

# Programming with Python

Feb 07, 2025

Note: Brief Summary of contents discussed.

## Give Output:

```
a = 150
b = 190
while ( a != b):
    if a > b:
        a = a - b
    else:
        b = b - a
print(a, b)
```

(Above code is Euclidean algo for GCD)

## Exercise: (Collatz Conjecture)

Write a Python program explore the Collatz Conjecture, which states that for any positive integer  $n$ :

- 1.If  $n$  is even, divide it by 2:  $n=n//2$
- 2.If  $n$  is odd, multiply it by 3 and add 1:  $n=3n+1$

The conjecture suggests that, regardless of the starting number, the sequence will eventually reach 1.

**Functions:** Complex problems are large in size and it benefits to divide the problem into smaller subproblems. The subproblems can be solved in the form of functions.

Functions are reusable blocks of code that perform a specific task. Functions help avoid code repetition, improve code readability and allow decomposition of complex problems into smaller ones.

**User-defined Functions:** Functions created by users to perform specific tasks.

### Defining a function:

```
def greet():  
    print("Hello, World!")
```

### Calling a Function:

A function is executed when it is called:

```
greet() #Function call, outputs 'Hello World'!
```

### Function with Parameters:

Functions can accept inputs (parameters) to make them dynamic:

```
def greet(name):  
    print(f"Hi, {name}!")  
  
greet("Amit")    # Output: Hi, Amit!
```

### Function with Return Value

Functions can return values using the return statement:

```
def add(a, b):  
    return a + b  
  
result = add(5, 3) #Function call  
print(result) # Output: 8
```

### Default and Keyword Arguments

Default Arguments: If a parameter is not provided, a default value is used:

```
def greet(name="Guest"):  
    print(f"Hello, {name}!")  
  
greet() # Default argument, outputs Hello, Guest!  
greet("Delhi") # Output: Hello, Delhi!
```

**Exercise:** Write a Python function to find the factorial of a number n.

**Exercise:** Write programs to find the sum of series below using `for` loop. Use functions for reusable code (such as factorial).

a.  $1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots \frac{x^n}{n!}$

b.  $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$

c.  $\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} \dots$

**Datatype:** `None` (`NoneType`). **Functions that return nothing return** `None`.

```
>>> type(None)
<class 'NoneType'>
```

**Misc: Formatting in print:**

f-strings: formatted string literals

(<https://docs.python.org/3/tutorial/inputoutput.html>)

```
>>> rollno = 100
>>> name = 'Aditya'
>>>
>>> print("Roll No: ", rollno, ", Name: ", name)
Roll No: 100 , Name: Aditya
>>>
>>> print(f"Roll No: {rollno}, Name: {name}")
Roll No: 100, Name: Aditya
```

NOTE: Further reading: <https://docs.python.org/3/tutorial/inputoutput.html>