Computational Thinking and Programming - 1

Python - Flow of Control

Empty Statement

The simplest statement is the empty statement i.e. a statement which does nothing. In Python, the empty statement is the pass statement.

It is written as:

```
pass
```

Whenever the interpreter encounters a pass statement, Python does nothing and simply moves to the next statement in the flow of control. The pass statement is a do nothing statement i.e. empty statement or a null operation statement.

Simple Statement

Any single executable statement is a simple statement in Python. Simple statement are single line instructions, like the ones we have seen earlier.

A simple example is

```
name=input("Enter your name")
```

Compound Statement

A compound statement is a group of statements executed as one unit. The compound statements are written in a specific pattern as shown below:

```
<compound statement header>:
    <indented body having multiple simple
     and/or compound statements>
```

A compound statement has a

- A header line which begins with a keyword and ends with a colon.
- A body consisting of one or more statements each indented inside the header line. All statements in the body are at the same level of indentation.

Compound Statement

In Python, indentation is used to declare a block. If two statements are at the same indentation level, then they are a part of the same block. The group of statements is also called a suite.

Generally four white spaces are used for indentation and is preferred over tabs.

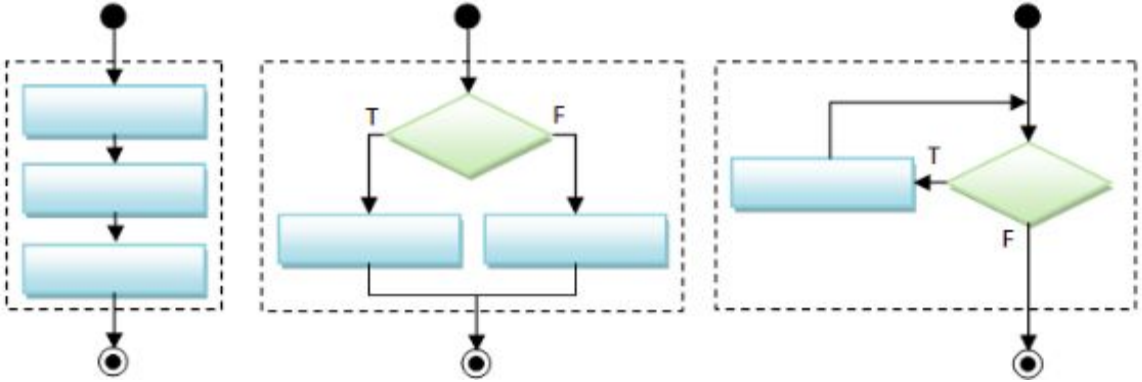
Indentation is the most used part of the python language since it declares the block of code.

All the statements of one block are intended at the same level indentation.

Statement Flow Control

In a program, statements may be executed sequentially, selectively or iteratively. Every programming language provides constructs to do it.

