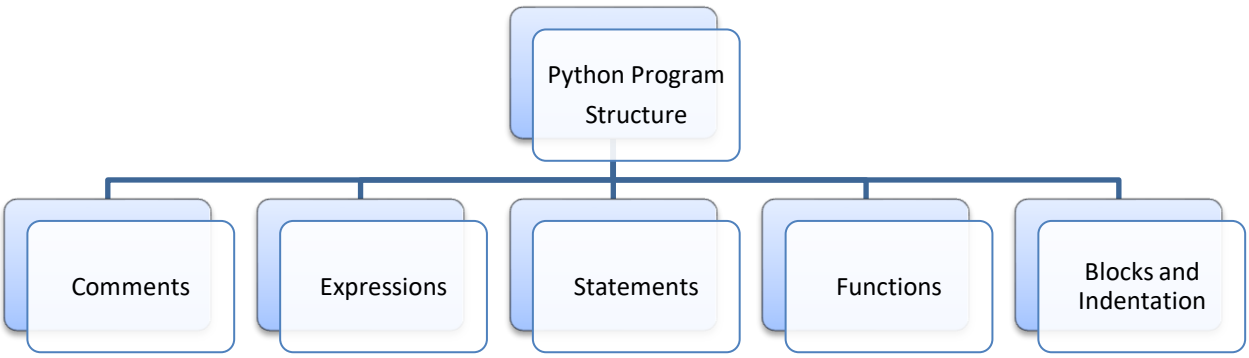
Chapter 2: Python Fundamentals

2.1 Concepts of Interpreter based programming language:

- An Interpreter directly executes instructions line by line written in a programming or scripting language without converting them to an object code or machine code.
- Examples of interpreted languages are Perl, Python and Matlab.

Structure of Python Programming language.

- Basic Structure of python programming includes following components:



Comments

- Comments are the additional readable information to get better understanding about the source code.
- Comments in Python are the non-executable statements.
- Comments are of 2 types:
  - **1)Single Line Comments:** which begin with a hash symbol (#).
  - E.g. #This is a sample python program
  - **2)Multiline Comments:** which begins with ‘’’ and ends with ‘’’(3 single quotes)
  - E.g. ‘’’ This is a sample python program1

This is a sample python program2 ’’’

Expression:

- An expression is any legal combination of symbols that represents a value.
- An expression represents something which python evaluates and which produces a value.
- E.g. 10, x + 5

Statements:

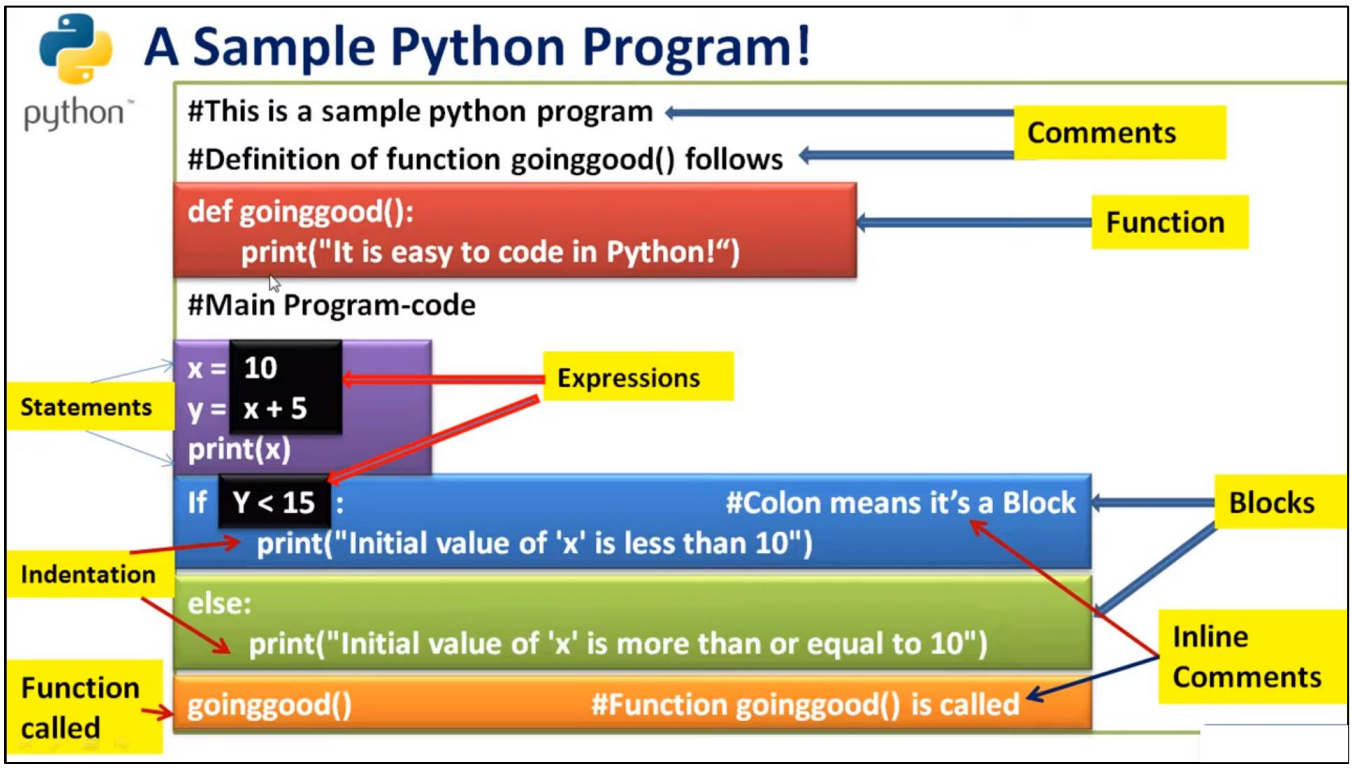
- A statement is a programming instruction that does something i.e. some action takes place.
- A statement executes and may or may not results in a value.
- E.g. print(x + 2), y = x + 5, x = 10

