# PYTHON NOTES

## Introduction:

Python is a popular programming language. It was created by ***Guido van Rossum***, and released in ***1991***.

Use Cases:

- Data Science, Machine Learning, GenAI.
- Web development (server-side).
- Software development.
- Mathematics.
- System scripting.

## Print Function:

`print("Sureshvj")` → Print a string
`print(x)` → Print a variable x
`print(x,y)` → Print two variables.
`print("Suresh, {0}, {1}".format(x,y))` → Print format str ***way-1***
`print("Suresh, {}, {}".format(x,y))` → Print format str ***way-2***
`print(f"Suresh {x}")` → Print format str ***way-3***
`print("Python", end='@')` → `end` concatenates 2 print function messages with `end` value.
`print('09','12','2016', sep='-')` → `sep` will separate different values with `sep` value.

## Variable declaration:

| | | |
|---|---|---|
| `x = 10` | | Declare single int variable |
| `x = "Suresh VJ"` | | Declare single str variable |
| `x, y = 26, "Suresh VJ"` | Different memory location | Declare multiple variables |
| `x, y = 5, 5` | Same memory location | |
| `x = y = "Suresh VJ"` | Same memory location | Declare multiple variables with single value |

### *Variable Declaration Rules:*

- Variable name should not start with **num, special char, capital letter**. (1a, @x, Age)
- Variable name shouldn't contain the **spaces**. (sur name = 'vj')
- Variable name can start with **underscore.** ( _ )

### *Constant Variables:*

- It is a special type of variable whose value should not change. Declared with capital letters.
- The constant variables declared in a separate python file (constatnt.py) and use those variables in another file (main.py) by importing them.

***constant.py***

```
# Declare constants
PI = 3.14
GRAVITY = 9.8
```

***main.py***

```
# Import constant file we created above
import constant

print(constant.PI) # prints 3.14
print(constant.GRAVITY) # prints 9.8
```

## *Data Types:*

| | | |
|---|---|---|
| Numeric data types | int, float, complex | 26, 10.5, 2+3j |
| String data types | str | 'Suresh VJ' |
| Sequence types | list, tuple, range | [], (), range(0,10) |
| Mapping data type | dict | {'key': value} |
| Set data types | set | {} |
| Boolean type | bool | True / False, |
| Null values | None | None |

Imp points:

- All data types are **objects**.
- All data types have **immutable** property except `list, set, dict`.
- All data types have **object intern** property except `list, set, tuple, dict`.

Some data supported by python:

| | | |
|---|---|---|
| Long int | 9618112600 | ------- |
| Binary | 0b0110101 | 0b----- |
| Decimal | 100 | 100--- |
| Octal | 0o215 | 0o---- |
| Hexa-decimal | 0x12d | 0x---d |

## *Scientific Notation of Float Data:*

```
x = 35e3        # 35000.0
y = 12E4        # 120000.0
z = -87.7e100   # -8.77e+101
print(x, y, z)
```

**Precision**: Float has a fixed number of bits, leading to precision limits.

**Scientific Notation**: Allows expressing large or small numbers compactly using **e** or **E** to denote powers of 10.
**Examples:**

- 35e3 means $35 \times 10^3$ which is 35000.
- $\mathbf{12E4}$ means $12 \times 10^4$ which is 120000.
- $\mathbf{-87.7e100}$ means $-87.7 \times 10^{100}$.

## *Operators:*

| | |
|---|---|
| Arithmetic operators | +, -, /, //, %, *, ** |
| Comparison operators | <, >, <=, >=, ==, != |
| Assignment operators | =, +=, -=, /=, //=, %=, *=, **= |
| Logical operators | and, or, not |
| Identical operator | is, in (is not, not in) |

## *Conditional Statements:*

### if:

```
if condition:
    # code
```

### if - else:

```
if condition:
    # code
else:
    #code
```

### elif :

```
if condition_1:
    # code
elif condition_2:
    #code
elif condition_3:
    #code
else:
    #code
```

### Nested if:

```
if condition_1:
    # code
    if condition_2:
        # code
```

### if - else:

```
if condition:
    if condition:
        # code
else:
    if condition:
        # code
```

### Advanced Syntax:

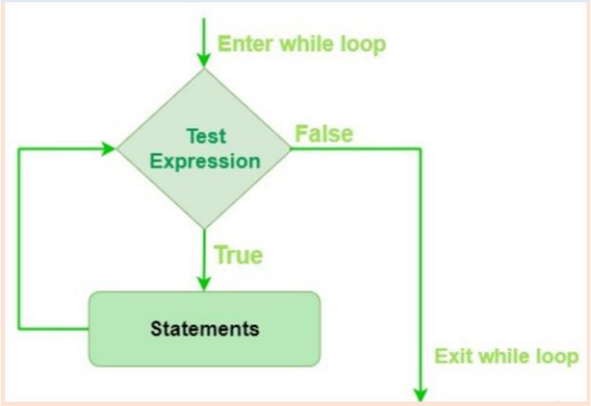
```
print("VJ") if <condition> else print("R")
print("A") if <condition_1> else print("B") if <condition_2> else print("C")
```

### Imp Points:

`elif` is also possible without `else`.

