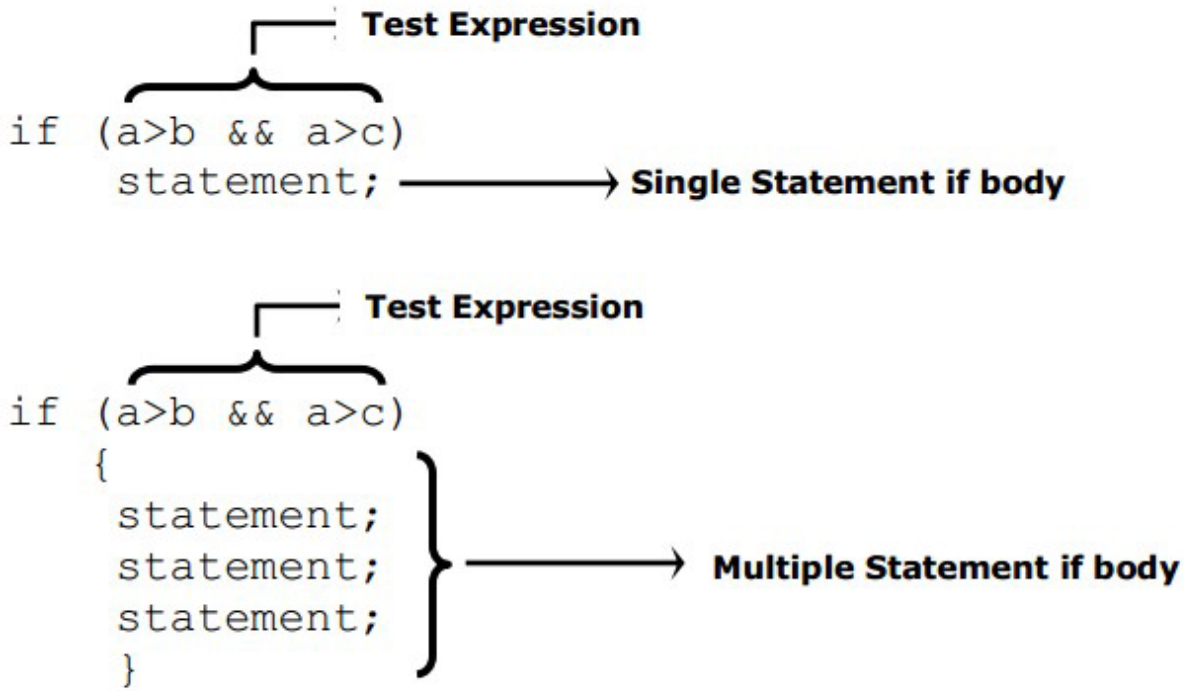
- ***if statement*** implements **one-way selection logic**.
- It executes the statement(s) on the basis of one condition.
- If the condition is ***true***, it executes if block.
- If the condition is ***false***, it does not execute if block.

if Statement – Syntax

```
if ( condition )
{
statement set ;
}
```

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

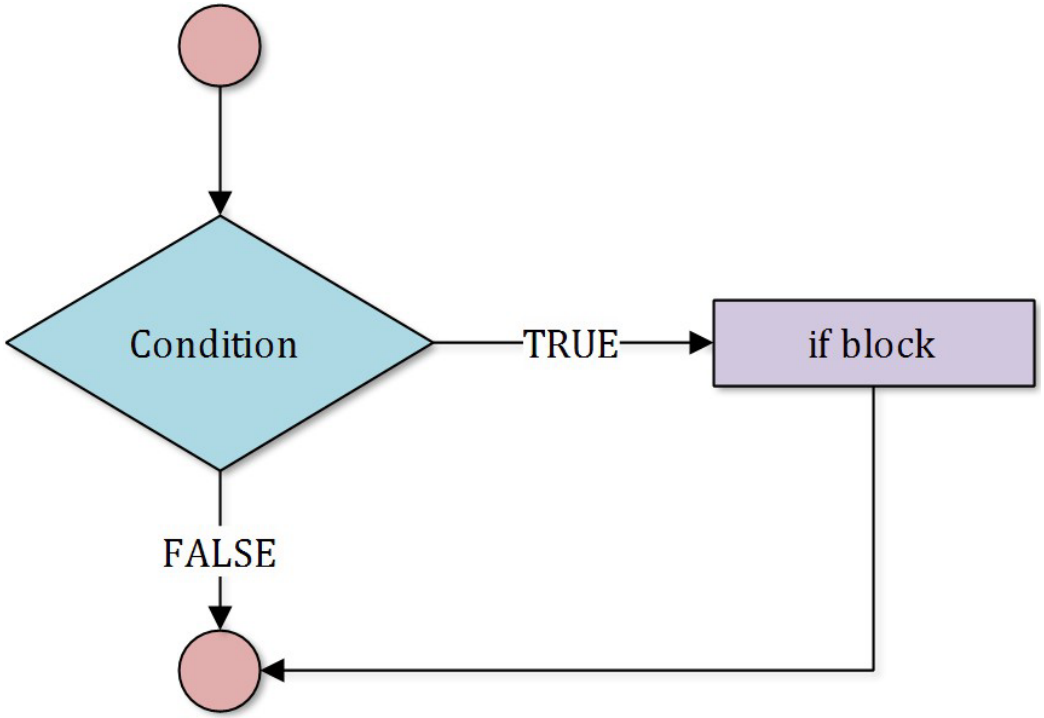
if Statement – Syntax



if Statement – Syntax

- There are two syntaxes of if statement.
- In first syntax we have multiple statements inside the if statement.
- In this case it is compulsory to enclose all the statements in the braces **{ }** .
- In second syntax we have just one statement inside the if statement.
- In this case it is optional to enclose the statement in the braces **{ }** .
- All the statements enclosed in **{}** is called as the **block**.