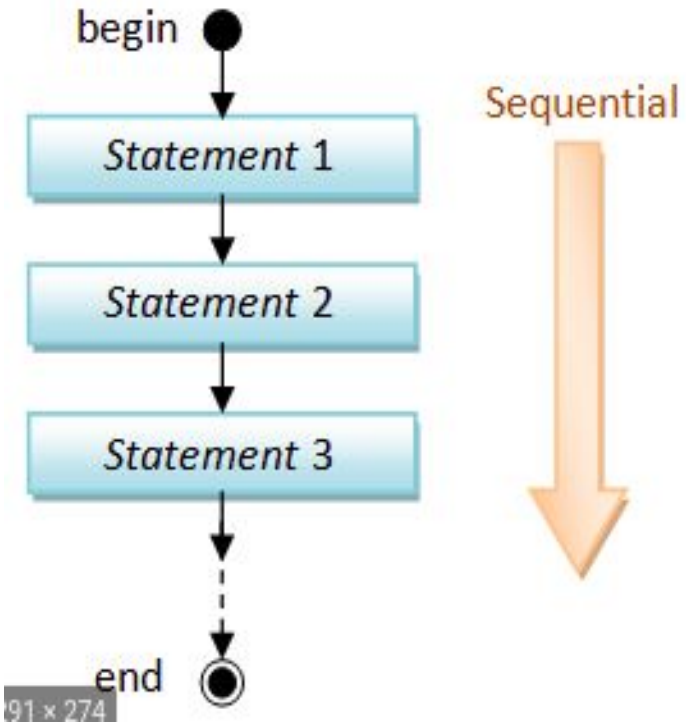
sequence **selection** **iteration**



Sequence

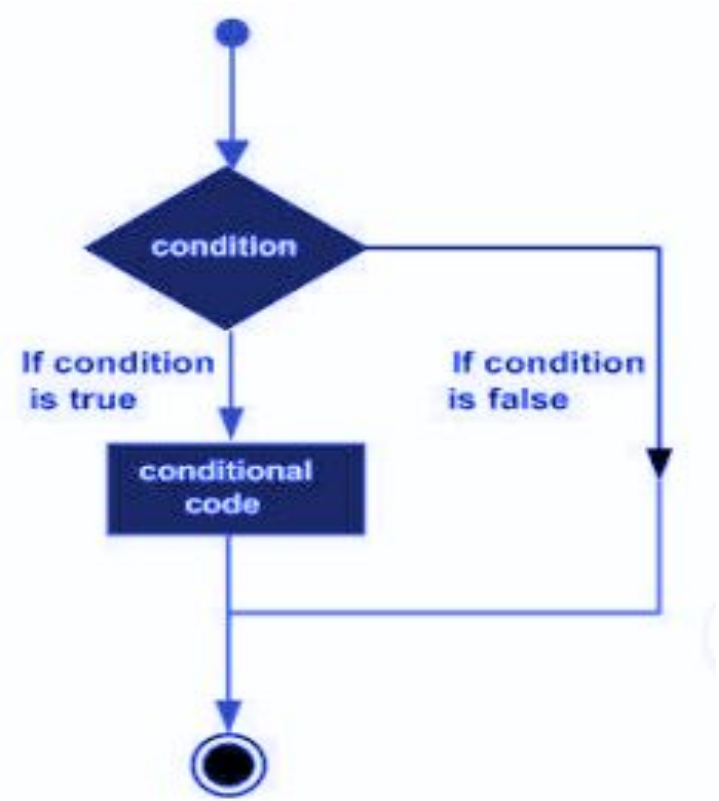
The sequence construct means the statements are executed sequentially i.e. one after the other. This is the default flow of statements.

Every Python program begins with the first statement of the program. Each statement in turn is executed. When the last statement is executed, the program is done. Sequence refers to the normal flow of control in a program.



Selection

The selection construct means the execution of a set of statement(s) depending upon a condition. If the condition evaluated to True, a course of action (a set of statements) is followed otherwise another course of action (a different set of statements) is followed. This construct (selection construct) is also called the decision construct since it helps in making a decision about which set of statements is to be executed.



Selection

Python if statement supports selection.

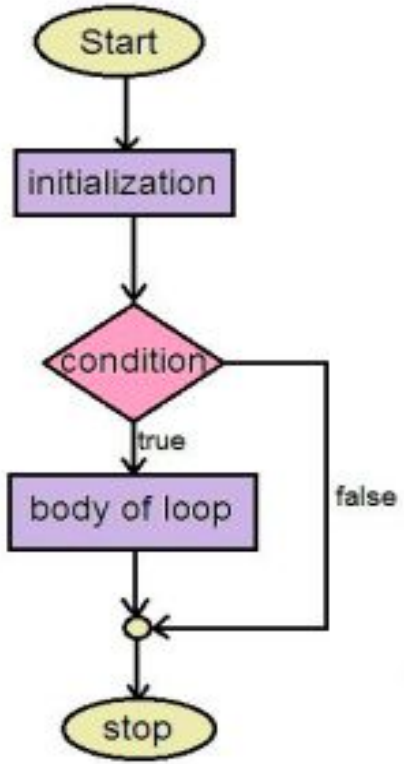
- A simple example of such a case is to display the result of a student depending upon his/her marks. The result is either “Pass” or “Fail” depending upon the condition whether the student has scored passing marks or not.