## *loops:*

### While




```
while <condition>:
    # Code
```

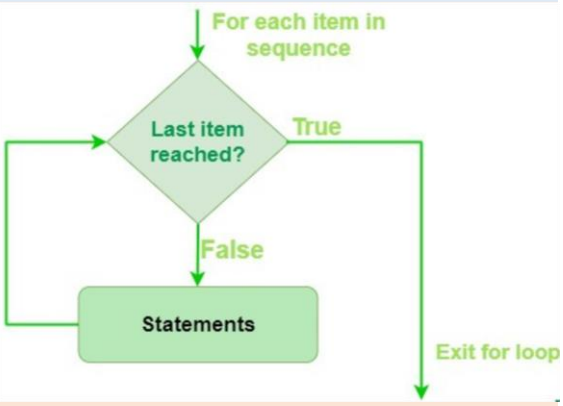
### While with else

```
while <condition>:
    # Code
else:
    #code
```

### Infinity while

```
while True:
    # Code
```

### For:




```
for i in <iterator>:
    # code
```

### For with else

```
for i in range(6):
  #code
else:
  print("Finally finished!")
```

### For – else with break

```
for x in range(6):
  if x == 3: break
  print(x)
else:
  print("Finally finished!")
# The else not execute if loop breaks
```

## *Control Flow Statements:*

### Pass

Pass Does nothing, just a placeholder.

```
for i in range(5):
    if i == 3:
        pass
    else:
        print(i)

# Do nothing when i equals 3
```

### Break:

Break exits the loop immediately.

```
for i in range(5):
    if i == 3:
        break
    print(i)

# Exit the loop when i equals 3
```

### Continue:

Continue skips the rest of the loop and starts the next iteration.

```
for i in range(5):
    if i == 3:
        continue
        print("X")
    print(i)

# Skip printing when i equals 3
```

***NOTE:*** The **`break`** and **`continue`** should use inside the loops only but **`pass`** can use any place.

## *Type Casting:*

The below constructors are used to perform the type casting.

| | | |
|---|---|---|
| `int()` | `float()` | `complex()` |
| `bool()` | `str()` | `list()` |
| `tuple()` | `set()` | `dict()` |

| from | int | float | complex | bool | str | list | tuple | set | dict |
|---|---|---|---|---|---|---|---|---|---|
| int | ✓ | ✓ | ✓ | 1/0 CK | ✓ | X | X | X | X |
| float | ✓ | ✓ | ✓ | CK | ✓ | X | X | X | X |
| bool | ✓ | ✓ | ✓ | T/F | ✓ | X | X | X | X |
| complex | X | X | ✓ | CK | ✓ | X | X | X | X |
| str | ✓ | ✓ | X | CK | ✓ | ✓ | ✓ | ✓ | X |
| list | X | X | X | CK | ✓ | ✓ | ✓ | ✓ | X |
| tuple | X | X | X | CK | ✓ | ✓ | ✓ | ✓ | X |
| set | X | X | X | CK | ✓ | ✓ | ✓ | ✓ | X |
| dict | X | X | X | CK | ✓ | keys | keys | keys | ✓ |

## *Mutable & Immutable:*

Mutable:

If data can be changeable or updatable in current memory location then that objects are called as mutable.

List Set Dict

Immutable:

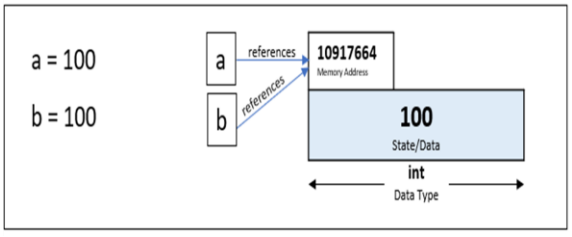
If data can't be changeable or updatable in current memory location then that objects are called as immutable.

Int Float Bool Str Tuple None

## *Obj interning:*

Object Interning is nothing but the two different variables having the same value is stored in the same address

If two variables / objects having same data, Python creates only one object and save that data in one instance only and provide the object address to both variables.