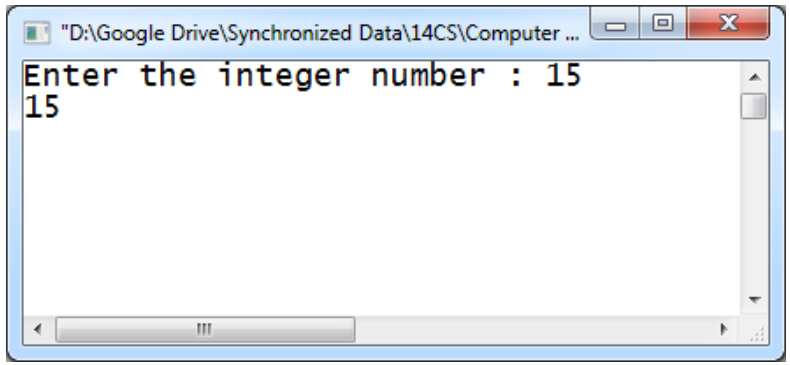
if Statement – Flow Chart



if Statement - Example

Problem Statement 1: If the number is positive then display it.

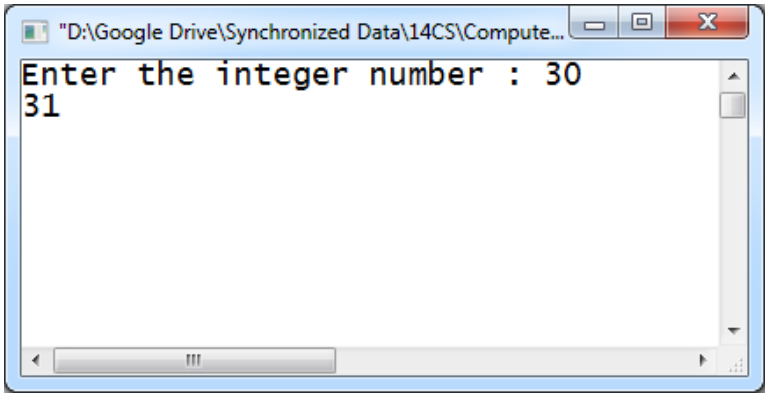
```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
     int num;

     cout<<"Enter the integer number : ";
     cin>>num;

     if(num>0)
          cout<<num;

     getch();
     return 0;
}
```



if Statement - Example

Problem Statement 2: If the number is multiple of 5 then add 1 to it and display the resultant number.

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
     int num;

     cout<<"Enter the integer number : ";
     cin>>num;

     if(num%5==0)
     {
          num = num + 1;
          cout<<num;
     }

     getch();
     return 0;
}
```



If-else Statement in C++

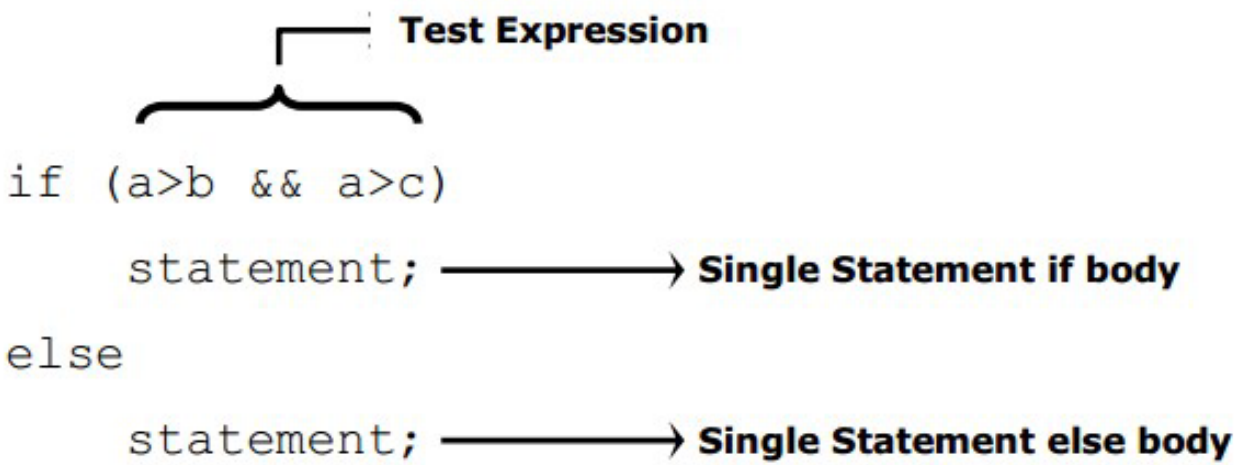
- ***If-else statement*** implements **two-way selection logic**.
- It executes the statement(s) on the basis of one condition.
- If the condition is ***true***, it executes if block.
- If the condition is ***false***, it executes else block.

If-else Statement – Syntax

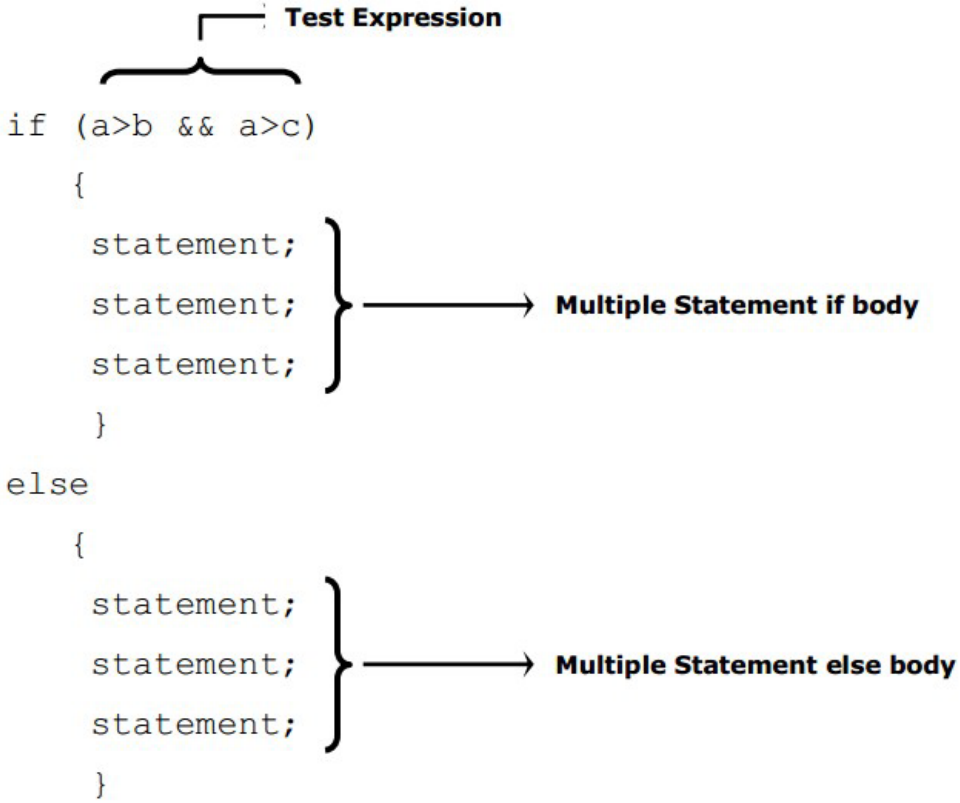
```
if ( condition )
{
statement set 1 ;
}
else
{
statement set 2 ;
}
```