- To input the marks of a student, and if the marks are above 75, the message should display that the child has performed ‘well’ otherwise it should display that ‘An improvement is needed’.

Iteration

The iteration construct means repetition of a set of statements depending upon a condition. As long as the condition is true, a set of statements are executed repeatedly. As soon as the condition becomes false, the repetition stops. It is also known as looping. **The set of statements that are executed again and again are called the body of the loop**. The condition on which the execution or exit of the loop depends is called the exit condition or test condition.

Python **for** and **while** statements support iteration.



Conditional Statement using if

The if statements are the conditional statements in Python that implement selection constructs. If statement checks for a condition, if the condition evaluates to true, a course of action is followed otherwise that course of action is ignored but another course of action is followed.

The simplest form of if statement tests a condition and if the condition evaluates to true, it carries out some instructions but does nothing if the condition evaluates to false.

```
if <test condition> :
    Statement/
    [statements]
```

where statement may be a single statement, a compound statement or just a pass statement.

Conditional Statement using if

For example:

```
ch=input("enter a character ")
if ch>='0' and ch<='9' :
    print("you have entered a digit")
```

Code to find whether character inputted is digit

Conditional Statement using if

For example:

```
age=int(input("enter your age"))
if age>18:
    print ("You are eligible to vote")
```

Code to find whether you are eligible to vote or not

Conditional Statement using if... else

if else statement : This form of statement checks for the test condition. If the condition evaluates to True then the statements indented below if are executed otherwise the statements indented below else are executed.

```
if <Condition1>:
  <Statement1>
else:
  <Statement2>
```

```
if Marks >= 75:
  print("Good")
else:
  print("Can do better")
```

Conditional Statement using if... else

For example:

```
age=int(input("enter your age"))
if age>18:
    print ("You are eligible to vote")
else:
    print ("You are not eligible to vote")
```

Code to find whether you are eligible to vote or not

Conditional Statement using if..elif..else

```
if <Condition1>:
  <Statement1>
elif <Condition2>:
  <Statement2>
  ...
else:
  <StatementN>
```

```
if Marks > 90:
  print("Good")
elif Marks >= 60:
  print("Can do better")
else:
  print("You need to work hard")
```

Question 1

Write a Python code to accept Age and Name from the user, and display a message as Eligible to VOTE and Can get License to Drive if the Age is greater or equal to 18, else it should display the number of years to wait for the same:

Sample Input for Age	Sample Input for Name	Message
`Age: 25`	`Mohit`	`Mohit you are Eligible to VOTE` `Can get License to Drive`
`Age: 11`	`Surmai`	`Surmai Wait for 7 years to Vote` `Wait for Driving License`

Question 2

Write a program to input the day number and print week day.

Day Number	Week Day
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday
7	Sunday

Question 2

Write a program to input the day number and print week day.

Day Number	Week Day
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday
7	Sunday

```
Day=int(input("Enter the day number:"))
if Day == 1:
    print("Monday")
elif Day == 2:
    print("Tuesday")
elif Day == 3:
    print("Wednesday")
elif Day == 4:
    print("Thursday")
elif Day == 5:
    print("Friday")
elif Day == 6:
    print("Saturday")
elif Day == 7:
    print("Sunday")
```

Question 3

Write a program to enter whether a number is positive, negative or zero.

```
Number = int(input("Enter a number :"))
if Number > 0:
    print(Number, " is positive")
elif Number < 0:
    print(Number, " is negative")
else:
    print(Number, " is zero")
```

```
Enter a number :6
6  is positive

Another run

Enter a number : -9
-9  is negative
```

Question 4

Write a program to check whether an alphabet is vowel or consonant.

```
ch = input("Enter a character :")
if ch=="a" or ch=="e" or ch=="i" or ch=="o"
or ch=="u":
    print("Character is a vowel")
else:
    print("Character is a consonant")
```

```
Enter a character: s
Character is a
consonant
```

