PYTHON PROGRAMMING

SYLLABUS

PYTHON PROGRAMMING

C URSE OBJECTIVES:

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.
4. To use Python data structures–- lists, tuples, dictionaries.
5. To do input/output with files in Python.

UNIT I

Introduction to Python Programming Language: Introduction to Python Language and installation, overview on python interpreters, working with python, Numeric Data Types: int, float, Boolean, complex and string and its operations, Standard Data Types: List, tuples, set and Dictionaries, Data Type conversions, commenting in python.

UNIT II

Variables and Operators: Understanding Python variables, multiple variable declarations, Python basic statements, Python basic operators: Arithmetic operators, Assignment operators, Comparison operators, Logical operators, Identity operators, Membership operators, Bitwise operators, Precedence of operators, Expressions.

UNIT III

Control Flow and Loops: conditional (if), alternative (if-else), chained conditional (if- elif -else), Loops: For loop using ranges, string, Use of while loops in python, Loop manipulation using pass, continue and break

UNIT IV

Functions: Defining Your Own Functions, Calling Functions, passing parameters and arguments, Python Function arguments: Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Powerful Lambda functions in python, Brief on other functions like sort, sorted and range.

UNIT V

I/O and Error Handling in Python : Introduction, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods introductionto Errors and Exceptions, Handling IO Exceptions, Run Time Errors, Handling Multiple Exceptions.

INDEX

UNIT –I

Introduction to Python Programming Language: Introduction to Python Language and installation, overview on python interpreters, working with python, Numeric Data Types: int, float, Boolean, complex and string and its operations, Standard Data Types: List, tuples, set and Dictionaries, Data Type conversions, commenting in python.

Introduction to Python and installation:

Python is a widely used general-purpose, high level programming language. It was initially designed by **Guido van Rossum in 1991** and developed by Python Software Foundation. It was mainly developed for emphasis on code readability, and its syntax allows programmers to express concepts in fewer lines of code.
Python is a programming language that lets you work quickly and integrate systems more efficiently.

There are two major Python versions- **Python 2 and Python 3**.

- On 16 October 2000, Python 2.0 was released with many new features.
- On 3rd December 2008, Python 3.0 was released with more testing and includes new features.

Beginning with Python programming:

1) Finding an Interpreter:

Before we start Python programming, we need to have an interpreter to interpret and run our programs. There are certain online interpreters like **https://ide.geeksforgeeks.org/**, http://ideone.com/ or http://codepad.org/ that can be used to start Python without installing an interpreter.

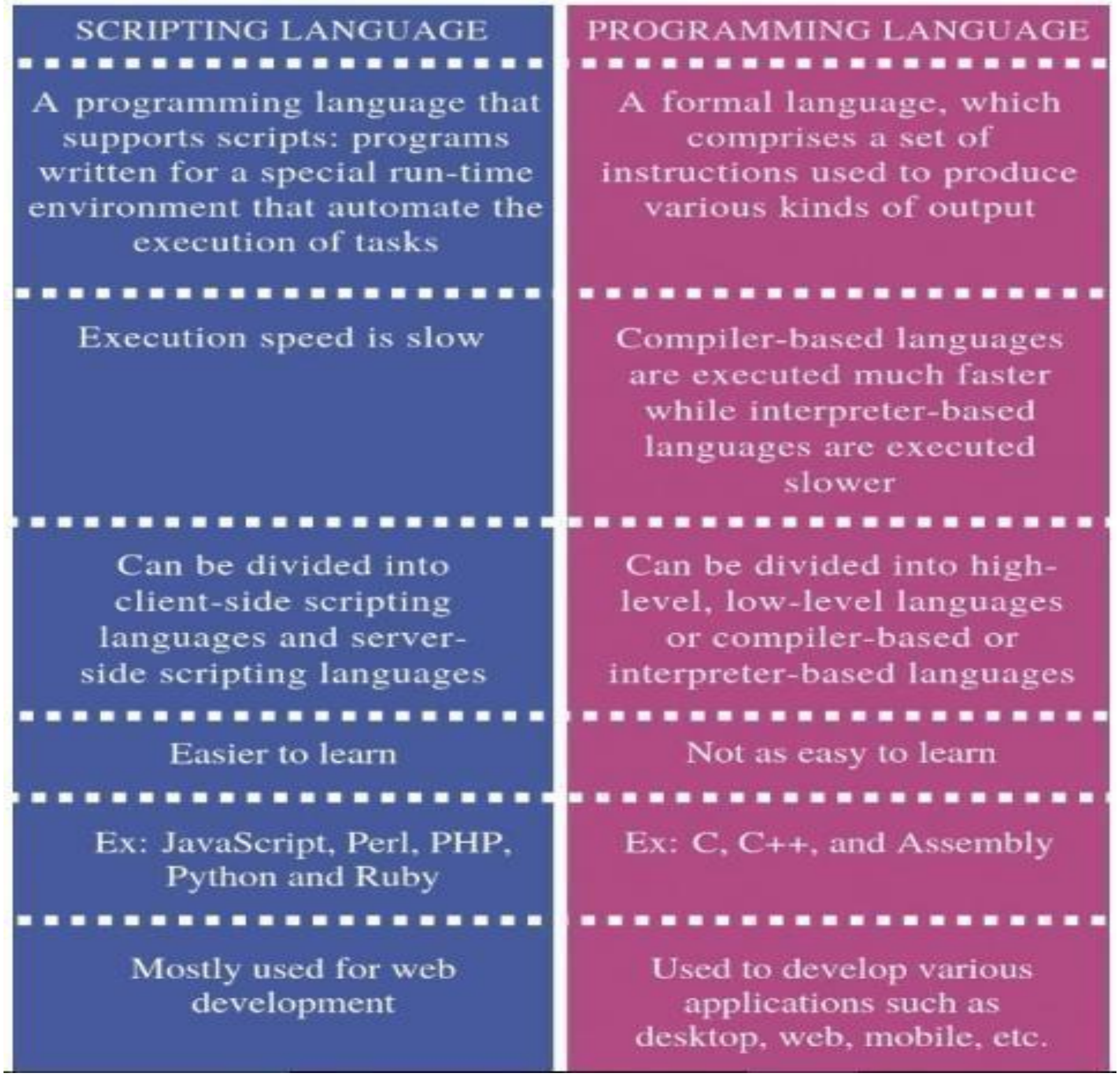
Windows: There are many interpreters available freely to run Python scripts like IDLE (Integrated Development Environment) which is installed when you install the python software from **http://python.org/downloads/**

2) Writing first program:

```
# Script Begins

    Statement1
```

```
     Statement2

     Statement3

 # Script Ends
```

Differences between scripting language and programming language:



SCRIPTING LANGUAGE	PROGRAMMING LANGUAGE
A programming language that supports scripts: programs written for a special run-time environment that automate the execution of tasks	A formal language, which comprises a set of instructions used to produce various kinds of output
Execution speed is slow	Compiler-based languages are executed much faster while interpreter-based languages are executed slower
Can be divided into client-side scripting languages and server-side scripting languages	Can be divided into high-level, low-level languages or compiler-based or interpreter-based languages
Easier to learn	Not as easy to learn
Ex: JavaScript, Perl, PHP, Python and Ruby	Ex: C, C++, and Assembly
Mostly used for web development	Used to develop various applications such as desktop, web, mobile, etc.

Why to use Python:

The following are the primary factors to use python in day-to-day life:

1. **Python is object-oriented**
   Structure supports such concepts as polymorphism, operation overloading and multiple inheritance.
2. **Indentation**
   Indentation is one of the greatest feature in python

3. **It's free (open source)**

   Downloading python and installing python is free and easy

4. **It's Powerful**
   - Dynamic typing
   - Built-in types and tools
   - Library utilities
   - Third party utilities (e.g. Numeric, NumPy, sciPy)
   - Automatic memory management

5. **It's Portable**
   - Python runs virtually every major platform used today
   - As long as you have a compaitable python interpreter installed, python programs will run in exactly the same manner, irrespective of platform.

6. **It's easy to use and learn**
   - No intermediate compile
   - Python Programs are compiled automatically to an intermediate form called byte code, which the interpreter then reads.
   - This gives python the development speed of an interpreter without the performance loss inherent in purely interpreted languages.
   - Structure and syntax are pretty intuitive and easy to grasp.

7. **Interpreted Language**

   Python is processed at runtime by python Interpreter

8. **Interactive Programming Language**

   Users can interact with the python interpreter directly for writing the programs

9. **Straight forward syntax**

   The formation of python syntax is simple and straight forward which also makes it popular.

Installation:

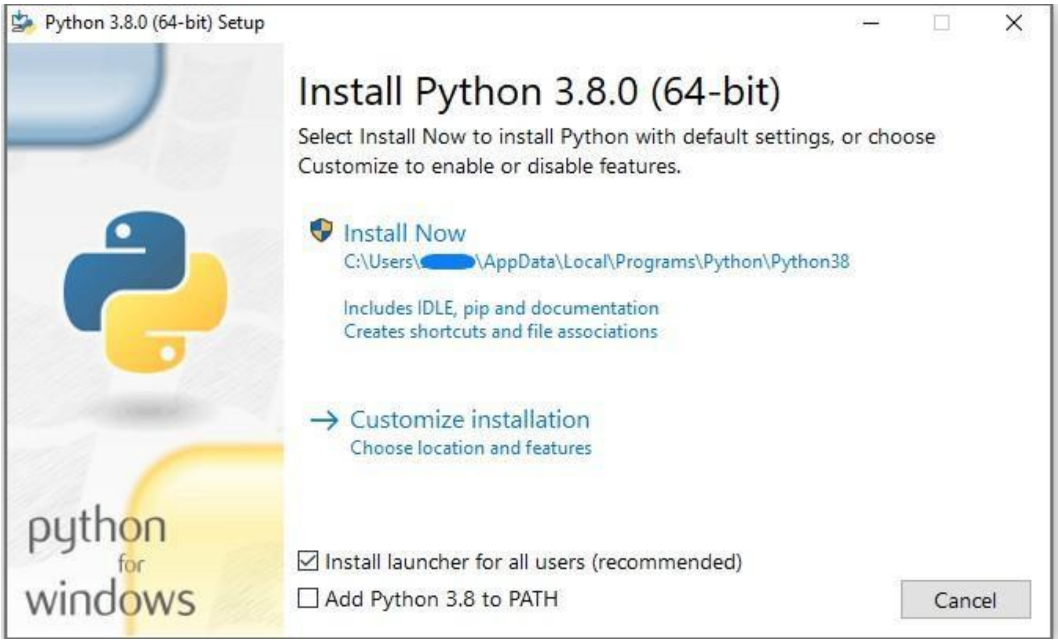
There are many interpreters available freely to run Python scripts like IDLE (Integrated Development Environment) which is installed when you install the python software from http://python.org/downloads/

Steps to be followed and remembered:

Step 1: Select Version of Python to Install.
Step 2: Download Python Executable Installer.
Step 3: Run Executable Installer.
Step 4: Verify Python Was Installed On Windows.