```
if ( condition )
statement set 1 ;
else
statement set 2 ;
```

If-else Statement – Syntax



If-else Statement – Syntax

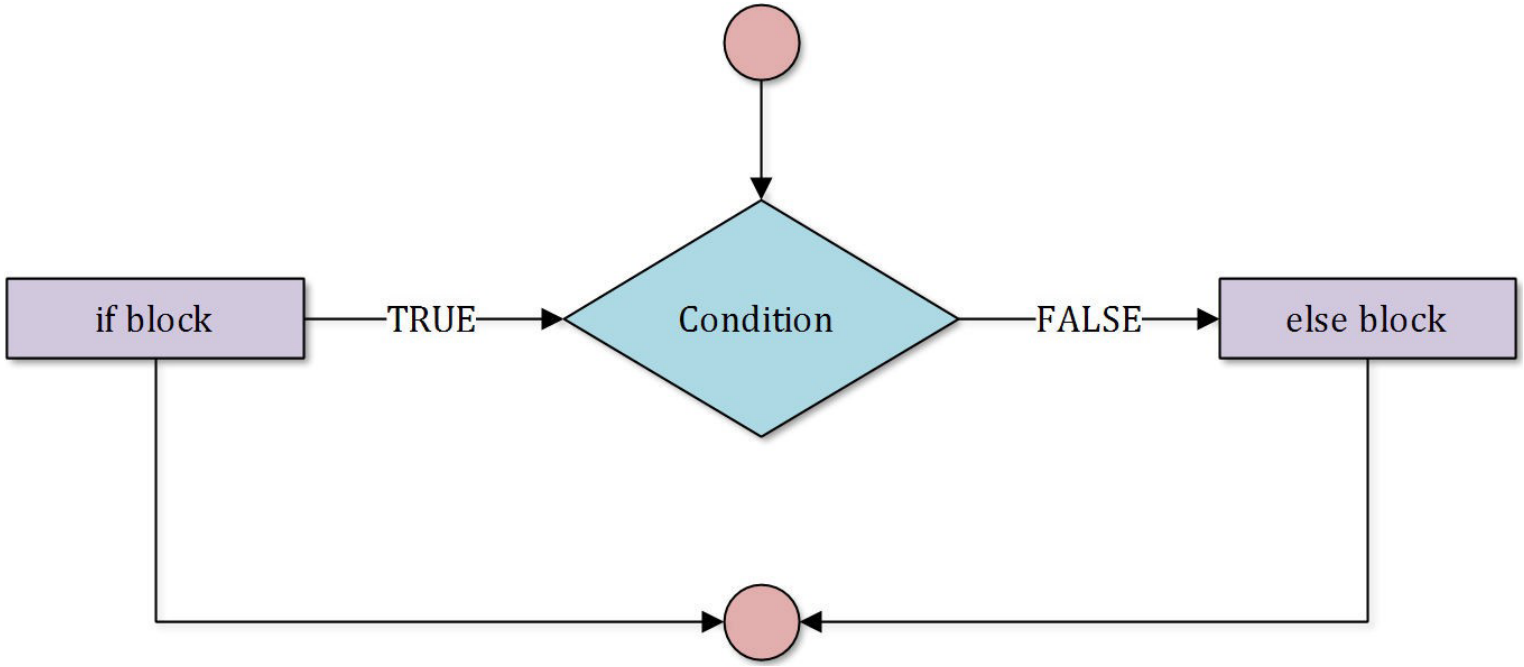


If-else Statement – Syntax

- There are two syntaxes of if-else statement.
- In first syntax we have multiple statements inside the if-else statement.
- In this case it is compulsory to enclose all the statements in the braces **{ }** .
- In second syntax we have just one statement inside the if-else statement.
- In this case it is optional to enclose the statement in the braces **{ }** .

if-else statement contains two blocks: **One if block** and **one else block**.

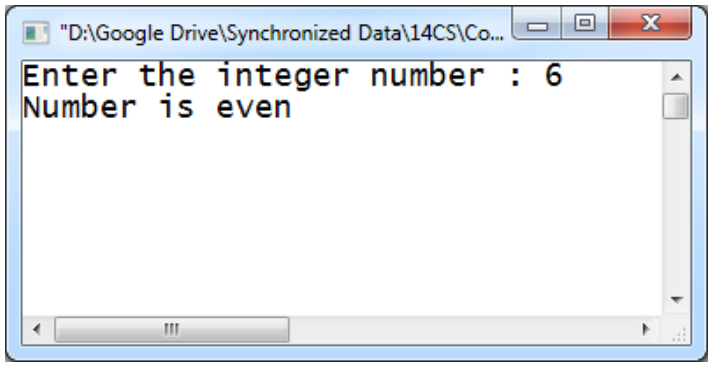
If-else Statement – Flow Chart



if-else Statement - Example

Problem Statement 1: If the number is even, display “Number is even” else display “Number is odd”.

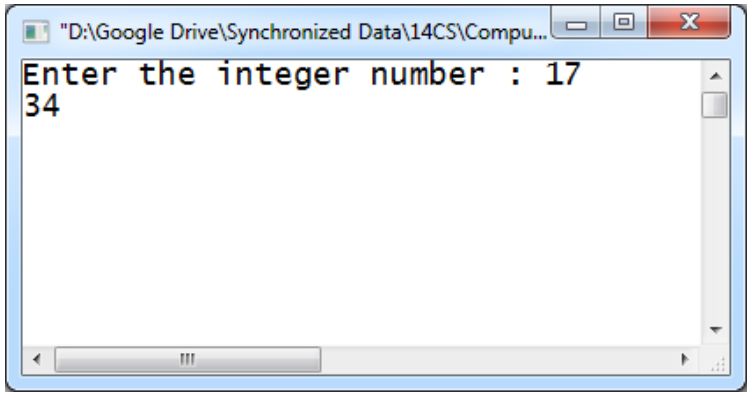
```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
     int num;

