Definition OF Function

A **program** is a set of statements that takes some input, does specific computations based on given input and produces desired output. A very Large program with a huge single list of instructions increases complexity.So Python allows us to divide a large program into some small independent units or blocks known as **functions.** Decomposing a complex problem into simpler one using functions improves clarity of the code.

Functions are the most important segments or subprograms of an application used to perform specific tasks. A python program can have one or more functions.

The advantages of using functions

- Reduce duplication of code.
- Induce reusability of code.

By using functions, we can avoid rewriting same logic/code again and again, Thus function reduces program size.

We can call python functions any number of times from any part of the program.So function induces reusability in a program.

Types of Functions:

Basically there are three types of functions used in python program:

- Built in functions (python library functions)
  - These are predefined functions and are always available in python library.
- Functions defined within modules
  - These are also predefined functions available in different modules.
- User defined functions
  - These are defined by programmer.

1.Built- in Functions

- These functions are already built in the library of python and can be accessed by programmer easily.
- These are always available and for using them, we don't have to import any module (file).
- Python has a small set of built-in functions like abs(), max(), min(), len(), range(),round(),bool() chr(), float(), int(),long(),str( ),type( ),id( ) etc.

Example:

max(x, y, z) returns the largest of its 3 arguments.

```
>>>max(80, -70, 100)
100
```

2.Functions defined in modules

When we want to use **module based functions** in our program, we need to **import** the corresponding module of that particular function.

The functions available in math module are:

ceil(), floor(), fabs(), exp(), log(), pow(), sqrt() cos(), sin()etc.

Example:

ceil(x) returns the smallest integer not less than x

fabs(x) returns the absolute value of x,where x is a numeric value.

Example:

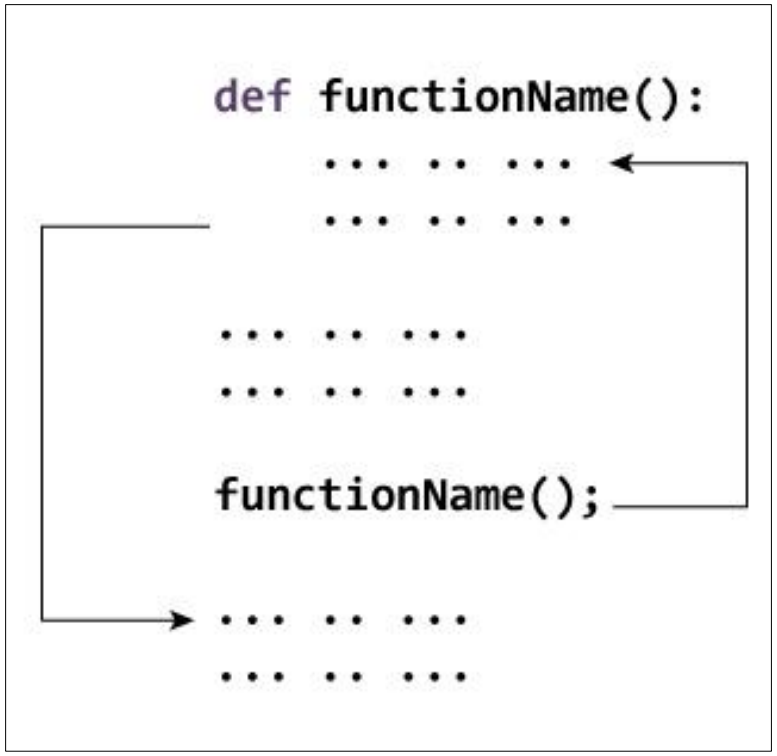
To work with the functions of **math** module, we must import math module in our program.

sqrt() returns the square root of a number

```
>>>import math
>>>math.sqrt(49)
 7.0
```

User defined function

In Python, programmers can also develop their own function(s). They are known as **user defined functions**.