Step 5: Verify Pip Was Installed.

Step 6: Add Python Path to Environment Variables (Optional)



Python 3.8.0 (64-bit) Setup

Install Python 3.8.0 (64-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

Install Now
C:\Users\[redacted]\AppData\Local\Programs\Python\Python38

Includes IDLE, pip and documentation
Creates shortcuts and file associations

→ Customize installation
Choose location and features

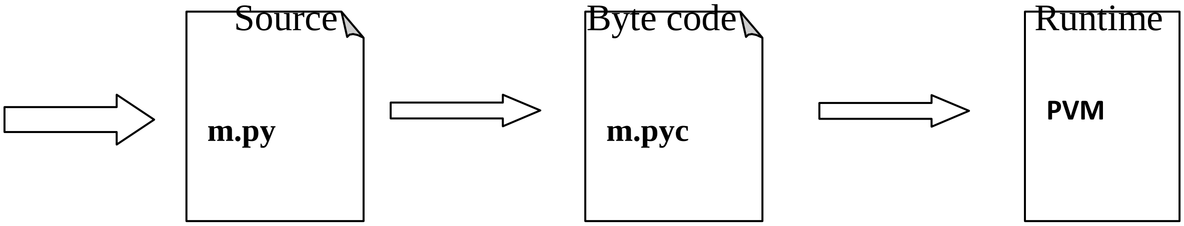
☑ Install launcher for all users (recommended)

□ Add Python 3.8 to PATH

Working with Python

Python Code Execution:

Python's traditional runtime execution model: Source code you type is translated to byte code, which is then run by the Python Virtual Machine (PVM). Your code is automatically compiled, but then it is interpreted.



Source code extension is .py
Byte code extension is .pyc (Compiled python code)

There are two modes for using the Python interpreter:

- Interactive Mode
- Script Mode

Running Python in interactive mode:

Without passing python script file to the interpreter, directly execute code to Python prompt.Once you‟re inside the python interpreter, then you can start.

>>> print("hello world")

hello world

# Relevant output is displayed on subsequent lines without the >>> symbol

>>> x=[0,1,2]

# Quantities stored in memory are not displayed by default.

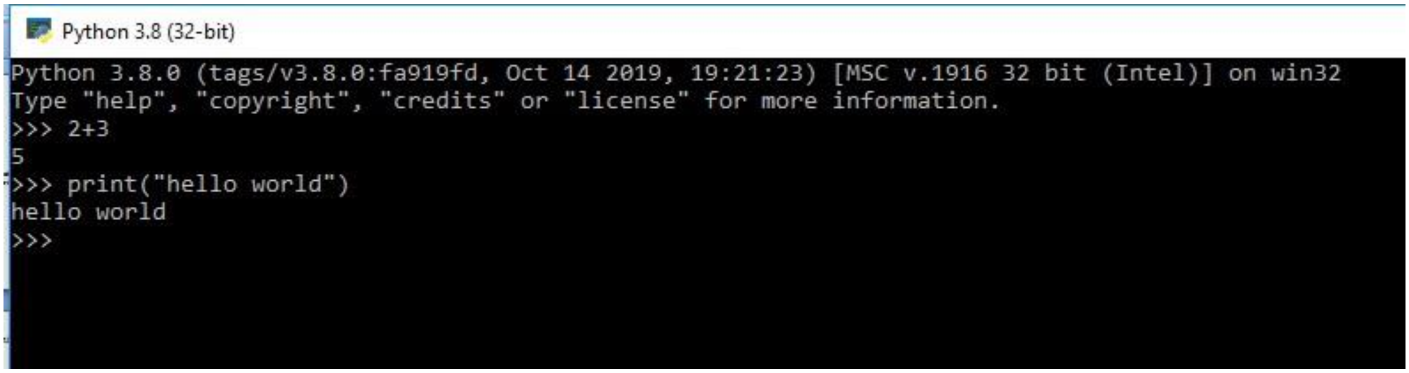
>>> x

#If a quantity is stored in memory, typing its name will display it.

[0, 1, 2]

>>> 2+3

5



```
Python 3.8.0 (tags/v3.8.0:fa919fd, Oct 14 2019, 19:21:23) [MSC v.1916 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> 2+3
5
>>> print("hello world")
hello world
>>>
```

The chevron at the beginning of the 1st line, i.e., the symbol >>> is a prompt the python interpreter uses to indicate that it is ready. If the programmer types 2+6, the interpreter replies 8.

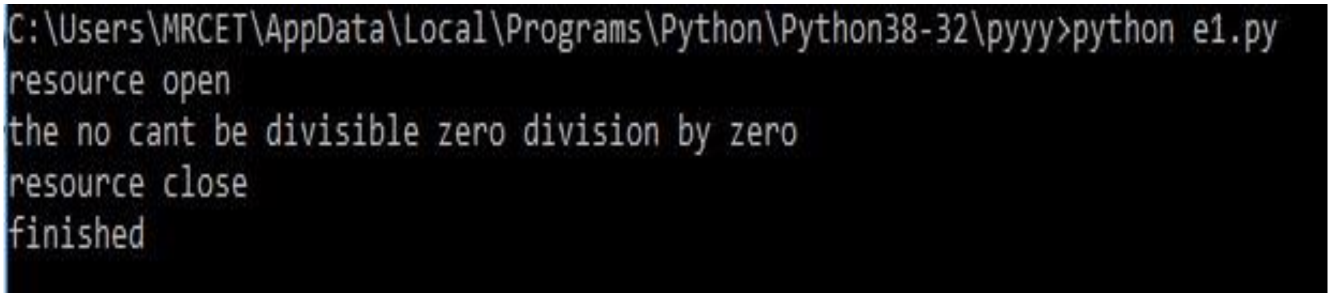
Running Python in script mode:

Alternatively, programmers can store Python script source code in a file with the .py extension, and use the interpreter to execute the contents of the file. To execute the script by the interpreter, you have to tell the interpreter the name of the file. For example, if you have a script name MyFile.py and you're working on Unix, to run the script you have to type:

python MyFile.py

Working with the interactive mode is better when Python programmers deal with small pieces of code as you can type and execute them immediately, but when the code is more than 2-4 lines, using the script for coding can help to modify and use the code in future.

Example:



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\pyyy>python e1.py
resource open
the no cant be divisible zero division by zero
resource close
finished
```

Numeric Data types:

The data stored in memory can be of many types. For example, a student roll number is stored as a numeric value and his or her address is stored as alphanumeric characters. Python has various standard data types that are used to define the operations possible on them and the storage method for each of them.

Int:

Int, or integer, is a whole number, positive or negative, without decimals, of unlimited length.

```
>>> print(24656354687654+2)
24656354687656
>>> print(20)
20
>>> print(0b10)
```

```
2
>>> print(0B10)
2
>>> print(0X20)
32
>>> 20
20
>>> 0b10
2
>>> a=10
>>> print(a)
10
```

# To verify the type of any object in Python, use the type() function:

```
>>> type(10)
<class 'int'>
>>> a=11
>>> print(type(a))
<class 'int'>
```

Float:

Float, or "floating point number" is a number, positive or negative, containing one or more decimals.

Float can also be scientific numbers with an "e" to indicate the power of 10.

```
>>> y=2.8
>>> y
2.8
>>> y=2.8
>>> print(type(y))
<class 'float'>
>>> type(.4)
<class 'float'>
```

```
>>> 2.
2.0
```

Example:

```
x = 35e3
y = 12E4
z = -87.7e100

print(type(x))
print(type(y))
print(type(z))
```

Output:

```
<class 'float'>
<class 'float'>
<class 'float'>
```

Boolean:

Objects of Boolean type may have one of two values, True or False:

```
>>> type(True)

<class 'bool'>

>>> type(False)

<class 'bool'>
```

String:

1. Strings in Python are identified as a contiguous set of characters represented in the quotation marks. Python allows for either pairs of single or double quotes.

- 'hello' is the same as "hello".
- Strings can be output to screen using the print function. **For example: print("hello").**

```
>>> print(" college")

 college

>>> type(" college")
```

```
<class 'str'>

>>> print(' college')

 college

>>> " "

' '
```

A string is a group/a sequence of characters. Since Python has no provision for arrays, we simply use strings. This is how we declare a string. We can use a pair of single or double quotes. Every string object is of the type „str‟.