     cout<<"Enter the integer number : ";
     cin>>num;

     if(num%2==0)
          cout<<"Number is even";
     else
          cout<<"Number is odd";

     getch();
     return 0;
}
```



if-else Statement - Example

Problem Statement 2: If the number is even, make it odd else double it and finally display the number.

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int num;

    cout<<"Enter the integer number : ";
    cin>>num;

    if(num%2==0)
    {
        num = num + 1;
        cout<<num;
    }
    else
    {
        num = num * 2;
        cout<<num;
    }

    getch();
    return 0;
}
```



if-else-if Statement in C++

- ***If-else-if statement*** implements **multi-way selection logic**.
- It executes the statement(s) on the basis of multiple conditions (atleast two).
- If the first condition is ***true***, it executes if block.
- If the first condition is ***false***, it checks second condition.
- If the second condition is ***true***, it executes else-if block 1.
- If the second condition is ***false***, it checks third condition.
- And the process continues up to n^{th} condition.
- If the n^{th} condition is ***true***, it executes else-if block n.
- If the n^{th} condition is ***false***, it executes else block.

if-else-if Statement – Syntax

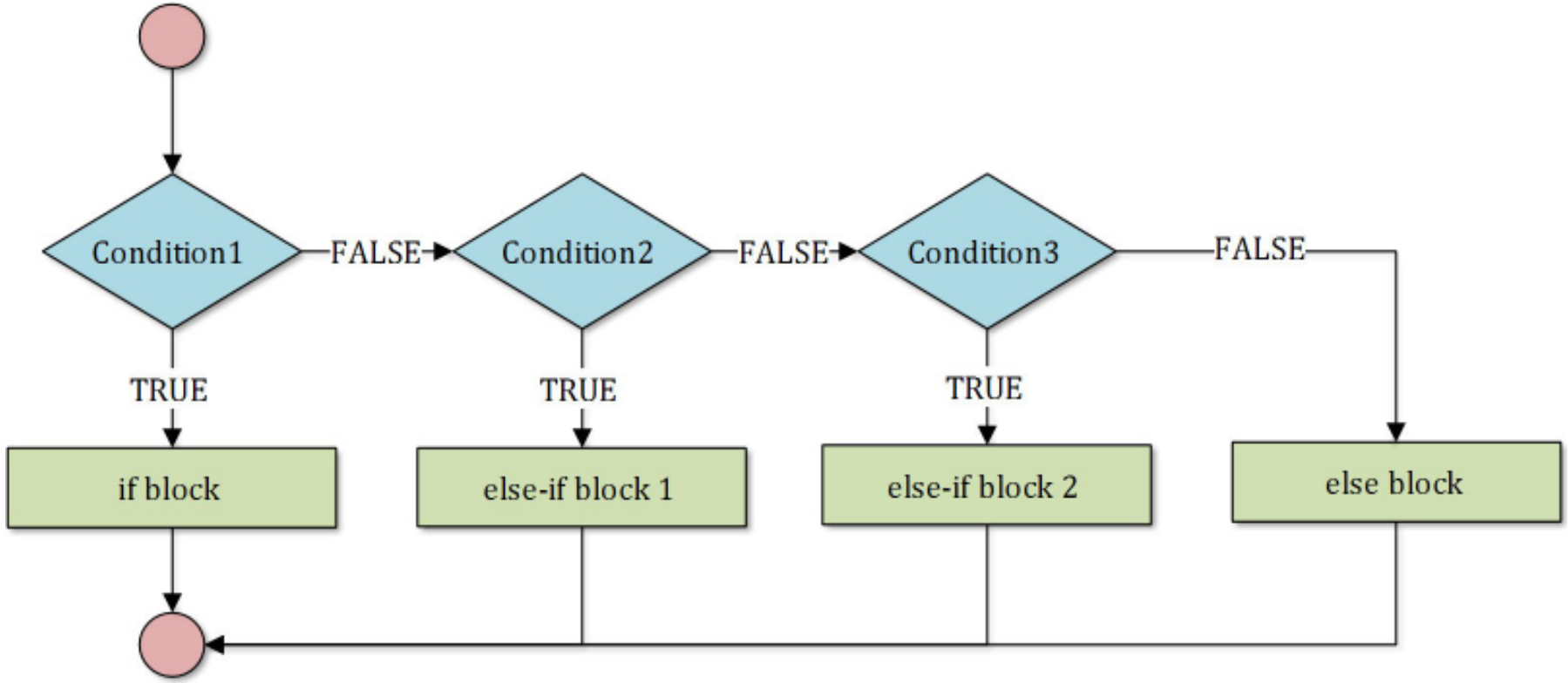
```
if ( condition1 )
{
statement set 1 ;
}
else if ( condition2 )
{
statement set 2 ;
}
else if ( condition3 )
{
statement set 3 ;
}
else
{
statement set 4 ;
}
```

```
if ( condition1 )
    statement set 1 ;
  else if ( condition2 )
    statement set 2 ;
          else if (
        condition3 )
    statement set 3 ;
else
    statement set 4 ;
```

if-else-if Statement – Syntax

- There are two syntaxes of if-else-if statement.
- In first syntax we have multiple statements inside the if-else-if statement.
- In this case it is compulsory to enclose all the statements in the braces **{ }** .
- In second syntax we have just one statement inside the if-else-if statement.
- In this case it is optional to enclose the statement in the braces **{ }** .
- if-else-if statement contains: **One if block**, **multiple else-if blocks (at least one)** and **one else block (optional)**.