Question 5

Write a program to check whether a character is uppercase or lowercase alphabet.

```
ch = input("Enter a character :"):
if ch>="A" and ch<="Z":
    print(Character is uppercase alphabet")
elif ch>="a" and ch<="z":
    print("Character is lowercase alphabet")
else:
    print("not a character")
```

```
Enter a character : m
Character is lowercase
alphabet
```

Question 6

Write a program to input two numbers and determine whether one is a multiple of the other or not.

```
num1=int(input("Enter the first number:"))
num2=int(input("Enter the second number:"))
if num1%num2==0:
    print(num1, " is a multiple of ",num2)
elif num2 % num1 == 0:
  print(num2, " is a multiple of ",num1)
else:
 print(num1," and ", num2," are not multiples")
```

```
Enter the first number:6
Enter the second number:2
6  is a multiple of  2
```

Another run

```
Enter the first number:9
Enter the second number:18
18  is a multiple of  9
```

Another run

```
Enter the first number:7
Enter the second number:88
7  and  88  are not multiples
```

Programs

1. Write a program to Input a number and display if the number entered is even or odd.
2. Write a menu driven program to calculate the area of a circle or perimeter of a circle. Depending upon the choice input by the user, display the same after taking the radius of the circle as input from the user.
3. Write a program to check whether a triangle is valid or not if angles are given using if else.
4. Write a program to input the coefficients of a quadratic equation and find all roots. In case of imaginary roots, just display that the roots are imaginary.

Program

5. Write a program to input marks of five subjects Physics, Chemistry, Biology, Mathematics and Computer, calculate percentage and grade according to given conditions:

PERCENTAGE	GRADE
>= 90	A
>= 80	B
>=70	C
>=60	D
>=40	E
< 40	F

6. Write a program to input electricity unit charge and calculate the total electricity bill according to the given condition:

For first 50 units Rs. 0.50/unit

For next 100 units Rs. 0.75/unit

For next 100 units Rs. 1.20/unit

For unit above 250 Rs. 1.50/unit

An additional surcharge of 20% is added to the bill.

7.Write a program to input basic salary of an employee and calculate gross salary (Gross Salary = Basic Salary + HRA + DA) as per the following:

BASIC SALARY	HRA	DA
< = 10000	20%	80%
BETWEEN 10001 TO 20000	25 %	90 %
>= 20001	30%	95%

Display appropriate messages.

Question 1

Write a program to Input a number and display if the number entered is even or odd.

```
num1=int(input("Enter the number:"))
if num1%2==0:
    print(num1, " is even")
else:
 print(num1, " is odd")
```

```
Enter the number:6
6 is even

Another run

Enter the number:13
13 is odd
```

Question 2

Write a menu driven program to calculate the area of a circle or perimeter of a circle. Depending upon the choice input by the user, display the same after taking the radius of the circle as input from the user.

```
print("1. Calculate Area of Circle")
print("2. Calculate Perimeter of Circle")
choice=int(input("Enter your choice:"))
if choice==1:
     r=eval(input("Enter the radius:"))
     ar=22/7*r*r
     print("Area :",ar)
else:
     r=eval(input("Enter the radius:"))
     per=2*22/7*r
     print("Perimeter :",per)
```

```
1. Calculate Area of Circle
2. Calculate Perimeter of Circle
Enter your choice:1
Enter the radius:4.5
Area :63.64285714285714
```

Question 3

Write a program to check whether a triangle is valid or not if angles are given using if else.

```
a=int(input("Enter first angle:"))
b=int(input("Enter second angle:"))
c=int(input("Enter third angle:"))
if a+b+c==180:
    print("Valid Triangle")
else:
    print("InValid Triangle")
```