```
>>> type("name")
<class 'str'>
>>> name=str()
>>> name
''
>>> a=str('')
>>> a
''
>>> a=str()
>>> a[2]
'c'
>>> fruit = 'banana'
>>> letter = fruit[1]
```

The second statement selects character number 1 from fruit and assigns it to letter. The expression in brackets is called an index. The index indicates which character in the sequence we want

String slices:

A segment of a string is called a slice. Selecting a slice is similar to selecting a character:

Subsets of strings can be taken using the slice operator **([ ] and [:])** with indexes starting at 0 in the beginning of the string and working their way from -1 at the end.

Slice out substrings, sub lists, sub Tuples using index.

Syntax:[Start: stop: steps]

- Slicing will start from index and will go up to **stop** in **step** of steps.
- Default value of start is 0,

- Stop is last index of list
- And for step default is 1

For example 1−

```
str = 'Hello World!'

print str    # Prints complete string

print str[0] # Prints first character of the string

print str[2:5] # Prints characters starting from 3rd to 5th

print str[2:] # Prints string starting from 3rd character print

str * 2 # Prints string two times

print str + "TEST" # Prints concatenated string
```

Output:

```
Hello World!

H

llo

llo World!

Hello World!Hello World!

Hello World!TEST
```

Example 2:

```
>>> x='computer'

>>> x[1:4]

'omp'

>>> x[1:6:2]

'opt'

>>> x[3:]
```

```
'puter'

>>> x[:5]

'compu'

>>> x[-1]

'r'

>>> x[-3:]

'ter'

>>> x[:-2]

'comput'

>>> x[::-2]

'rtpo'

>>> x[::-1]

'retupmoc'
```

Immutability:

It is tempting to use the [] operator on the left side of an assignment, with the intention of changing a character in a string.
For example:

```
>>> greeting=' college!'
>>> greeting[0]='n'

TypeError: 'str' object does not support item assignment
```

The reason for the error is that strings are **immutable**, which means we can‟t change an existing string. The best we can do is creating a new string that is a variation on the original:

```
>>> greeting = 'Hello, world!'
>>>new_greeting = 'J' + greeting[1:]
>>>new_greeting
'Jello, world!'
```

Note: The plus **(+)** sign is the string concatenation operator and the asterisk **(*)** is the repetition operator

String functions and methods:

There are many methods to operate on String.

S.no	Method name	Description
1.	isalnum()	Returns true if string has at least 1 character and all characters are alphanumeric and false otherwise.
2.	isalpha()	Returns true if string has at least 1 character and all characters are alphabetic and false otherwise.
3.	isdigit()	Returns true if string contains only digits and false otherwise.
4.	islower()	Returns true if string has at least 1 cased character and all cased characters are in lowercase and false otherwise.
5.	isnumeric()	Returns true if a string contains only numeric characters and false otherwise.
6.	isspace()	Returns true if string contains only whitespace characters and false otherwise.
7.	istitle()	Returns true if string is properly “titlecased” and false otherwise.
8.	isupper()	Returns true if string has at least one cased character and all cased characters are in uppercase and false otherwise.
9.	replace(old, new [, max])	Replaces all occurrences of old in string with new or at most max occurrences if max given.
10.	split()	Splits string according to delimiter str (space if not provided) and returns list of substrings;
11.	count()	Occurrence of a string in another string
12.	find()	Finding the index of the first occurrence of a string in another string
13.	swapcase()	Converts lowercase letters in a string to uppercase and viceversa
14.	startswith(str, beg=0,end=len(string))	Determines if string or a substring of string (if starting index beg and ending index end are given) starts with substring str; returns true if so and false otherwise.

Note:
All the string methods will be returning either true or false as the result

1. isalnum():

Isalnum() method returns true if string has at least 1 character and all characters are alphanumeric and false otherwise.

Syntax:

String.isalnum()

Example:

```
>>> string="123alpha"
>>>string.isalnum() True
```

2. isalpha():

isalpha() method returns true if string has at least 1 character and all characters are alphabetic and false otherwise.

Syntax:

String.isalpha()

Example:

```
>>> string="nikhil"
>>>string.isalpha()
True
```

3. isdigit():

isdigit() returns true if string contains only digits and false otherwise.

Syntax:

String.isdigit()

Example:

```
>>> string="123456789"
>>>string.isdigit()
True
```

4. islower():

Islower() returns true if string has characters that are in lowercase and false otherwise.

Syntax:

String.islower()

<u>Example:</u>

```
>>> string="nikhil"
>>>string.islower()
True
```

5. isnumeric():

isnumeric() method returns true if a string contains only numeric characters and false otherwise.

<u>Syntax:</u>

String.isnumeric()

<u>Example:</u>

```
>>> string="123456789"
>>>string.isnumeric()
True
```

6. isspace():

isspace() returns true if string contains only whitespace characters and false otherwise.

<u>Syntax:</u>

String.isspace()

<u>Example:</u>

```
>>> string=" "
>>>string.isspace()
True
```

7. istitle()

istitle() method returns true if string is properly “titlecased”(starting letter of each word is capital) and false otherwise

<u>Syntax:</u>

String.istitle()

Example:

```
>>> string="Nikhil Is Learning"
>>>string.istitle()
True
```

8. isupper()

isupper() returns true if string has characters that are in uppercase and false otherwise.

Syntax:

String.isupper()

Example:

```
>>> string="HELLO"
>>>string.isupper()
True
```

9. replace()

replace() method replaces all occurrences of old in string with new or at most max occurrences if max given.

Syntax:

String.replace()

Example:

```
>>> string="Nikhil Is Learning"
>>>string.replace('Nikhil','Neha')
 'Neha Is Learning'
```

10.split()

split() method splits the string according to delimiter str (space if not provided)

Syntax:

String.split()

Example:

```
>>> string="Nikhil Is Learning"
>>>string.split()
```

```
 ['Nikhil', 'Is', 'Learning']
```

11.count()

count() method counts the occurrence of a string in another string Syntax:

String.count()

Example:

```
>>> string='Nikhil Is Learning'
>>>string.count('i')
3
```

12.find()

Find() method is used for finding the index of the first occurrence of a string in another string

Syntax:

String.find(„string‟)

Example:

```
>>> string="Nikhil Is Learning"
>>>string.find('k')
 2
```

13.swapcase()

converts lowercase letters in a string to uppercase and viceversa

Syntax:

String.find(„string‟)

Example:

```
>>> string="HELLO"
>>>string.swapcase()
 'hello'
```

14.startswith()

Determines if string or a substring of string (if starting index beg and ending index end are given) starts with substring str; returns true if so and false otherwise.

Syntax:

String.startswith(„string‟)

Example:

```
>>> string="Nikhil Is Learning"
>>>string.startswith('N')
True
```

15.endswith()

Determines if string or a substring of string (if starting index beg and ending index end are given) ends with substring str; returns true if so and false otherwise.

Syntax:

String.endswith(„string‟)

Example:

```
>>> string="Nikhil Is Learning"
>>>string.startswith('g')
True
```

If you want to include either type of quote character within the string, the simplest way is to delimit the string with the other type. If a string is to contain a single quote, delimit it with double quotes and vice versa:

```
>>> print(" is an autonomous (') college")

 is an autonomous (') college

>>> print(' is an autonomous (") college')  is an
```

autonomous (") college **Suppressing Special**

Character:

Specifying a backslash (\) in front of the quote character in a string "escapes" it and causes Python to suppress its usual special meaning. It is then interpreted simply as a literal single quote character:

```
>>> print(" is an autonomous (\') college")
```

```
 is an autonomous (') college

>>> print(' is an autonomous (\") college')

 is an autonomous (") college
```

The following is a table of escape sequences which cause Python to suppress the usual special interpretation of a character in a string:

```
>>> print('a\
....b')
a. ..b
>>> print('a\
b\
c')
abc
>>> print('a \n b')
a
 b
>>> print(" \n college")
 college
```

Escape Sequence	Usual Interpretation of Character(s) After Backslash	"Escaped" Interpretation
\'	Terminates string with single quote opening delimiter	Literal single quote (') character
\"	Terminates string with double quote opening delimiter	Literal double quote (") character
\newline	Terminates input line	Newline is ignored
\\	Introduces escape sequence	Literal backslash (\) character

In Python (and almost all other common computer languages), a tab character can be specified by the escape sequence \t:

```
>>> print("a\tb")
a	b
```

Standard Data types:

List:

- It is a general purpose most widely used in data structures
- List is a collection which is ordered and changeable and allows duplicate members. (Grow and shrink as needed, sequence type,sortable).
- To use a list, you must declare it first. Do this using square brackets and separate values with commas.
- We can construct / create list in many ways.

Ex:

```
>>> list1=[1,2,3,'A','B',7,8,[10,11]]

>>> print(list1)

[1, 2, 3, 'A', 'B', 7, 8, [10, 11]]
```

```
>>> x=list()

>>> x

[]
```

```
>>> tuple1=(1,2,3,4)

>>> x=list(tuple1)

>>> x

[1, 2, 3, 4]
```

List operations:

These operations include indexing, slicing, adding, multiplying, and checking for membership

Basic List Operations:

Lists respond to the + and * operators much like strings; they mean concatenation and repetition here too, except that the result is a new list, not a string.

Python Expression	**Results**	**Description**
len([1, 2, 3])	3	Length
[1, 2, 3] + [4, 5, 6]	[1, 2, 3, 4, 5, 6]	Concatenation
['Hi!'] * 4	['Hi!', 'Hi!', 'Hi!', 'Hi!']	Repetition
3 in [1, 2, 3]	True	Membership
for x in [1, 2, 3]: print x,	1 2 3	Iteration

Indexing, Slicing, and Matrixes

Because lists are sequences, indexing and slicing work the same way for lists as they do for strings.

Assuming following input −

L = ['', 'college', '!']

Python Expression	Results	Description
L[2]		Offsets start at zero
L[-2]	college	Negative: count from the right
L[1:]	['college', '!']	Slicing fetches sections

List slices:

```
>>> list1=range(1,6)
>>> list1
range(1, 6)
>>> print(list1)
range(1, 6)
>>> list1=[1,2,3,4,5,6,7,8,9,10]
>>> list1[1:]
[2, 3, 4, 5, 6, 7, 8, 9, 10]
>>> list1[:1]
[1]
>>> list1[2:5]
[3, 4, 5]
>>> list1[:6]
[1, 2, 3, 4, 5, 6]
>>> list1[1:2:4]
[2]
>>> list1[1:8:2]
[2, 4, 6, 8]
```

List methods:

The list data type has some more methods. Here are all of the methods of list objects:

- Del()
- Append()
- Extend()
- Insert()
- Pop()
- Remove()
- Reverse()
- Sort()

Delete: Delete a list or an item from a list

```
>>> x=[5,3,8,6]
>>> del(x[1])           #deletes the index position 1 in a list
>>> x
[5, 8, 6]
--------
>>> del(x)
>>> x                   # complete list gets deleted
```

Append: Append an item to a list

```
>>> x=[1,5,8,4]
>>>x.append(10)
>>> x
[1, 5, 8, 4, 10]
```

Extend: Append a sequence to a list.