Syntax of function

def function-name(parameters) :
#block of statement(s)

Example:

```
def hello_world():     #called function
  print("hello world")

hello_world()          #calling function
```

Output:

hello world

Defining functions in python

```
def functionName( list of parameters ):
    "_docstring"
    function_block
    return [expression]
Top level statements
```

```
def userfunction (arg1, arg2, arg3 ...):
        program statement1
        program statement2
        program statement3
        ....
        return
userfunction(arg1,arg2,arg3)
```

Top level statements

- In python program, generally all **python definitions** are given at the top followed by statements which are not part of any functions These statements are not indented at all.
- The non indented statements written after all the function definitions are often called **top level statements** .

Function definition with example

- Keyword **def** marks the start of function header.
- A **function name** to uniquely identify it. Name of the Function follows the same rule of naming the identifier.
- **Parameters** (arguments) through which we pass values to a function are optional.
- A **colon (:)** is used to mark the end of function header.
- The string after the function header is called the **docstring** . It is briefly used to explain what a function does. **comments** are ignored by python interpreter but **docstrings** can be viewed when the program is running.
- One or more python statements form function body.All the statements of the block should have **same indentation level**.
- A **return statement is used** to return value(s) from the function but it is always optional.

```
#python function to calculate the sum o
    f two variables

#defining the function
def sum(a,b):
   '"takes a and b and return the
     sum'"
    return a+b;

#taking values from the user
a = int(input("Enter a: "))
b = int(input("Enter b: "))

#printing the sum of a and b
print("Sum = ",sum(a,b))
```

Output:

```
Enter a: 10
Enter b: 20
Sum = 30
```

HOW A FUNCTION WORKS

- Execution always begins from the first statement of the program.
- A python program may contain several funtion definitions.
- If any function definition is found,python executes only function header for the correctness of it and skips all lines of function body(block).
- When python sequentially reaches top level statement's function call, python transfers control to the function header and then execution of function body takes place.
- Finally function execution ends with a return statement if any or the last statement of function body.

FLOW OF EXECUTION IN A FUNCTION CALL

- **Flow of execution** refers to the order in which statements are executed.
- A function body is executed in **execution frame**.
- Whenever a **function call** statement is executed, **execution frame** for the called function is created and the **control** is transferred to invoke the **called function**.
- Within the function's execution frame,the body of the function gets executed and after the last statement of the function the **control** returns to the statement with/without any value(s) to the function from where it is called(calling function).

Function Parameters:

The values being passed through a **function call** statement are called **arguments or actual parameters**.The values received in the **function definition** are called **parameters or formal parameters**.

A function has two types of parameters:

- **Formal Parameter(parameters):** Formal parameters are written in the function prototype(function definition). **Formal parameters** are local variables which are assigned values from the arguments when the function is called.
- **Actual Parameter(arguments):** When a function is called, the values that are passed are called **actual parameters.** At the time of the call, each actual parameter is assigned to the corresponding formal parameter in the function definition.

Note:

1. Function which is called by another Function is called **Called Function**. The **called function** contains the **definition of the function and formal parameters** are associated with them.
2. The Function which calls another Function is called **Calling Function** and **actual paramaters** are associated with them.
3. In python, a function must be defined **before** the function calling otherwise python interpreter gives an **error**.

Lambda function

Python lambda function doesn't have any return statement.It has only a single expression which is always returned by default. The Python lambda function is anonymous as it is a function without a **def keyword** and **name**. To create a Python lambda function, we have to use the **lambda keyword**.

The basic syntax of python lambda is

Lambda arguments : expression

The Python lambda function accepts any number of arguments but use only one expression.

For instance, lambda a, b: a + b. Here, a and b are the arguments accepted by the lambda function. a + b is the expression.

Example:

```
add = lambda x, y : x + y
print(add(10, 20))

print("\nResult from a Function")
def add_func(x, y):
    return x + y

print(add_func(10, 20))
```

Both lambda function and regular function returns the same result. However, the **regular function** needs a **def** keyword, **function name**, and a **return value**. Whereas, **lambda function** does not need any of them. By default, it returns the expression result.

Summary of Functions

- **What is a function**
- **How a function works**
- **Syntax of user defined function**
- **Calling function and called function**
- **Formal parameter and actual parameter**