Functions:

- A function is a code that has a name and it can be reused (executed again) by specifying its name in the program, where needed.
- A function begin with ‘def’ statement
- E.g. goinggood( )

Block and Indentation:

- A group of statements which are part of another statement or a function are called block or code-block or suite in python.
- Indentation is used to show blocks in python. Four spaces together mark the next indent-level.



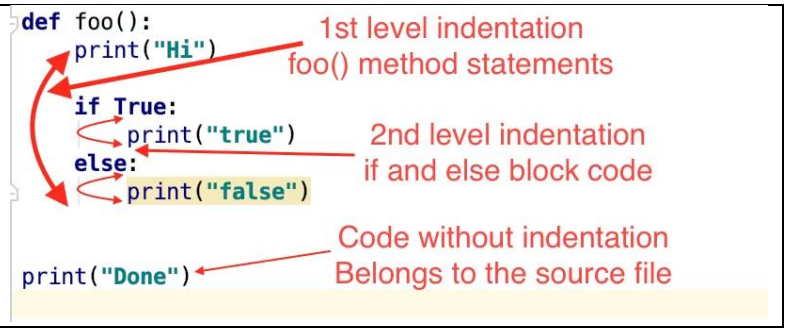
Python code Indention and execution

- Indentation refers to the spaces at the beginning of a code line.
- Where in other programming languages the indentation in code is for readability only, the indentation in Python is very important.
- Python uses indentation to indicate a block of code.
- The leading whitespaces (space and tabs) at the start of a line is used to determine the indentation level of the line.
- Increase the indent level to group the statements for that code block. Similarly, reduce the indentation to close the grouping.
- **Example**:

```
def foo():
    print("Hi")

    if True:
        print("true")
    else:
        print("false")

print("Done")
```



Python Indentation Rules:

- We can't split indentation into multiple lines using backslash.
- The first line of Python code can't have indentation, it will throw IndentationError.
- You should avoid mixing tabs and whitespaces to create indentation.
- It is preferred to use whitespaces for indentation than the tab character.
- The best practice is to use 4 whitespaces for first indentation and then keep adding additional 4 whitespaces to increase the indentation.

2.2 Python Variables:

Variables:

- Variables are containers for storing data values.

Rules for Python Variable:

- A variable can have a short name (like x and y) or a more descriptive name (age, carname, total_volume).
- A variable name must start with a letter or the underscore character
- A variable name cannot start with a number
- A variable name can only contain alpha-numeric characters and underscores (A-z, 0-9, and _)
- Variable names are case-sensitive (age, Age and AGE are three different variables).

Valid Variable Name:	Invalid Variable Name:
myvar = "John" my_var = "John" _my_var = "John" myVar = "John" MYVAR = "John" myvar2 = "John"	2myvar = "John" my-var = "John" my var = "John"

Creating Variables

- Python has no command for declaring a variable.
- A variable is created the moment you first assign a value to it.
- Variables do not need to be declared with any particular type, and can even change type after they have been set.

Example:

```
x = 4       # x is of type int
z = "Sally" # x is now of type str
y='Alice'
print(x)
```

Note: String variables can be declared either by using single or double quotes.

Many Values to Multiple Variables

Python allows you to assign values to multiple variables in one line:

Example:

```
x, y, z = "Orange", "Banana", "Cherry"
print(x)
print(y)
print(z)
```

Output:
Orange
Banana
Cherry

One Value to Multiple Variables

We can assign the same value to multiple variables in one line:

Example:

```
x = y = z = "Orange"
print(x)
print(y)
print(z)
```

Output:
Orange
Orange
Orange

Global Variables

- Variables that are created outside of a function are known as global variables.
- Global variables can be used by everyone, both inside of functions and outside.

Example:

```
x = "awesome" #Global Variable

def myfunc():
  print("Python is " + x)#local Variable
```

Output:
Python is awesome

myfunc() //function call	

Note: If you create a variable with the same name inside a function, this variable will be local, and can only be used inside the function. The global variable with the same name will remain as it was, global and with the original value.