```
>>> x=[1,2,3,4]
>>> y=[3,6,9,1]
>>>x.extend(y)
>>> x
[1, 2, 3, 4, 3, 6, 9, 1]
```

Insert: To add an item at the specified index, use the insert () method:

```
>>> x=[1,2,4,6,7]
>>>x.insert(2,10)   #insert(index no, item to be inserted)
>>> x
[1, 2, 10, 4, 6, 7]
-----------------
>>>x.insert(4,['a',11])
>>> x
```

```
[1, 2, 10, 4, ['a', 11], 6, 7]
```

Pop: The pop() method removes the specified index, (or the last item if index is not specified) or simply pops the last item of list and returns the item.

```
>>> x=[1, 2, 10, 4, 6, 7]

>>>x.pop()

7

>>> x

[1, 2, 10, 4, 6]

- - - - - - - - - - - - - - - - - - - - - - - -

>>> x=[1, 2, 10, 4, 6]

>>>x.pop(2)

10

>>> x

[1, 2, 4, 6]
```

Remove: The **remove()** method removes the specified item from a given list.

```
>>> x=[1,33,2,10,4,6]

>>>x.remove(33)

>>> x

[1, 2, 10, 4, 6]

>>>x.remove(4)

>>> x

[1, 2, 10, 6]
```

Reverse: Reverse the order of a given list.

```
>>> x=[1,2,3,4,5,6,7]
```

```
>>>x.reverse()

>>> x

[7, 6, 5, 4, 3, 2, 1]
```

Sort: Sorts the elements in ascending order

```
>>> x=[7, 6, 5, 4, 3, 2, 1]

>>>x.sort()

>>> x

[1, 2, 3, 4, 5, 6, 7]

- - - - - - - - - - - - - - -

>>> x=[10,1,5,3,8,7]

>>>x.sort()

>>> x

[1, 3, 5, 7, 8, 10]
```

List loop:

Loops are control structures used to repeat a given section of code a certain number of times or until a particular condition is met.

Method #1: For loop

```
#list of items

list = ['M','R','C','E','T']

i = 1

#Iterating over the list
for item in list:
  print ('college ',i,' is ',item)
i = i+1
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/lis.py college
1  is  M
```

```
college  2  is  R
college  3  is  C
college  4  is  E
college  5  is  T
```

Method #2: For loop and range()

In case we want to use the traditional for loop which iterates from number x to number y.

```
# Python3 code to iterate over a list
list = [1, 3, 5, 7, 9]

# getting length of list
length = len(list)

# Iterating the index
# same as 'for i in range(len(list))'
for i in range(length):
    print(list[i])
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/listlooop.py
1
3
5
7
9
```

Method #3: using while loop

```
# Python3 code to iterate over a list
list = [1, 3, 5, 7, 9]

# Getting length of list
length = len(list)
i = 0

# Iterating using while loop
while i< length:
    print(list[i])
i += 1
```

Mutability:

A mutable object can be changed after it is created, and an immutable object can't.

Append: Append an item to a list

```
>>> x=[1,5,8,4]

>>>x.append(10)

>>> x

[1, 5, 8, 4, 10]
```

Extend: Append a sequence to a list.

```
>>> x=[1,2,3,4]

>>> y=[3,6,9,1]

>>>x.extend(y)

>>> x
```

Delete: Delete a list or an item from a list

```
>>> x=[5,3,8,6]

>>> del(x[1])            #deletes the index position 1 in a list

>>> x

[5, 8, 6]
```

Insert: To add an item at the specified index, use the insert () method:

```
>>> x=[1,2,4,6,7]

>>>x.insert(2,10)   #insert(index no, item to be inserted)

>>> x

[1, 2, 10, 4, 6, 7]

-----------------

>>>x.insert(4,['a',11])

>>> x

[1, 2, 10, 4, ['a', 11], 6, 7]
```

Pop: The pop() method removes the specified index, (or the last item if index is not specified) or simply pops the last item of list and returns the item.

```
>>> x=[1, 2, 10, 4, 6, 7]

>>>x.pop()

7

>>> x

[1, 2, 10, 4, 6]

------------------------

>>> x=[1, 2, 10, 4, 6]

>>>x.pop(2)

10

>>> x

[1, 2, 4, 6]
```

Remove: The **remove()** method removes the specified item from a given list.

```
>>> x=[1,33,2,10,4,6]

>>>x.remove(33)

>>> x

[1, 2, 10, 4, 6]

>>>x.remove(4)

>>> x

[1, 2, 10, 6]
```

Reverse: Reverse the order of a given list.

```
>>> x=[1,2,3,4,5,6,7]

>>>x.reverse()
```

```
>>> x

[7, 6, 5, 4, 3, 2, 1]
```

Sort: Sorts the elements in ascending order

```
>>> x=[7, 6, 5, 4, 3, 2, 1]

>>>x.sort()

>>> x

[1, 2, 3, 4, 5, 6, 7]
```

- - - - - - - - - - - - - - -

```
>>> x=[10,1,5,3,8,7]

>>>x.sort()

>>> x

[1, 3, 5, 7, 8, 10]
```

Aliasing:

1. An alias is a second name for a piece of data, often easier (and more useful) than making a copy.
2. If the data is immutable, aliases don‟t matter because the data can‟t change.
3. But if data can change, aliases can result in lot of hard – to – find bugs.
4. Aliasing happens whenever one variable‟s value is assigned to another variable.

   For ex:

   ```
   a = [81, 82, 83]
   b = [81, 82, 83]
   print(a == b)
   print(a is b)
   b = a
   print(a == b)
   print(a is b)
   b[0] = 5
   print(a)
   ```

   Output:

   ```
   C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/alia.py
   ```

```
True
False
True
True
[5, 82, 83]
```

Because the same list has two different names, a and b, we say that it is **aliased**. Changes made with one alias affect the other. In the example above, you can see that a and b refer to the same list after executing the assignment statement b = a.

Cloning Lists:

If we want to modify a list and also keep a copy of the original, we need to be able to make a copy of the list itself, not just the reference. This process is sometimes called cloning, to avoid the ambiguity of the word copy.

The easiest way to clone a list is to use the slice operator.Taking any slice of a creates a new list. In this case the slice happens to consist of the whole list.

Example:

```
a = [81, 82, 83]

b = a[:]       # make a clone using slice

print(a == b)

print(a is b)

b[0] = 5

print(a)

print(b)
```

Output:

C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/clo.py

```
True
False
[81, 82, 83]
[5, 82, 83]
```

Now we are free to make changes to b without worrying about a

List parameters:

Passing a list as an argument actually passes a reference to the list, not a copy of the list. Since lists are mutable, changes made to the elements referenced by the parameter change the same list that the argument is referencing.

#for example, the function below takes a list as an argument and multiplies each element in the list by 2:

```
def doubleStuff(List):

    """ Overwrite each element in aList with double its value. """

    for position in range(len(List)):

        List[position] = 2 * List[position]


things = [2, 5, 9]

print(things)

doubleStuff(things)

print(things)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/lipar.py == [2, 5, 9]

[4, 10, 18]
```

Tuple:

A tuple is a collection which is ordered and unchangeable. In Python tuples are written with round brackets.

- Supports all operations for sequences.
- Immutable, but member objects may be mutable.
- If the contents of a list shouldn"t change, use a tuple to prevent items from accidently being added, changed, or deleted.

- Tuples are more efficient than list due to python‟s implementation.

We can construct tuple in many ways:

```
X=()     #no item tuple
X=(1,2,3)
X=tuple(list1)
X=1,2,3,4
```

Example:

```
>>> x=(1,2,3)
>>> print(x)
(1, 2, 3)
>>> x
(1, 2, 3)
- - - - - - - - - - - - - - -
>>> x=()
>>> x
()
- - - - - - - - - - - - - - - - - -
>>> x=[4,5,66,9]
>>> y=tuple(x)
>>> y
(4, 5, 66, 9)
- - - - - - - - - - - - - - - - - - -
>>> x=1,2,3,4
>>> x
(1, 2, 3, 4)
```

Some of the operations of tuple are:

- Access tuple items
- Change tuple items
- Loop through a tuple
- Count()
- Index()
- Length()

Access tuple items: Access tuple items by referring to the index number, inside square brackets

```
>>> x=('a','b','c','g')
>>> print(x[2])
c
```

Change tuple items: Once a tuple is created, you cannot change its values. Tuples are unchangeable.

```
>>> x=(2,5,7,'4',8)
>>> x[1]=10
Traceback (most recent call last):
  File "<pyshell#41>", line 1, in <module>
    x[1]=10
TypeError: 'tuple' object does not support item assignment
>>> x
(2, 5, 7, '4', 8)     # the value is still the same
```

Loop through a tuple: We can loop the values of tuple using for loop

```
>>> x=4,5,6,7,2,'aa'
>>> for i in x:
          print(i)



4
5
6
7
2
aa
```

Count (): Returns the number of times a specified value occurs in a tuple

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>>x.count(2)
4
```

Index (): Searches the tuple for a specified value and returns the position of where it was found

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>>x.index(2)
```

```
1
```

(Or)

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=x.index(2)
>>> print(y)
1
```

Length (): To know the number of items or values present in a tuple, we use len().