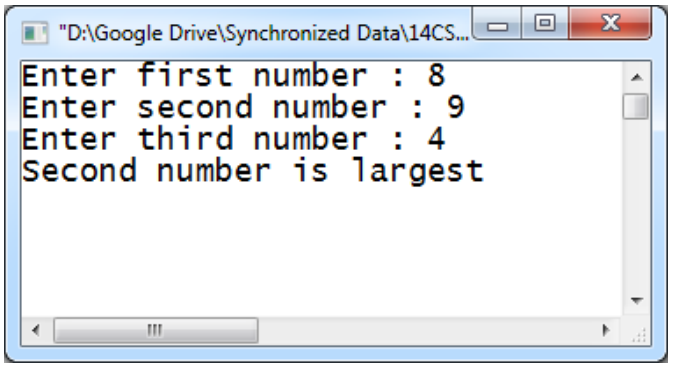
if-else-if Statement – Flow Chart



if-else-if Statement - Example

Problem Statement: Compare three numbers and display which number is largest among them.

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int num1, num2, num3;

    cout<<"Enter first number : ";
    cin>>num1;
    cout<<"Enter second number : ";
    cin>>num2;
    cout<<"Enter third number : ";
    cin>>num3;

    if(num1>num2 && num1>num3)
        cout<<"First number is largest";
    else if(num2>num1 && num2>num3)
        cout<<"Second number is largest";
    else
        cout<<"Third number is largest";

    getch();
    return 0;
}
```



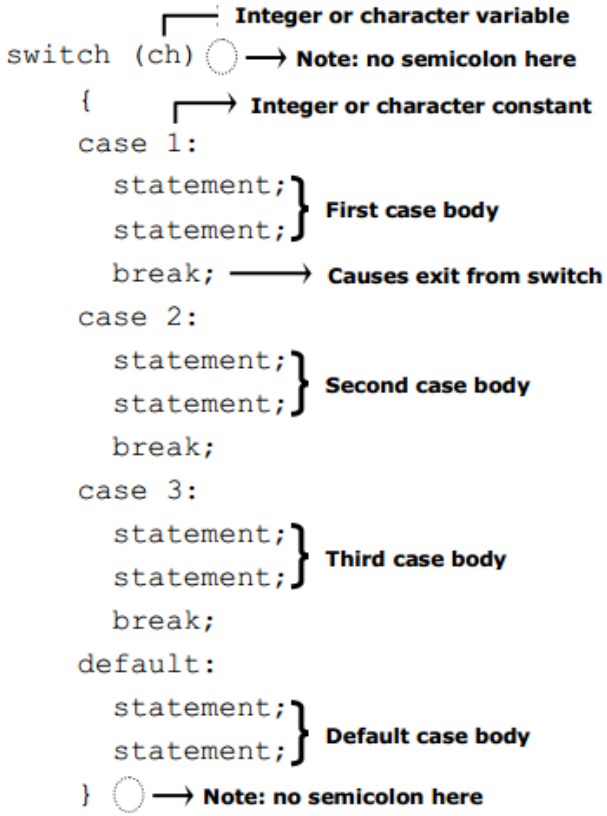
switch Statement in C++

- ***switch*** implements **choice-way selection logic**.
- It executes the statement(s) on the basis of expression and available choices.
- It first evaluates the expression and matches the value of expression to available choices (cases).
- If the value matches with first case, then case 1 body is executed.
- If the value matches with second case, then case 2 body is executed.
- And the process continues up to n^{th} case.
- If the value does not matches with any of the case, then default case body is executed.

switch Statement – Syntax

```
switch ( expression )
{
case 1 :
statement set 1 ; break ;
case 2 :
statement set 2 ;
break ; case 3 :
statement set 3 ; break ;
default :
statement set 4 ;
}
```

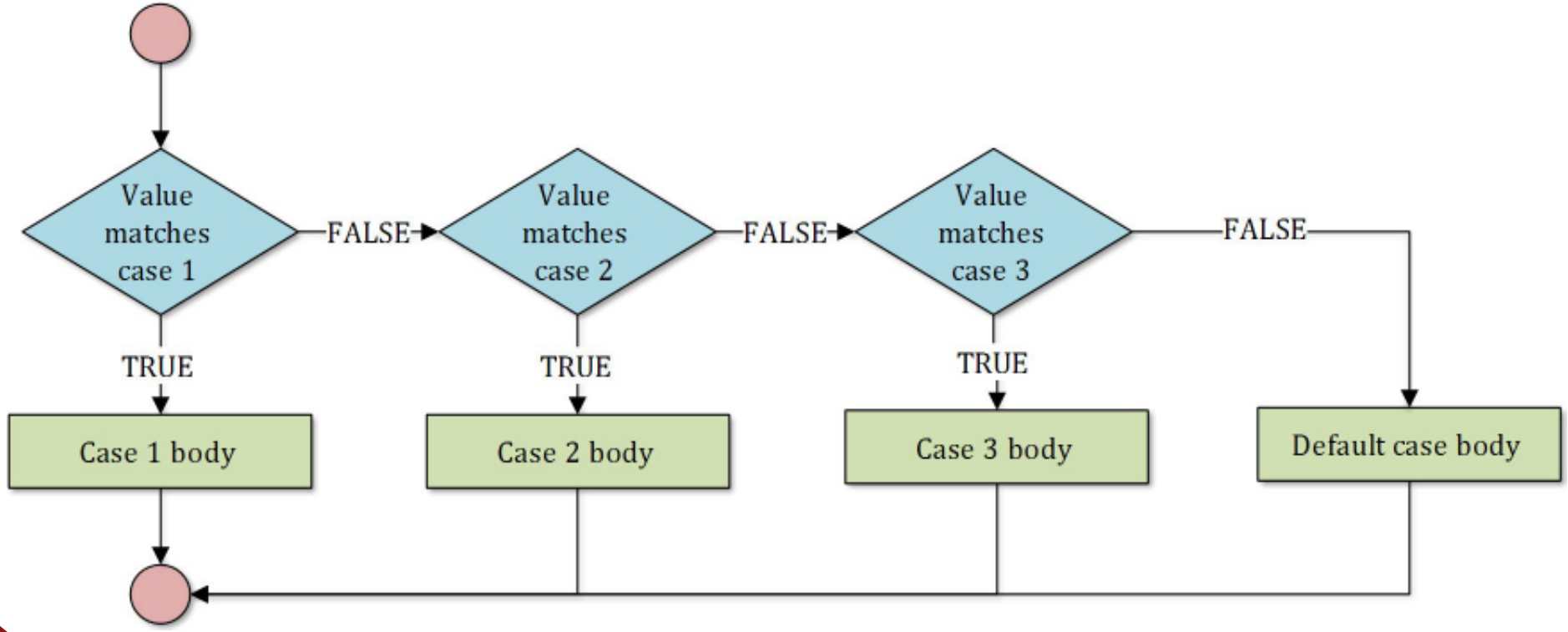
switch Statement – Syntax



switch Statement – Syntax

- In switch statement, first the expression is evaluated to a single value.
- In expression we can only use the value of data types: **char**, **short**, **int** and **long**. No any other data types is accepted.
- We cannot use relational operation in switch statement.
- switch statement always contain one expression and multiple cases. Where each case is ended by break statement.
- Last case is the default case (it is optional), it is executed when the evaluated value does not match with any of the case.

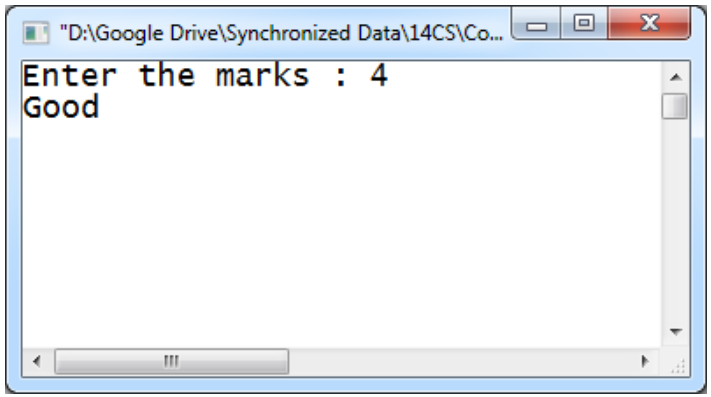
switch Statement – Flow Chart



switch Statement - Example

Problem Statement: Give remarks to the student according to the marks he/she gets out of 5 in the sessional test.

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int marks;

    cout<<"Enter the marks : ";
    cin>>marks;

    switch(marks)
    {
        case 0:
            cout<<"Very Bad";
            break;
        case 1:
            cout<<"Not Satisfactory";
            break;
        case 2:
            cout<<"Slightly Satisfactory";
            break;
        case 3:
            cout<<"Satisfactory";
            break;
        case 4:
            cout<<"Good";
            break;
        case 5:
            cout<<"Excellent";
            break;
    }

    getch();
    return 0;
}
```