*Eligible to interning property:*

Int Float Bool Complex Str

*Not eligible to interning property:*

List Tuple Set Dict

## *String:*

Declaration: `''`, `""`, `''' '''`, `""" """`
Properties:

| | |
|---|---|
| Immutable | Interned obj |
| Ordered | |
| Sliceable | |
| Non-inclusive | |

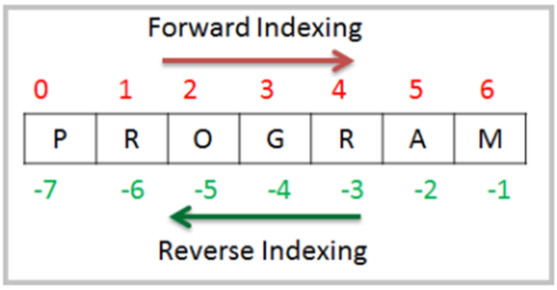
- String index numbers starts from 0 in forward direction, and -1 in reverse direction.

| *Syntax* | *Explanation* |
|---|---|
| `s.capitalize()` | Capitalize the starting character of the string and rest of all characters will be converted into lower case. |
| `s.title()` | title the starting character of each word in a string and rest of all characters will be converted into lower case. |
| `s.casefold()` | Used to convert string to lower case. It is similar to lower() string method, but case **removes all the case distinctions** present in a string. (`"Groß"`) |
| `s.lower()` | Used for converting into lowercase |
| `s.upper()` | Used for converting into uppercase |
| `s.swapcase()` | Converts all uppercase characters to lowercase and vice versa |
| `s.istitle()` | It returns True if all the words in the string are title cased, otherwise returns False. |
| `s.islower()` | It returns **True** if all alphabets in a string are in lowercase. otherwise returns **False**. |
| `s.isupper()` | It returns **True** if all alphabets in a string are in uppercase. otherwise returns **False**. |
| `s.center(4, '*')`<br>`s.center(4)` | It will return a new string which contains 4 * s before and after the input string "S". |
| `s.strip()`<br>`s.strip(s1)` | It Remove spaces / specified characters from starting and ending of the string. |
| `s.rstrip()`<br>`s.rstrip(s1)` | It Remove spaces / specified characters from right side of the string. |
| `s.lstrip()`<br>`s.lstrip(s1)` | It Remove spaces / specified characters from left side of the string. |
| `s.count('sub_str')` | Returns the number of occurrences of a substring in the given string |
| `s.find('sub_str')` | Returns the lowest index or first occurrence of the substring if it is found in a given string. If it is not found, then it returns -1. |
| `s.rfind('sub_str')` | Returns the rightmost index of the substring if found in the given string. If not found then it returns -1. |
| `s.startswith('sub_str')` | Returns **True** if a string starts with the specified prefix ('sub_str'), otherwise returns **False**. |
| `s.endswith('sub_str')` | Returns True if a string ends with the given suffix ('sub_str'), otherwise returns False. |
| `s.index('sub_str')` | Returns index of the first occurrence of an existing substring inside a given string. Otherwise, it raises **`ValueError.`** |

| | |
|---|---|
| `s.rindex('sub_str')` | Highest index of the substring inside the string if the substring is found. Otherwise, it raises **`ValueError.`** |
| `s.isnumaric()` | Returns "**True**" if all characters in the string are numeric characters, otherwise returns "**False**". |
| `s.isalnum()` | It checks whether all the characters in a given string are either alphabet or numeric (alphanumeric) characters. |
| `s.isalpha()` | It is used to check whether all characters in the String is an alphabet. |
| `s.isdisit()` | Returns "**True**" if all characters in the string are digits, Otherwise, It returns "False". |
| `s.isdecimal()` | Returns true if all characters in a string are decimal, else it returns False. |
| `s.isspace()` | Returns "**True**" if all characters in the string are whitespace characters, Otherwise, It returns "**False**". This function is used to check if the argument contains all whitespace characters, such as:<br>• ' ' – Space<br>• '\t' – Horizontal tab<br>• '\n' – Newline<br>• '\v' – Vertical tab<br>• '\f' – Feed<br>• '\r' – Carriage return |

## *Slicing:*

- In python, all sequence data index numbers start from 0 in Forword direction and start with -1 in reverse direction.
- Slicing is a process used to extract a subset of elements from a sequence.




In slicing the selection direction and step direction should be same. otherwise, it will not work.