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=len(x)
>>> print(y)
12
```

Tuple Assignment

Python has tuple assignment feature which enables you to assign more than one variable at a time. In here, we have assigned tuple 1 with the college information like college name, year, etc. and another tuple 2 with the values in it like number (1, 2, 3… 7).

For Example,

Here is the code,

- >>> tup1 = (", 'eng college','2004','cse', 'it','csit');
- >>> tup2 = (1,2,3,4,5,6,7);
- >>> print(tup1[0])
-
- >>> print(tup2[1:4])
- (2, 3, 4)

Tuple 1 includes list of information of

Tuple 2 includes list of numbers in it

We call the value for [0] in tuple and for tuple 2 we call the value between 1 and 4

Run the above code- It gives name for first tuple while for second tuple it gives number (2, 3, 4)

Tuple as return values:

A Tuple is a comma separated sequence of items. It is created with or without (). Tuples are immutable.

```
# A Python program to return multiple  values from a method using tuple

# This function returns a tuple
def fun():
    str = " college"
    x   = 20
    return str, x; # Return tuple, we could also
 # write (str, x)
 # Driver code to test above method
str, x = fun() # Assign returned tuple
print(str)
print(x)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/tupretval.py
 college
20
```

- Functions can return tuples as return values.

```
def circleInfo(r):
    """ Return (circumference, area) of a circle of radius r """
    c = 2 * 3.14159 * r
    a = 3.14159 * r * r
    return (c, a)
print(circleInfo(10))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/functupretval.py
(62.8318, 314.159)
```

```
def f(x):
  y0 = x + 1
  y1 = x * 3
  y2 = y0 ** y3
  return (y0, y1, y2)
```

Tuple methods:

Count (): Returns the number of times a specified value occurs in a tuple

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>>x.count(2)
4
```

Index (): Searches the tuple for a specified value and returns the position of where it was found

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>>x.index(2)
1
```

(Or)

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=x.index(2)
>>> print(y)
1
```

Set:

A set is a collection which is unordered and unindexed with no duplicate elements. In Python sets are written with curly brackets.

- To create an empty set we use **set()**
- Curly braces „{}‟ or the set() function can be used to create sets

We can construct tuple in many ways:

```
X=set()
X={3,5,6,8}
X=set(list1)
```

Example:

```
>>> x={1,3,5,6}
>>> x
{1, 3, 5, 6}
- - - - - - - - - - - - - - -
>>> x=set()
>>> x
set()
- - - - - - - - - - - - - - -
>>> list1=[4,6,"dd",7]
>>> x=set(list1)
>>> x
{4, 'dd', 6, 7}
```

- We cannot access items in a set by referring to an index, since sets are unordered the items has no index.
- But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

Some of the basic set operations are:

- Add()
- Remove()
- Len()
- Item in x
- Pop
- Clear

Add (): To add one item to a set use the add() method.To add more than one item to a set use the update() method.

```
>>> x={"","college","cse","dept"}
>>>x.add("autonomous")
>>> x
{", 'dept', 'autonomous', 'cse', 'college'}

- - -
>>> x={1,2,3}
>>>x.update("a","b")
>>> x
{1, 2, 3, 'a', 'b'}
```

```
>>> x={1,2,3}
>>>x.update([4,5],[6,7,8])
>>> x
{1, 2, 3, 4, 5, 6, 7, 8}
```

Remove (): To remove an item from the set we use remove or discard methods.

```
>>> x={1, 2, 3, 'a', 'b'}
>>>x.remove(3)
>>> x
{1, 2, 'a', 'b'}
```

Len (): To know the number of items present in a set, we use len().

```
>>> z={'', 'dept', 'autonomous', 'cse', 'college'}
>>>len(z)
5
```

Item in X:you can loop through the set items using a for loop.

```
>>> x={'a','b','c','d'}
>>> for item in x:
        print(item)

c
d
a
b
```

pop (): This method is used to remove an item, but this method will remove the **last** item. Remember that sets are unordered, so you will not know what item that gets removed.

```
>>> x={1, 2, 3, 4, 5, 6, 7, 8}
>>>x.pop()
1
>>> x
{2, 3, 4, 5, 6, 7, 8}
```

Clear (): This method will the set as empty.

```
>>> x={2, 3, 4, 5, 6, 7, 8}
>>>x.clear()
>>> x
set()
```

The set also consist of some mathematical operations like:

Intersection	AND	&
Union	OR	|
Symmetric Diff	XOR	^
Diff	In set1 but not in set2	set1-set2
Subset	set2 contains set1	set1<=set2
Superset	set1 contains set2	set1>=set2

Some examples:

```
>>> x={1,2,3,4}
>>> y={4,5,6,7}
>>> print(x|y)
{1, 2, 3, 4, 5, 6, 7}
```

```
>>> x={1,2,3,4}
>>> y={4,5,6,7}
>>> print(x&y)
{4}
```

```
>>> A = {1, 2, 3, 4, 5}
>>> B = {4, 5, 6, 7, 8}
>>> print(A-B)
{1, 2, 3}
```

```
>>> B = {4, 5, 6, 7, 8}
>>> A = {1, 2, 3, 4, 5}
>>> print(B^A)
{1, 2, 3, 6, 7, 8}
```

Dictionaries:

A dictionary is a collection which is unordered, changeable and indexed. In Python dictionaries are written with curly brackets, and they have keys and values.

- Key-value pairs
- Unordered

We can construct or create dictionary like:

X={1:‟A‟,2:‟B‟,3:‟c‟}

X=dict([(„a‟,3) („b‟,4)]

X=dict(„A‟=1,‟B‟ =2)

Examples:

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1
{'brand': ", 'model': 'college', 'year': 2004}
```

- - - - - - - - - - - - -

To access specific value of a dictionary, we must pass its key,

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> x=dict1["brand"]
>>> x
"
```

- - - - - - - - - - - - - - -

To access keys and values and items of dictionary:

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1.keys()
dict_keys(['brand', 'model', 'year'])
>>> dict1.values()
dict_values([", 'college', 2004])
>>> dict1.items()
dict_items([('brand', "), ('model', 'college'), ('year', 2004)])
```

- -

```
>>> for items in dict1.values():
        print(items)



college
2004

>>> for items in dict1.keys():
        print(items)


brand
model
year

>>> for i in dict1.items():
        print(i)


('brand', ")
('model', 'college')
```

```
('year', 2004)
```

Some of the operations are:

- Add/change
- Remove
- Length
- Delete

Add/change values: You can change the value of a specific item by referring to its key name

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1["year"]=2005
>>> dict1
{'brand': '', 'model': 'college', 'year': 2005}
```

Remove(): It removes or pop the specific item of dictionary.

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> print(dict1.pop("model"))
college
>>> dict1
{'brand': '', 'year': 2005}
```

Delete: Deletes a particular item.

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> del x[5]
>>> x
```

Length:we use len() method to get the length of dictionary.

```
>>>{1: 1, 2: 4, 3: 9, 4: 16}
{1: 1, 2: 4, 3: 9, 4: 16}
>>> y=len(x)
>>> y
4
```

Iterating over (key, value) pairs:

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> for key in x:
        print(key, x[key])
```

```
1 1
2 4
3 9
4 16
5 25
>>> for k,v in x.items():
        print(k,v)


1 1
2 4
3 9
4 16
5 25
```

List of Dictionaries:

```
>>> customers = [{"uid":1,"name":"John"},
    {"uid":2,"name":"Smith"},
           {"uid":3,"name":"Andersson"},
            ]
>>>>>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'Andersson'}]

## Print the uid and name of each customer
>>> for x in customers:
        print(x["uid"], x["name"])


1 John
2 Smith
3 Andersson

##Modify an entry, This will change the name of customer 2 from Smith to Charlie
>>> customers[2]["name"]="charlie"
>>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'charlie'}]

##Add a new field to each entry

>>> for x in customers:
        x["password"]="123456" # any initial value


>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 2, 'name': 'Smith', 'password':
'123456'}, {'uid': 3, 'name': 'charlie', 'password': '123456'}]

##Delete a field
>>> del customers[1]
>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 3, 'name': 'charlie', 'password':
'123456'}]

>>> del customers[1]
>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}]

##Delete all fields

>>> for x in customers:
        del x["uid"]


>>> x
{'name': 'John', 'password': '123456'}
```

Data Type conversions:

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 constructor functions:

int() - constructs an integer number from an integer literal, a float literal (by rounding down to the previous whole number), or a string literal (providing the string represents a whole number)

float() - constructs a float number from an integer literal, a float literal or a string literal (providing the string represents a float or an integer)

str() - constructs a string from a wide variety of data types, including strings, integer literals and float literals

Examples:

Integers:

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

Print(x)

Print(y)

Print(z)
```

Output:

```
1
2
3
```

Floats:

```
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

Print(x)

Print(y)

Print(z)

Print(w)
```

Output:

```
1.0
2.8
3.0
4.2
```

Strings:

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

Print(y)

Print(z)

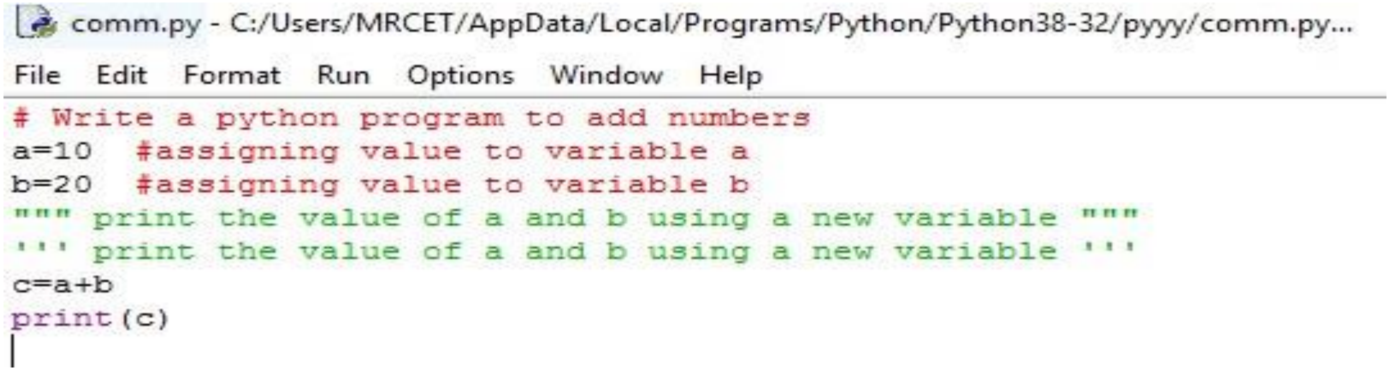
Output:

s1
2
3.0

Commenting in python:

Single-line comments begins with a hash(#) symbol and is useful in mentioning that the whole line should be considered as a comment until the end of line.