Enter first angle:70
Enter second angle:70
Enter third angle:40
Valid Triangle

Question 4 - Program to calculate grade

Math module imported to use sqrt() and fabs() functions

```
import math
a = int(input('Enter a: '))
b = int(input('Enter b: '))
c = int(input('Enter c: '))
d = ((b**2) - (4*a*c))
sol1 = (-b-math.sqrt(math.fabs(d)))/(2*a)
sol2 = (-b+math.sqrt(math.fabs(d)))/(2*a)
print("Roots are ",sol1,sol2)
if d<=0:
    print("Roots are imaginary")
else:
    print("Roots are real")
```

```
Enter a: 2
Enter b: 2
Enter c: 2
Roots are
-1.3660254037844386
0.3660254037844386
Roots are imaginary
```

Question 5 - Program to calculate grade

```
m1 = int(input("Enter marks of subject1:"))
m2 = int(input("Enter marks of subject2:"))
m3 = int(input("Enter marks of subject3:"))
m4 = int(input("Enter marks of subject4:"))
m5 = int(input("Enter marks of subject5:"))
total =m1+m2+m3+m4+m5
per=total/500*100
if per>90:
     print("Grade A")
elif per>80:
     print("Grade B")
elif per>70:
     print("Grade C")
elif per>60:
     print("Grade D")
elif per>40:
     print("Grade E")
else:
     print("Grade F")
```

```
Enter marks of subject1:77
Enter marks of subject2:88
Enter marks of subject3:77
Enter marks of subject4:88
Enter marks of subject5:99
Percentage : 85.8
Grade B
```

Question 6 - Electricity Bill

```
units=float(input("Enter the units consumed="))
if(units<=50 and units>=0):
    bill=units*0.50
elif(units<=150):
    bill=50*0.50+(units-50)*0.75
elif(units<=250)
    bill=50*0.50+100*0.75+(units-150)*1.20
else:
    bill=50*0.50+100*0.75+100*1.20+(units-250)*1.50
surcharge=bill*0.20
amt=bill+surcharge
print("Amount to be paid :",amt)
```

```
Enter the units consumed=400
Amount to be paid : 534.0
```

Question 7

```
basic=float(input("Enter the basic salary:"))
if(basic<10000):
    hra=0.8*basic
    da=0.2*basic
elif(basic>10000 and basic<=20000):
    hra=0.9*basic
    da=0.25*basic
else:
    hra=0.95*basic
    da=0.3*basic
gross=basic+da+hra
print("Gross Salary calculated:",gross)
```

```
Enter the basic salary:12000
Gross Salary calculated: 25800.0
```

Nested if

```
if <Condition1>:
      if <Condition2>:
            <Statement(s)>
      else:
            <Statement(s)>
elif <Condition3>:
      <Statement(s)>
else:
<Statement(s)>
```

```
if <Condition1>:
      <Statement(s)>
elif <Condition2>:
      if <Condition3>:
            <Statement(s)>
      else:
            <Statement(s)>
else:
      <Statement(s)>
```

Nested if

```
age = int(input("Enter your age : "))
if age < 18:
    print("You are minor")
    print("You are not eligible to work")
else:
    if age >= 18 and age <=60:
        print("You are eligible to work")
        print("Please fill in your details and apply!")
    else:
        print("You are too old to work as per the Government rules")
        print("Collect your pension")
```

```
Enter your age : 40
You are eligible to work
Please fill in your details and apply!
```

```
Enter your age : 67
You are too old to work as per the
Government rules
Collect your pension
```

Indentation

Say, there are different suites named as A,B,C,D etc with indents at various levels. The concept of indentation can be easily understood by the following:

```
Statements /Suite A:
    Statements/Suite B
    Statements/Suite C
        Statements/Suite D
        Statements/Suite E
    Statements/Suite F
Statements/Suite G
```

Indentation

Let us understand the following script :

```
if a<b:
        print("A is smaller than B")
        print("B is greater than A")
```

Both statements are at same indent level

The above code will print both statements if the condition "a<b" is true.