**Syntax:** `variable[start:stop:step]`

***Ex:***

```
x = "PROGRAM"
x[3:7] # GRAM
```

***start:*** The index at which the slice starts (inclusive). If omitted, it defaults to the beginning of the sequence.

***stop:*** The index at which the slice ends (exclusive). If omitted, it defaults to the end of the sequence.

***step:*** The interval between elements in the slice. If omitted, it defaults to 1.

| Start to Stop Direction | Step Direction | Example (sequence = [0, 1, 2, 3, 4, 5]) | Result | Works |
|---|---|---|---|---|
| Positive | Positive | sequence[1:4:1] | [1, 2, 3] | Yes |
| Positive | Negative | sequence[1:4:-1] | [] | No |
| Positive | Positive | sequence[-4:-1:1] | [2, 3, 4] | Yes |
| Negative | Negative | sequence[-1:-4:-1] | [5, 4, 3] | Yes |
| Positive | Positive | sequence[1:-1:1] | [1, 2, 3, 4] | Yes |
| Positive | Negative | sequence[1:-1:-1] | [] | No |
| Positive | Positive | sequence[-4:4:1] | [2, 3, 4] | Yes |
| Positive | Negative | sequence[-4:4:-1] | [] | No |
| Negative | Positive | sequence[-1:1:1] | [] | No |
| Negative | Negative | sequence[4:-4:-1] | [4, 3, 2, 1] | Yes |

## *List:*

Declaration: `[]`, `list()`
Properties:

| | |
|---|---|
| Mutable | Allow duplicates |
| Ordered | Not interned obj |
| Sliceable | Allow all data types |
| Non-inclusive | |

- Declaration Possible ways:
  `[]`, `[4]`, `[4,]`, `[4, ]`
- List index numbers starts from 0 in forward direction, and -1 in reverse direction.

| | |
|---|---|
| `l.append(val)` | Append the value end of the list |
| `l.extend([val, val, ..])` | Add provided list of values at end |
| `l.insert(idx, val)` | Insert a value at a particular index position |
| `l.copy()` | Copy the list into another variable. |
| `l.count(val)` | Returns the frequency of a value from a list. |
| `l.index(val)` | Return the index number of a value. |
| `l.reverse()` | Reverse the list. |
| `l.sort(reverse= T / F)` | Sort the list – default ascending order (`reverse= False`) |
| `l.pop(idx)` | Remove specified indexed value - default remove last value |
| `l.remove(val)` | Remove first occurrence of the specified value |
| `l.clear()` | Clear the list object from memory |

## *Tuple:*

Declaration: `()`, `tuple()`
Properties:

| | |
|---|---|
| Immutable | Allow duplicates |
| Ordered | Not interned obj |
| Sliceable | Allow all data types |
| Non-inclusive | |

- Declaration Possible ways:
  `t = 1,2,3`
  `(), 4,, (4, )`
- Tuple index numbers starts from 0 in forward direction, and -1 in reverse direction.

| | |
|---|---|
| `t.count(val)` | Returns the frequency of a value from a list. |
| `t.index(val)` | Return the index number of a value. |

## *Set:*

Declaration: `set()`
Properties:

| | |
|---|---|
| Mutable | Not allow duplicates |
| Not ordered | Not interned obj |
| Can't sliceable | Not allow dict, list, set |

- Declaration Possible ways:
  `{4}, {4,}, {4, }`
- Set not allows mutable data types.

| | |
|---|---|
| `s.add(val)` | Add a value to set |
| `s.copy()` | Return a copy of the set |
| `s1.difference(s2)` | Returns difference (*items exist only in the first set*) between two sets. |
| `s1.difference_update(s2)` | Update the set s1 with items which are not existed in s2. |
| `s.discard("val")` | Remove a specified item [*Error Handled*] |
| `s1.intersection(s2)` | Returns a set with items which are present in both s1, s2. |
| `s1.intersection_update(s2)` | Removes the items from s1 which are not present in s2. |
| `s.pop()` | Remove a random value from set |
| `s.remove(val)` | Remove a specified item [Not *Error Handled*] |
| `s.clear()` | Clear the list object from memory |

## *Dict:*

**Declaration:** `{'key':'value'},dict()`
**Properties:**

- Mutable
- Ordered(from 3.7)
- Non-Sliceable
- Allow duplicate values, not keys
- Not interned obj
- Key should be immutable
- value can be anything