A Multi line comment is useful when we need to comment on many lines. In python, triple double quote(“ “ “) and single quote(„ „ „)are used for multi-line commenting.


comm.py - C:/Users/MRCET/AppData/Local/Programs/Python/Python38-32/pyyy/comm.py...
File
Edit
Format
Run
Options
Window
Help

```
# Write a python program to add numbers
a=10  #assigning value to variable a
b=20  #assigning value to variable b
""" print the value of a and b using a new variable """
''' print the value of a and b using a new variable '''
c=a+b
print(c)
```

UNIT II

Variables and Operators: Understanding Python variables, Multiple variable declarations, Python basic statements, Python basic operators: Arithmetic operators, Assignment operators, Comparison operators, Logical operators, Identity operators, Membership operators, Bitwise operators, Precedence of operators, Expressions.

Variables:

Variables are nothing but reserved memory locations to store values. This means that when you create a variable you reserve some space in memory.

Based on the data type of a variable, the interpreter allocates memory and decides what can be stored in the reserved memory. Therefore, by assigning different data types to variables, you can store integers, decimals or characters in these variables.

Rules for Python variables:

- 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)

Assigning Values to Variables:

Python variables do not need explicit declaration to reserve memory space. The declaration happens automatically when you assign a value to a variable. The equal sign (=) is used to assign values to variables.

The operand to the left of the = operator is the name of the variable and the operand to the right of the = operator is the value stored in the variable

For example −

```
a= 100          # An integer assignment

b = 1000.0          # A floating point
```

```
c = "John"         # A string

print  (a)

print  (b)

print (c)
```

This produces the following result −

```
100

1000.0

John
```

Multiple Assignment:

Python allows you to assign a single value to several variables simultaneously.

For example :

```
a = b = c = 1
```

Here, an integer object is created with the value 1, and all three variables are assigned to the same memory location. You can also assign multiple objects to multiple variables.

For example −

```
a,b,c = 1,2,"“
```

Here, two integer objects with values 1 and 2 are assigned to variables a and b respectively, and one string object with the value "john" is assigned to the variable c.

Output Variables:

The Python print statement is often used to output variables.

Variables do not need to be declared with any particular type and can even change type after they have been set.

```
x = 5                  # x is of type int
x = " "       # x is now of type str
print(x)
```

Output:

To combine both text and a variable, Python uses the **"+"** character:

Example

```
x = "awesome"
print("Python is " + x)
```

Output

```
Python is awesome
```

You can also use the + character to add a variable to another variable:

Example

```
x = "Python is "
y = "awesome"
z = x + y
print(z)
```

Output:

```
Python is awesome
```

Python basic statements:

A statement is an instruction that the Python interpreter can execute. We have normally two basic statements, the assignment statement and the print statement. Some other kinds of statements that are if statements, while statements, and for statements generally called as control flows.

Examples:

An **assignment** statement creates new variables and gives them values:

```
>>> x=10

>>> college=""
```

An **print** statement is something which is an input from the user, to be printed / displayed on to the screen (or) monitor.

```
>>> print("colege")

 college
```

Python basic Operators:

Operators are used to perform operations on variables and values. Python divides the operators in the following groups:

- Arithmetic operators
- Assignment operators
- Comparison operators
- Logical operators
- Identity operators
- Membership operators
- Bitwise operators

Arithmetic operators

Operator	Name	Example
+	Addition	x + y
-	Subtraction	x - y
*	Multiplication	x * y
/	Division	x / y

Assignment operators

Operator	Example	Same As
=	x = 5	x = 5
+=	x += 3	x = x + 3
-=	x -= 3	x = x - 3

*=	x *= 3	x = x * 3
/=	x /= 3	x = x / 3

Comparison operators

Operator	Name	Example
==	Equal	x == y
!=	Not equal	x != y
>	Greater than	x > y
<	Less than	x < y
>=	Greater than or equal to	x >= y
<=	Less than or equal to	x <= y

Logical operators

Operator	Description	Example
and	Returns True if both statements are true	x < 5 and x < 10
or	Returns True if one of the statements is true	x < 5 or x < 4
not	Reverse the result, returns False if the result is true	not(x < 5 and x < 10)

Identity operators

Operator	Description	Example

is	Returns true if both variables are the same object	x is y
is not	Returns true if both variables are not the same object	x is not y

Membership operators

Operator	Description	Example
in	Returns True if a sequence with the specified value is present in the object	x in y
not in	Returns True if a sequence with the specified value is not present in the object	x not in y

Bitwise operators

Operator	Name	Description
&	AND	Sets each bit to 1 if both bits are 1
|	OR	Sets each bit to 1 if one of two bits is 1
^	XOR	Sets each bit to 1 if only one of two bits is 1
~	NOT	Inverts all the bits
<<	Zero fill left shift	Shift left by pushing zeros in from the right and let the leftmost bits fall off
>>	Signed right shift	Shift right by pushing copies of the leftmost bit in from the left, and let the rightmost bits fall off

Precedence of Operators:

Operator precedence affects how an expression is evaluated.

For example, x = 7 + 3 * 2; here, x is assigned 13, not 20 because operator * has higher precedence than +, so it first multiplies 3*2 and then adds into 7.

Example 1:

```
>>> 3+4*2

11
```

Multiplication gets evaluated before the addition operation

```
>>> (10+10)*2

40
```

Parentheses () overriding the precedence of the arithmetic operators

Example 2:

```
a  =  20
b  =  10
c  =  15
d = 5
e = 0

e = (a + b) * c / d       #( 30 * 15 ) / 5
print("Value of (a + b) * c / d is ",  e)

e = ((a + b) * c) / d     # (30 * 15 ) / 5
print("Value of ((a + b) * c) / d is ",  e)

e = (a + b) * (c / d);    # (30) * (15/5)
print("Value of (a + b) * (c / d) is ",  e)

e = a + (b * c) / d;      # 20 + (150/5)
print("Value of a + (b * c) / d is ",  e)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/opprec.py
Value of (a + b) * c / d is 90.0
Value of ((a + b) * c) / d is 90.0
Value of (a + b) * (c / d) is  90.0
Value of a + (b * c) / d is  50.0
```

Expressions:

An expression is a combination of values, variables, and operators. An expression is evaluated using assignment operator.

Examples: Y=x + 17

```
>>> x=10

>>> z=x+20

>>> z

30

>>> x=10

>>> y=20

>>> c=x+y

>>> c

30
```

A value all by itself is a simple expression, and so is a variable.

```
>>> y=20

>>> y

20
```

Python also defines expressions only contain identifiers, literals, and operators. So,

Identifiers: Any name that is used to define a class, function, variable module, or object is an identifier.

Literals: These are language-independent terms in Python and should exist independently in any programming language. In Python, there are the string literals, byte literals, integer literals, floating point literals, and imaginary literals.

Operators: In Python you can implement the following operations using the corresponding tokens.

Operator	Token
add	+
subtract	-
multiply	*
Integer Division	/
remainder	%
Binary left shift	<<
Binary right shift	>>
and	&
or	\
Less than	<
Greater than	>
Less than or equal to	<=
Greater than or equal to	>=
Check equality	==
Check not equal	!=

Some of the python expressions are:

Generator expression:

Syntax:(compute(var) for var in iterable)

```
>>> x = (i for i in 'abc')  #tuple comprehension
>>> x
<generator object <genexpr> at 0x033EEC30>

>>> print(x)
<generator object <genexpr> at 0x033EEC30>
```

You might expect this to print as ('a', 'b', 'c') but it prints as <generator object <genexpr> at 0x02AAD710> The result of a tuple comprehension is not a tuple: it is actually a generator. The only thing that you need to know now about a generator now is that you can iterate over it, but ONLY ONCE.

Conditional expression:

Syntax:true_value if Condition else false_value

```
>>> x = "1" if True else "2"

>>> x

'1'
```

UNIT –III

CONTROL FLOW AND LOOPS

conditional (if), alternative (if-else), chained conditional (if- elif -else), Loops: For loop using ranges, string, use of while loops in python, Loop manipulation using pass, continue and break

Conditional (if):

The if statement contains a logical expression using which data is compared and a decision is made based on the result of the comparison.