Decision to Choose Between Conditional Control Structure

- If there is only **one possible outcome** of the program, use **if statement**.
- If there are **two possible outcomes** of the program, use **if-else statement**.
- If there are **more than two possible outcomes** of the program, use **if-else-if statement** or **switch statement**.
- If the condition depends on **range of values**, use **if-else-if statement**.
- If the condition includes **>** , **<** , **>=** or **<=** relational operators, use **if-else-if statement**.
- If the condition depends on **exactly one value**, use **switch** statement.
- If the condition includes **==** relational operators, use **switch statement**.

Program Examples

if, if-else, if-else-if and switch statements

Program Example 01

Problem Statement:

Write a program in C++ that asks you the marks obtained in six different subjects. The program displays the total obtained marks, percentage and the grade as shown in following distribution.

Percentage	Grade
>=85	A+
>=80 and <85	A
>=75 and <80	B+
>=70 and <75	B
>=65 and <70	C+
>=60 and <65	C
>=55 and <60	D+
>=50 and <55	D
<50	F

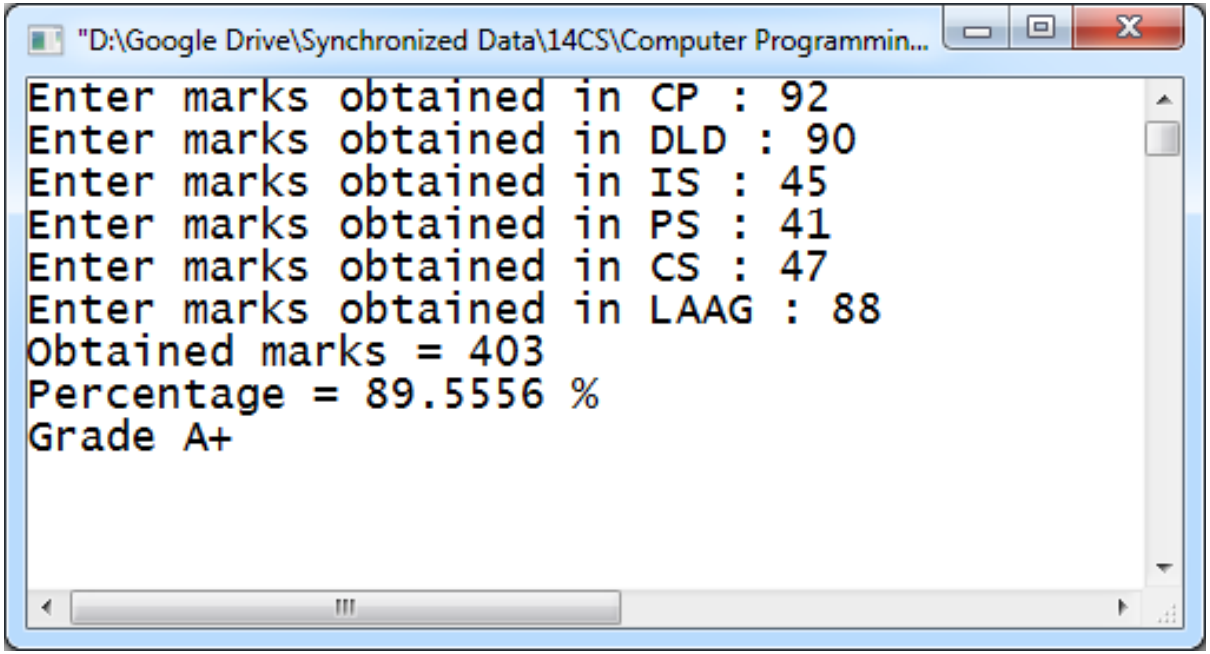
Program Example 01

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int CP,DLD,IS,PS,CS,LAAG,ObtainedMarks;
    float Percentage;

    cout<<"Enter marks obtained in CP : ";        cin>>CP;
    cout<<"Enter marks obtained in DLD : ";       cin>>DLD;
    cout<<"Enter marks obtained in IS : ";        cin>>IS;
    cout<<"Enter marks obtained in PS : ";        cin>>PS;
    cout<<"Enter marks obtained in CS : ";        cin>>CS;
    cout<<"Enter marks obtained in LAAG : ";      cin>>LAAG;