- Declaration Possible ways:

```
{'key_1':'value_1','key_2':'value_2'}

dict(key_1='value_1', key_2='value_2')
```

| Method | Description |
|---|---|
| `d.clear()` | Removes all items from the dictionary. |
| `d.copy()` | Returns a shallow copy of the dictionary. |
| `d.fromkeys(seq, v)` | Creates a new dictionary with keys from `seq` and values set to `v` (default is `None`). |
| `d.get(key, default)` | Returns the value for `key` if `key` is in the dictionary, else `default`. |
| `d.items()` | Returns a view object with a list of dictionary's key-value tuple pairs. |
| `d.keys()` | Returns a view object with a list of all the keys in the dictionary. |
| `d.pop(key, default)` | Removes the specified key and returns the corresponding value. If key is not found, `default` is returned if provided, otherwise `KeyError` is raised. |
| `d.popitem()` | Removes and returns a (key, value) pair from the dictionary. Pairs are returned in LIFO (last-in, first-out) order in Python 3.7+. |

| Method | Description |
|---|---|
| `d.setdefault(key, default)` | Returns the value of `key` if `key` is in the dictionary, else inserts `key` with a value of `default` and returns `default`. |
| `d.update([other])` | Updates the dictionary with the key-value pairs from `other`, overwriting existing keys. |
| `d.values()` | Returns a view object with a list of all the values in the dictionary. |
| `d.__contains__(key)` | Checks if the dictionary contains the specified key (e.g., `key in d`). |
| `d.__delitem__(key)` | Deletes the specified key from the dictionary (e.g., `del d[key]`). |
| `d.__getitem__(key)` | Returns the value associated with the specified key (e.g., `d[key]`). |
| `d.__setitem__(key, value)` | Sets the value associated with the specified key (e.g., `d[key] = value`). |
| `d.__len__()` | Returns the number of items in the dictionary (e.g., `len(d)`). |

## *Concatenation:*

Concatenation is the process of extend the value with new value.

*Ex:* `a = "Suresh", b = " VJ"`
b concatenates with a is `"Suresh VJ"`

1. str with str concatenation is possible.
2. *list with list, list with str, and list with set* concatenations are possible.
3. tuple with tuple concatenation is possible.

`a = a+b, a += b`
we can do concatenation by above ways

| | |
|---|---|
| a = a + b | Obj creation task in both mutable and immutable data types. |
| a+= b | Obj updating process in mutable data, obj |

## *Sort & Reverse:*

***Sort:***

`sortend(x)` → ascending
`sortend(x, reverse=True)` → descending

- When we sort the string, that returns list of characters. If we want to converts that list into str then use `"".join(output_list)`
- List has by its own sort function `l.sort()`
- Sort applicable to Str List Tuple Set Dict

***Reverse:***

```
x[::-1]
reversed(x)
```

- Can't apply reverse operation on Set and Dict

## *Comprehension:*

Let's consider list x as below & applying comprehension in 3 way i.e *with out condition, with if, with if else*

```
x = range(0,11)

lst = [i+2 for i in x]
lst = [i+2 for i in x if i <= 5]
lst = [i+2 if i > 3 else i for i in x]
```

This concept applicable to:

List Tuple Set Dict

For Dict we should pass key value pair as below:

```
lst = {f"key{i}" : i+2 for i in x}
```

## *Lambda Function:*

A lambda function is a small anonymous function.

**Syntax:**

```
lambda arguments : expression
```

- A lambda function can take any number of arguments, but can only have one expression.

```
# Squaring a number
x = lambda a : a ** 2
print(x(4)) # Prints 16
```

```
# Creating a multiplier function.
def multiplier(n):
    return lambda a : a * n

# lambda function to here.
doubler = multiplier(2)
print(doubler(11)) # Prints a * n value.
```

## *map() Function:*

It is used to apply a given function to all items in an iterable (like a list) and return a map object (which can be converted into a list, tuple, etc.).

```
map(function, iterable, ...)
```

**function**: Function name.
**iterable**: One or more iterable objects (like lists, tuples, etc.).

- map() applies the function to all items in the input iterable.
- It returns a map object (an iterator) which can be converted into other collections like a list, set, or tuple.

```
def double(x):
    return x * x

numbers = [1, 2, 3, 4, 5]
squared_numbers = map(double, numbers)

print(list(squared_numbers))  # Output: [1, 4, 9, 16, 25]
```

```
list_var = [3, 'rama', 7]
filter_strs = lambda val: type(val) == str
list(map(filter_strs, list_var)) # Output: [False, True, False]
```

```
import itertools
# Defining lambda function.
doubler = lambda input_num, multiplier : input_num * multiplier

# Defining data with list
data = [4, 85, 29]

output = list(map(doubler, data, itertools.repeat(2)))# OUTPUT: [8, 170, 58]
```