Syntax:
if expression:
statement(s)
If the boolean expression evaluates to TRUE, then the block of statement(s) inside the if statement is executed. If boolean expression evaluates to FALSE, then the first set of code after the end of the if statement(s) is executed.

if Statement Flowchart:

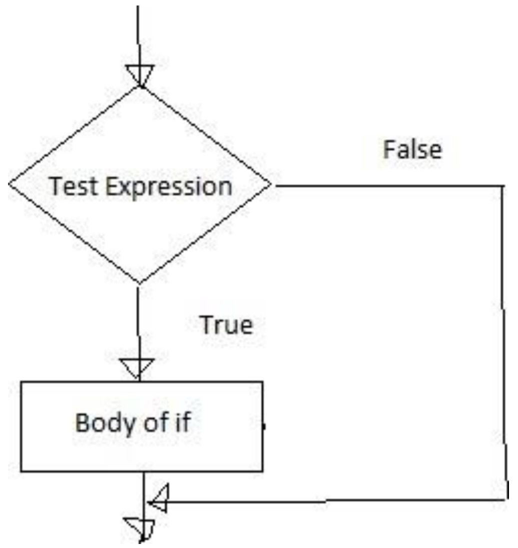


Fig: Operation of if statement

Example: Python if Statement

a = 3
if a > 2:

```
    print(a, "is greater")
print("done")

a = -1
if a < 0:
     print(a, "a is smaller")
print("Finish")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/if1.py
3 is greater
done
-1 a is smaller
Finish
```

- -

```
a=10

if a>9:

    print("A is Greater than 9")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/if2.py

A is Greater than 9
```

Alternative if(If-Else):

An else statement can be combined with an if statement. An else statement contains the block of code (false block) that executes if the conditional expression in the if statement resolves to 0 or a FALSE value.

The else statement is an optional statement and there could be at most only one elseStatement following if.

Syntax of if - else :

```
if test expression:
        Body of ifstmts
else:
```

Body of elsestmts

If - else Flowchart :

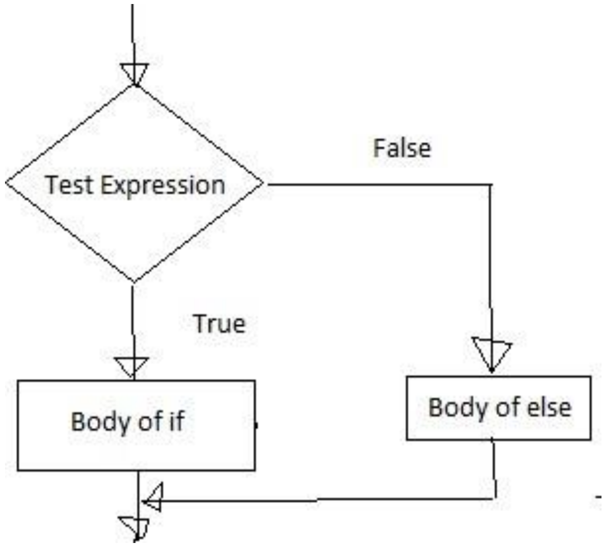


Fig: Operation of if – else statement

Example of if - else:

```
a=int(input('enter the number'))
if a>5:
    print("a is greater")
else:
    print("a is smaller than the input given")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ifelse.py enter
the number 2
a is smaller than the input given
----------------------------------------
```

```
a=10
b=20
if a>b:
    print("A is Greater than B")
else:
    print("B is Greater than A")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/if2.py
B is Greater than A
```

Chained Conditional: (If-elif-else):

The elif statement allows us to check multiple expressions for TRUE and execute a block of code as soon as one of the conditions evaluates to TRUE. Similar to the else, the elif statement is optional. However, unlike else, for which there can be at most one statement, there can be an arbitrary number of elif statements following an if.

Syntax of if – elif - else :

```
If test expression:
        Body of if stmts
elif test expression:
        Body of elifstmts
else:
        Body of else stmts
```

Flowchart of if – elif - else:

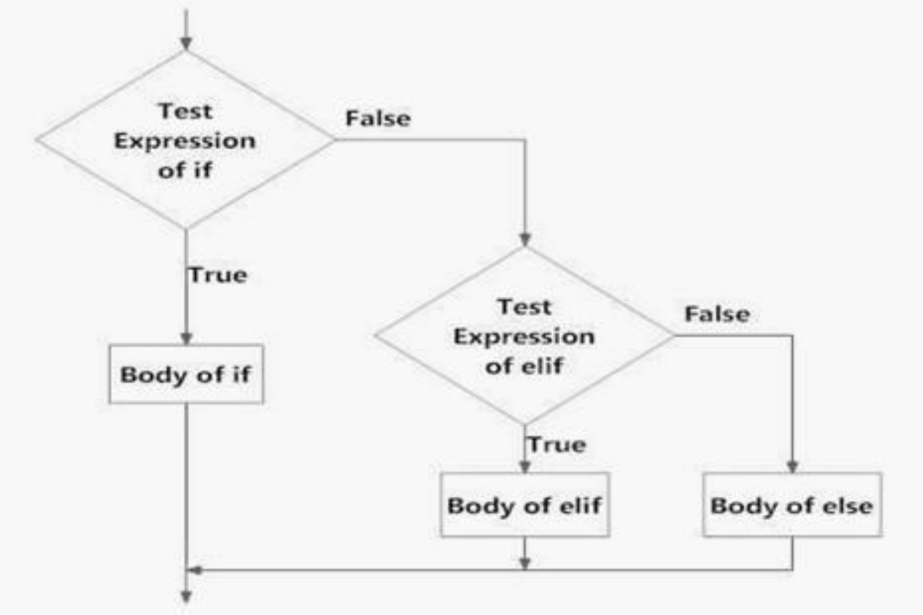


Fig: Operation of if – elif - else statement

Example of if - elif – else:

```
a=int(input('enter the number'))
b=int(input('enter the number'))
c=int(input('enter the number'))
if a>b:
    print("a is greater")
elif b>c:
    print("b is greater")
else:
    print("c is greater")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ifelse.py enter
the number5
enter the number2
enter the number9
a is greater
>>>
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ifelse.py
enter the number2
enter the number5
enter the number9
c is greater
```

```
var = 100
if var == 200:
    print("1 - Got a true expression value")
    print(var)
elif var == 150:
    print("2 - Got a true expression value")
    print(var)
elif var == 100:
    print("3 - Got a true expression value")
    print(var)
else:
    print("4 - Got a false expression value")
    print(var)
print("Good bye!")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ifelif.py
```

```
3 - Got a true expression value

100

Good bye!
```

Iteration:

A loop statement allows us to execute a statement or group of statements multiple times as long as the condition is true. Repeated execution of a set of statements with the help of loops is called iteration.

Loops statements are used when we need to run same code again and again, each time with a different value.

Statements:

In Python Iteration (Loops) statements are of three types:

1. While Loop
2. For Loop
3. Nested For Loops

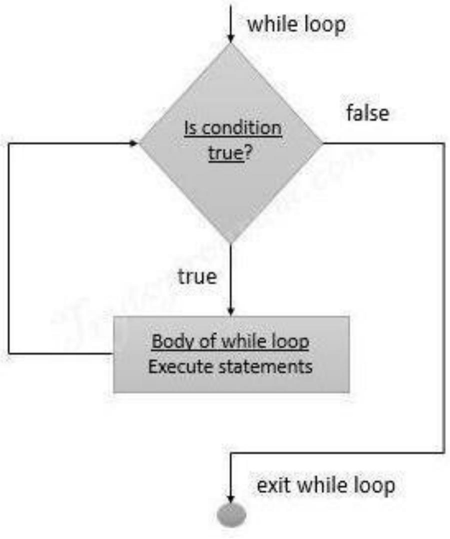
While loop:

- Loops are either infinite or conditional. Python while loop keeps reiterating a block of code defined inside it until the desired condition is met.
- The while loop contains a boolean expression and the code inside the loop is repeatedly executed as long as the boolean expression is true.
- The statements that are executed inside while can be a single line of code or a block of multiple statements.

Syntax:

```
while(expression):
          Statement(s)
```

Flowchart:



Example Programs:

1.______________________________

```
i=1
while i<=6:
        print(" college")
        i=i+1
```

output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh1.py
 college
college
college
college
college
college
```

2.____

```
i=1

while i<=3: print("",end="
   ") j=1
   while j<=1:
      print("CSE DEPT",end="")
      j=j+1
```

```
        i=i+1
          print()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh2.py

 CSE  DEPT     CSE

DEPT   CSE DEPT
```

3. __________________________________

```
i=1
j=1
while i<=3:
    print("",end="  ")

    while j<=1:
        print("CSE DEPT",end="")
        j=j+1
i=i+1
print()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh3.py

  CSE DEPT
```

4. __________________________________

```
i = 1
while  (i<  10):
        print  (i)
        i = i+1
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh4.py
1
2
3
4
```

```
5
6
7
8
9
```

2. ______________________________

```
a = 1
b = 1
while (a<10):
print ('Iteration',a)
 a = a + 1
b = b + 1
if (b == 4):
break
print ('While loop terminated')
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh5.py
Iteration 1
Iteration 2
Iteration 3
While loop terminated
```

- - - - - - - - - - - - - - - - -

```
count = 0
while (count < 9):
    print("The count is:", count)
    count = count + 1
print("Good bye!")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/wh.py = The
count is: 0
The count is: 1
The count is: 2
The count is: 3
The count is: 4
The count is: 5
The count is: 6
The count is: 7
The count is: 8
```