    ObtainedMarks = CP + DLD + IS + PS + CS + LAAG;
    cout<<"Obtained marks = "<<ObtainedMarks<<endl;

    Percentage = (ObtainedMarks/450.0)*100;
    cout<<"Percentage = "<<Percentage<<" %"<<endl;
```

Program Example 01

```
    if(Percentage>=85)
        cout<<"Grade A+";
    else if(Percentage>=80 && Percentage<85)
        cout<<"Grade A";
    else if(Percentage>=75 && Percentage<80)
        cout<<"Grade B+";
    else if(Percentage>=70 && Percentage<75)
        cout<<"Grade B";
    else if(Percentage>=65 && Percentage<70)
        cout<<"Grade C+";
    else if(Percentage>=60 && Percentage<65)
        cout<<"Grade C";
    else if(Percentage>=55 && Percentage<60)
        cout<<"Grade D+";
    else if(Percentage>=50 && Percentage<55)
        cout<<"Grade D";
    else if(Percentage<50)
        cout<<"Grade F";

    getch();
    return 0;
}
```

Program Example 01



Program Example 02

Problem Statement:

There are two circular grounds Ground-A and Ground-B. Ground-A is having diameter of 15 meters and Ground-B is having diameter of 20 meters. Mohsin is running in Ground-A and Neetesh is running in Ground-B. Write a computer program that asks the user to input the time taken, in seconds, to complete one compete round of the ground by both the friends and displays who is running faster.

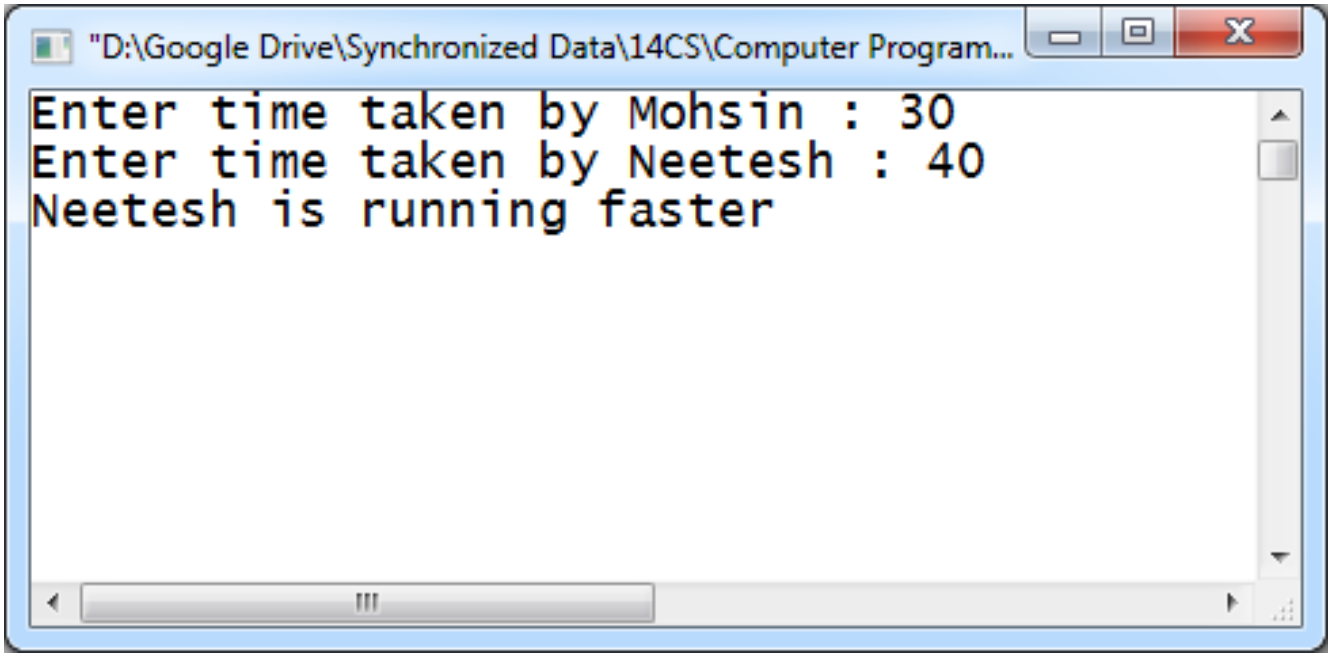
Program Example 02

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int dA =15, dB=20, TA, TB;
    float speedA, speedB;
    const float PI = 3.1415;

    cout<<"Enter time taken by Mohsin : ";
    cin>>TA;
    cout<<"Enter time taken by Neetesh : ";
    cin>>TB;
```

Program Example 02

```
    speedA = (2*PI*(dA/2))/TA;
    speedB = (2*PI*(dB/2))/TB;

    if(speedA > speedB)
        cout<<"Mohsin is running faster";
    else
        cout<<"Neetesh is running faster";

    getch();
    return 0;
}
```

Program Example 02



Program Example 03

Problem Statement:

Write a computer program that asks the user to enter three angles of a triangle. The program displays whether the triangle is right-angle, acute-angle or obtuse-angle.