Indentation

- One statement is linked with if

```
if 5>40:
      print("5 is not smaller than 40")
print("Done")
```

Done

- Two statements linked with if

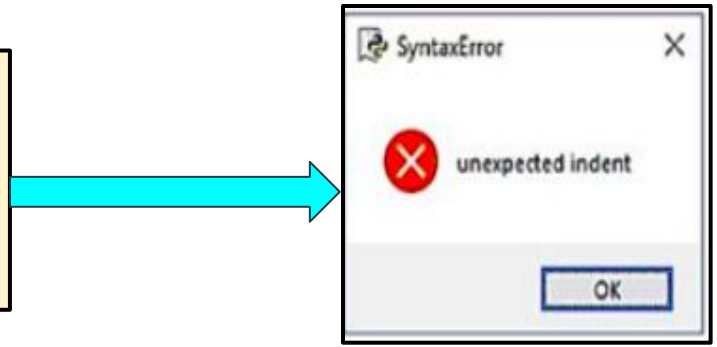
```
if 5>40:
      print("5 is not smaller than 40")
      print("Done")
```

No output will be shown

Indentation

- Invalid indentation is a syntax error

```
print("5 is not smaller than 40")
    print(“Done”)
```



- If you have only one statement to execute, you can put it on the same line as the if statement.

```
if a > b: print("a is greater than b")
```

Programs

1. Write a Menu driven program to calculate the surface area and volume of a cube, cuboid or sphere depending upon the user's choice.
2. Write a program to input a number. If it is an even number print its square otherwise print its cube.
3. Write a program to input principal amount and time. If the time is more than 10 years, print the simple interest with a rate of 8% p.a. Otherwise print it with 12 % p.a.
4. Write a program to check if a year is leap year or not. If a year is divisible by 4 then it is leap year but if the year is century year like 2000, 1900, 2100 then it must be divisible by 400.

Find syntax error(s), if any, in the following:

1.

```
12=age
if age=<10:
    print(Primary)
elseif age=<13:
    print(Middle)
elseif age<=15:
    print(Secondary)
else age<=17:
    print(Sr Secondary)
```

2.

```
a=b=c=12,13,14
if (a>=b or a<=c and a+c<=b):
print("A")
ELSE
print(a+b+c)
```

Solution

1.

```
age=12
if age<=10:
        print("Primary")
elif age<=13:
        print("middle")
elif age<=15:
        print("secondary")
elif age<=17:
```

2.

```
a,b,c=12,13,14        or   a=b=c=12
if (a>=b or a<=c and a+c<=b):
        print("A")    or  print(a)
else :
        print(a+b+c)
```

Find the output:

```
var=100
if var<200:
        print("Expression value is less than 200")
        if var==150:
                print("Which is 150")
        elif var==100:
                print("Which is 100")
        elif var==50:
                print("Which is 50")
elif var<50:
        print("Expression value is less than 50")
else:
        print("Could not find true expression")
print("Good Bye")
```

Solution:

```
Expression is less than 200
Which is 100
Good bye
```

Find output of the following:

What will the program print if the user provides the following as input :

(a) 3

(b) 21

(c) 5

(d) 17

(e) -5

(a) wow 3

(b) Whoa 21

(c) 6

(d) 27

(e) Wow -5

```
val = eval(input())
if val < 10:
    if val != 5:
        print("wow ", end='')
    else:
        val += 1
else:
    if val == 17:
        val += 10
    else:
        print("whoa ", end='')
print(val)
```

Solution

(a) Wow 3
(b) Whoa 21
(c) 6
(d) 27
(e) Wow -5

Find output of the following:

1.

```
x = 0
a = 0
b = -5
if a > 0:
    if b < 0:
        x = x + 5
    elif b > 5:
        x = x + 4
    else:
        x = x + 3
else:
    x = x + 2
print(x)
```

OUTPUT:
2

2.

```
x = 0
a = 1
b = -5
if a > 0:
    if b < 0:
        x = x + 5
    elif b > 5:
        x = x + 4
    else:
        x = x + 3
else:
    x = x + 2
print(x)
```

OUTPUT:
5