Example:

x = "awesome" #global variable
 	
def myfunc():
  x = "fantastic"
  print("Python is " + x) #local variable
 	
myfunc() #function call
 	
print("Python is " + x) #printing global variable
	Output:
	Python is fantastic
	Python is awesome

The global Keyword

- Normally, when you create a variable inside a function, that variable is local, and can only be used inside that function.
- To create a global variable inside a function, you can use the global keyword.

Example

- If you use the global keyword, the variable belongs to the global scope:

def myfunc():
  global x
  x = "fantastic"
 	
myfunc() #function call
 	
print("Python is " + x)
	Output:
	Python is fantastic

Example

- To change the value of a global variable inside a function, refer to the variable by using the global keyword:

x = "awesome"
 	
def myfunc():
  global x
  x = "fantastic"
 	
myfunc() #function call
 	
print("Python is " + x)
	Output:
	Python is fantastic

2.3 Python Datatypes:

- In programming, data type is an important concept
- Variables can store data of different types, and different types can do different things.
- Python has the following data types built-in by default, in these categories:

Data Types	Keywords
Text Types:	str
Numeric Types:	int, float, complex
Boolean Type:	bool

Getting the Data Type

- You can get the data type of any object by using the type() function:

Example:

x = 5 print(type(x))	**Output:** <class 'int'>

Setting the Data Type

- In Python, the data type is set when you assign a value to a variable:

Example:	Data Types
x = "Hello World"	str
x = 20	int
x = 20.5	float
x = 1j	complex
x = True	bool

Type Conversions and Casting:

- If you want to specify the data type of a variable, this can be done with casting.

```
x = str(3)    # x will be '3'
y = int(3)    # y will be 3
z = float(3)  # z will be 3.0
```

Other Examples:

Example	Data Type
x = str("Hello World")	str
x = int(20)	int
x = float(20.5)	float
x = complex(1j)	Complex
x = bool(5)	bool

Python Casting

- There may be times when you want to specify a type on to a variable. This can be done with casting. Python is an object-orientated language, and as such it uses classes to define data types, including its primitive types.
- Casting in python is therefore done using functions as follows:
- **int()** – an integer number from an integer literal, a float literal (by removing all decimals), or a string literal (providing the string represents a whole number)
- **float()** - a float number from an integer literal, a float literal or a string literal (providing the string represents a float or an integer)
- **str()** - a string from a wide variety of data types, including strings, integer literals and float literals

Example:

```
int()
x = int(1)   # x will be 1
y = int(2.8) # y will be 2
z = int("3") # z will be 3

float()
x = float(1)     # x will be 1.0
y = float(2.8)   # y will be 2.8
z = float("3")   # z will be 3.0
w = float("4.2") # w will be 4.2

str()
x = str("s1") # x will be 's1'
y = str(2)    # y will be '2'
z = str(3.0)  # z will be '3.0'
```

2.4 User defined function

- A function is a block of code which only runs when it is called.
- You can pass data, known as parameters, into a function.
- A function can return data as a result.

Creating a Function

- In Python a function is defined using the **def** keyword:

Syntax:

```
def function_name(Parameter List):
        function body
```

Example:

```
def my_function():
  print("Hello from a function")
```

Calling a Function

- To call a function, use the function name followed by parenthesis:

Example

```
def my_function():
  print("Hello from a function")

my_function()  #function call
```

Arguments

- Information can be passed into functions as arguments.
- Arguments are specified after the function name, inside the parentheses. You can add as many arguments as you want, just separate them with a comma.
- The following example has a function with one argument (fname). When the function is called, we pass along a first name, which is used inside the function to print the full name:

Example:

```
def my_function(fname):
  print(" Welcome  " + fname )

my_function("Jay")
my_function("Parth")
my_function("Dhruvi")
```

Output:

```
Welcome Jay
Welcome Parth
Welcome Dhruvi
```

Parameters or Arguments?

- The terms parameter and argument can be used for the same thing: information that are passed into a function.
- A parameter is the variable listed inside the parentheses in the function definition.
- An argument is the value that is sent to the function when it is called.

Number of Arguments

- By default, a function must be called with the correct number of arguments. Meaning that if your function expects 2 arguments, you must call the function with 2 arguments, not more, and not less.

Example

(This function expects 2 arguments, and gets 2 arguments:)

```
def my_function(fname, lname):
  print(fname + " " + lname)

my_function("Alice", " Evan")
```

Output:

```
Alice Evan
```

Function with Default Parameter Value

- The following example shows how to use a default parameter value.
- If we call the function without argument, it uses the default value:

Example:

```
def my_function(country = "Norway"):
  print("I am from " + country)

my_function("Sweden")
my_function("India")
my_function() // this function will take default value
my_function("Brazil")
```

Output:

```
I am from Sweden
I am from India
I am from Norway
I am from Brazil
```

Function with Return Values

- To let a function return a value, use the return statement:

Example

```
def my_function(x):
  return 5 * x

print(my_function(3))
print(my_function(5))
print(my_function(9))
```

Output:

```
15
25
45
```