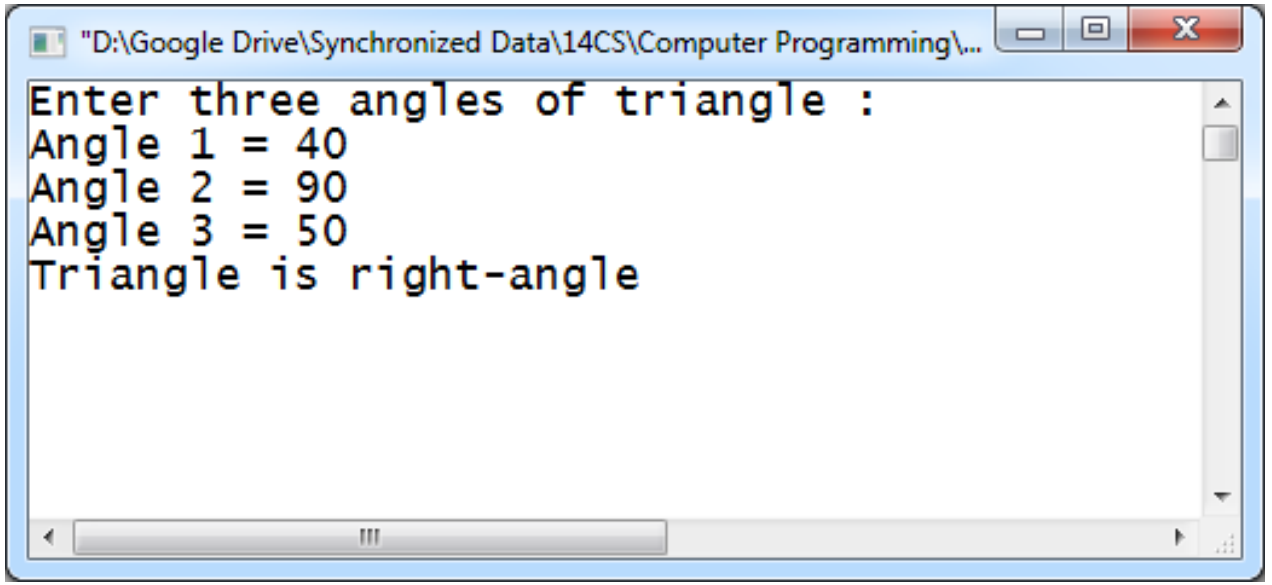
Program Example 03

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int ang1, ang2, ang3;

    cout<<"Enter three angles of triangle : "<<endl;
    cout<<"Angle 1 = ";
    cin>>ang1;
    cout<<"Angle 2 = ";
    cin>>ang2;
    cout<<"Angle 3 = ";
    cin>>ang3;
```

Program Example 03

```
    if(ang1==90 || ang2==90 || ang3==90)
        cout<<"Triangle is right-angle";
    else if(ang1<90 || ang2<90 || ang3<90)
        cout<<"Triangle is acute-angle";
    else
        cout<<"Triangle is obtuse-angle";

    getch();
    return 0;
}
```

Program Example 03



Program Example 05

Problem Statement:

Write a computer program that asks the user to enter any character. The program should whether the entered character is a vowel or a consonant.

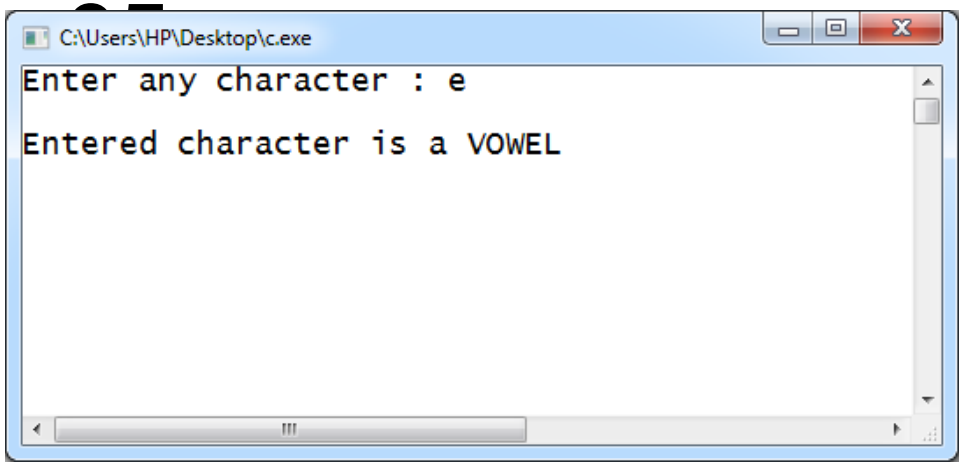
Program Example 05

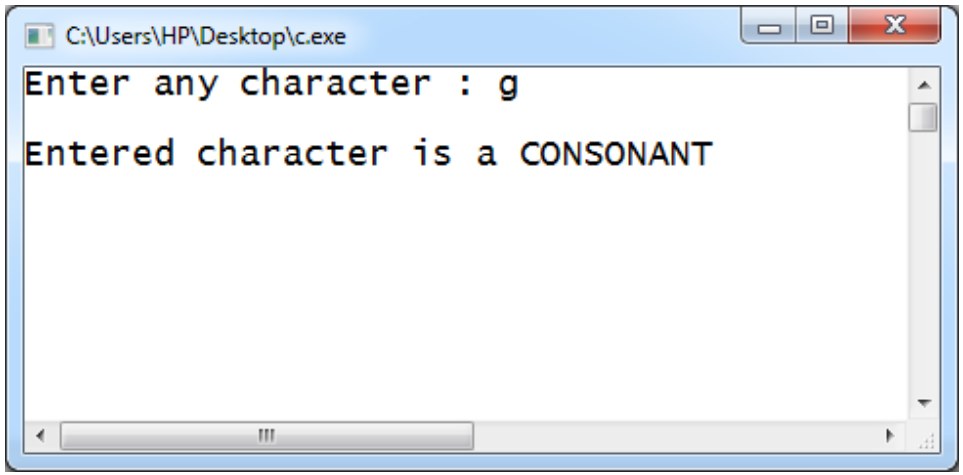
```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    char ch;

    cout<<"Enter any character : ";
    ch = getche();

    switch(ch)
    {
        case 'a':
        case 'e':
        case 'i':
        case 'o':
        case 'u':
            cout<<endl<<endl<<"Entered character is a VOWEL";
            break;
```

Program Example 05

```
        default:
            cout<<endl<<endl<<"Entered character is a CONSONANT";
            break;
    }

    getch();
    return 0;
}
```

Program Example





Do it by Yourself!

Problem Statement:

Write a computer program that asks the user to enter date of birth and month of birth. The program should display the zodiac star.

Capricorn  22 Dec - 20 Jan	Aquarius  21 Jan -19 Feb	Pisces  20 Feb - 20 Mar	Aries  21 Mar- 19 Apr
Taurus  20 Apr - 20 May	Gemini  21 May - 21 Jun	Cancer  22 Jun - 23 Jul	Leo  24 Jul - 23 Aug
Virgo  24 Aug - 22 Sept	Libra  23 Sept - 22 Oct	Scorpio  23 Oct - 22 Nov	Sagitarius  23 Nov - 20 Dec