```
Good bye!
```

For loop:

Python **for loop** is used for repeated execution of a group of statements for the desired number of times. It iterates over the items of lists, tuples, strings, the dictionaries and other iterable objects

Syntax: for var in sequence:

Statement(s)

A sequence of values assigned to var in each iteration

Holds the value of item
in sequence in each iteration

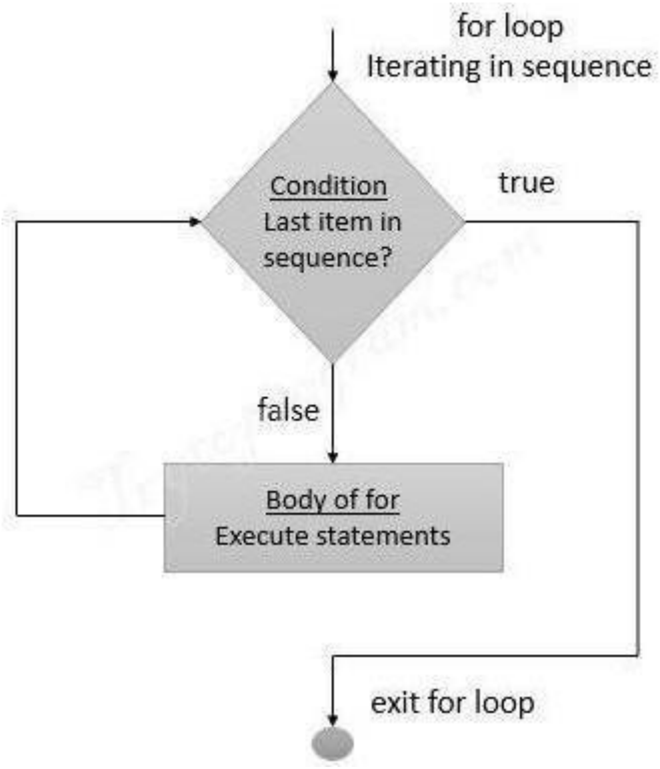
Sample Program:

```
numbers = [1, 2, 4, 6, 11, 20]
seq=0
for val in numbers:
    seq=val*val
    print(seq)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/fr.py
1
4
16
36
121
400
```

Flowchart:



Iterating over a list:

```
#list of items
list = ['M','R','C','E','T']
i = 1

#Iterating over the list
for item in list:
  print ('college ',i,' is ',item)
i = i+1
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/lis.py college
1  is  M
college  2  is  R
college  3  is  C
college  4  is  E
college  5  is  T
```

Iterating over a Tuple:

```
tuple = (2,3,5,7)
```

```
print ('These are the first four prime numbers ')
#Iterating over the tuple
for a in tuple:
  print (a)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fr3.py
These are the first four prime numbers
2
3
5
7
```

Iterating over a dictionary:

```
#creating a dictionary
college = {"ces":"block1","it":"block2","ece":"block3"}

#Iterating over the dictionary to print keys
print ('Keys are:')
for keys in college:
  print (keys)

#Iterating over the dictionary to print values
print ('Values are:')
for blocks in college.values():
  print(blocks)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/dic.py
Keys are:
ces
it
ece
Values are:
block1
block2
block3
```

Iterating over a String:

```
#declare a string to iterate over
college = "
```

```
#Iterating over the string
for name in college:
  print (name)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/strr.py
M
R
C
E
T
```

Nested For loop:

When one Loop defined within another Loop is called Nested Loops.

Syntax:

```
for val in sequence:
          for val in sequence:
          statements
statements
```

# Example 1 of Nested For Loops (Pattern Programs)

```
for i in range(1,6):
   for j in range(0,i):
      print(i, end=" ")
   print(")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/nesforr.py
1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
- - - - - - - - - - - - - - - - -
```

# Example 2 of Nested For Loops (Pattern Programs)

```
for i in range(1,6):
    for j in range(5,i-1,-1):
        print(i, end=" ")
    print('')
```

C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/nesforr.py

Output:

```
1 1 1 1 1

2 2 2 2

3 3 3

4 4
```

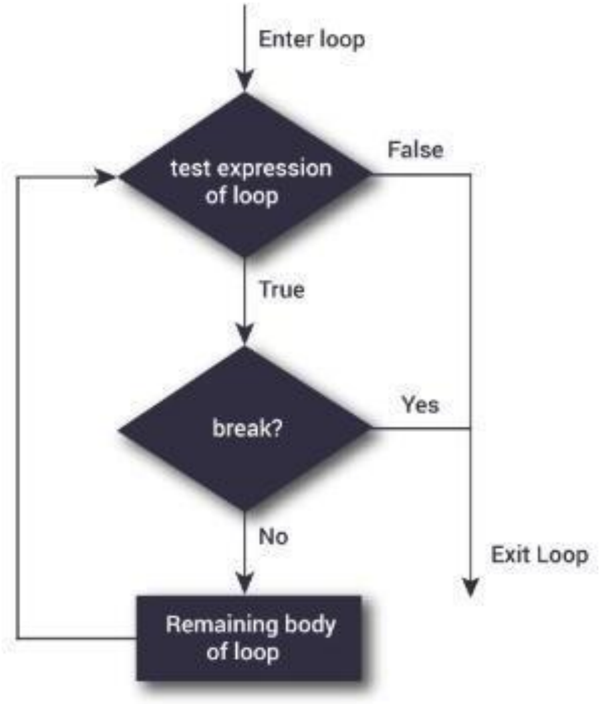
Break and continue:

In Python, **break and continue** statements can alter the flow of a normal loop.Sometimes we wish to terminate the current iteration or even the whole loop without checking test expression.The break and continue statements are used in these cases.

Break:

The break statement terminates the loop containing it and control of the program flows to the statement immediately after the body of the loop.If break statement is inside a nested loop (loop inside another loop), break will terminate the innermost loop.

Flowchart:



The following shows the working of break statement in for and while loop:

```
for var in sequence:
          # code inside for loop
         If condition:
                   break (if break condition satisfies it jumps to outside loop)
         # code inside for loop
# code outside for loop


while test expression

         # code inside while loop
         If condition:
                   break (if break condition satisfies it jumps to outside loop)
         # code inside while loop
# code outside while loop
```

Example:

```
for val in " COLLEGE":
    if val == " ":
        break
    print(val)

print("The end")
```

Output:

```
M
R
C
E
T
The end
```

# Program to display all the elements before number 88

```
for num in [11, 9, 88, 10, 90, 3, 19]:
   print(num)
   if(num==88):
              print("The number 88 is found")
              print("Terminating the loop")
              break
```

Output:

```
11
9
88
The number 88 is found
Terminating the loop
```

#______________________________

```
for letter in "Python": # First Example
    if letter == "h":
        break
    print("Current Letter :", letter )
```

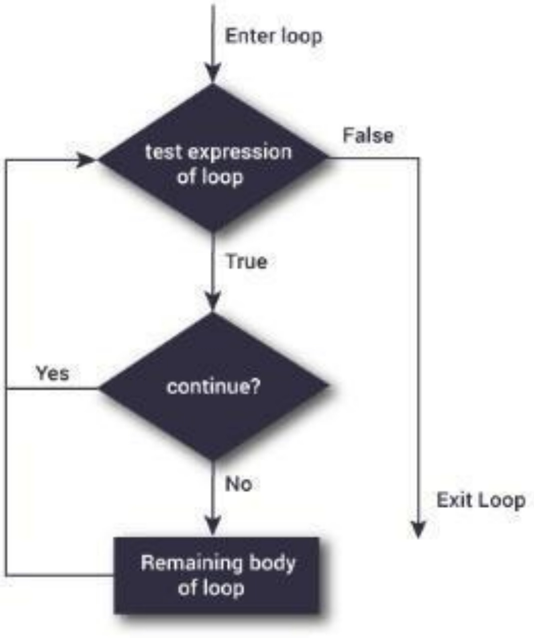
Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/br.py =

Current Letter : P

Current Letter : y
Current Letter : t
```

Continue:

The continue statement is used to skip the rest of the code inside a loop for the current iteration only. Loop does not terminate but continues on with the next iteration.

Flowchart:



The following shows the working of break statement in for and while loop:

```
for var in sequence:
     # code inside for loop
    If condition:
        continue (if break condition satisfies it jumps to outside loop)
    # code inside for loop
# code outside for loop


while test expression

    # code inside while loop
    If condition:
        continue(if break condition satisfies it jumps to outside loop)
    # code inside while loop
# code outside while loop
```

Example:

```
# Program to show the use of continue statement inside loops

for val in "string":
    if val == "i":
        continue
    print(val)

print("The end")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/cont.py s
t
r
n
g
The end
```

```
# program to display only odd numbers

for num in [20, 11, 9, 66, 4, 89, 44]:
    # Skipping the iteration when number is even
    if num%2 == 0:
        continue
    # This statement will be skipped for all even numbers
    print(num)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/cont2.py
11
9
89
```

```
#______________
for letter in "Python": # First Example
```

```
    if letter == "h":
        continue
    print("Current Letter :", letter)
Output:

C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/con1.py
Current Letter : P
Current Letter : y
Current Letter : t
Current Letter : o
Current Letter : n
```

Pass:

In Python programming, pass is a null statement. The difference between a comment and pass statement in Python is that, while the interpreter ignores a comment entirely, pass is not ignored.
pass is just a placeholder for functionality to be added later.

Example:

```
sequence = {'p', 'a', 's', 's'}
for val in sequence:
    pass
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/f1.y.py
>>>
```

Similarily we can also write,

```
def f(arg): pass    # a function that does nothing (yet)

class C: pass       # a class with no methods (yet)
```

UNIT IV

Functions:

Defining Your Own Functions, Calling Functions, passing parameters and arguments, Python Function arguments: Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Powerful Lambda functions in python, Brief on other functions like sort, sorted and range.

Functions:

Functions and its use: Function is a group of related statements that perform a specific task.Functions help break our program into smaller and modular chunks. As our program grows larger and larger, functions make it more organized and manageable. It avoids repetition and makes code reusable.

Basically, we can divide functions into the following two types:

1. **Built-in functions -** Functions that are built into Python.

   Ex: abs(),all().ascii(),bool()………so on….

   ```
   integer = -20

   print('Absolute value of -20 is:', abs(integer))
   ```

   Output:

   ```
   Absolute value of -20 is: 20
   ```

2. **User-defined functions -** Functions defined by the users themselves.

   ```
   def add_numbers(x,y):
     sum = x + y
     return sum

   print("The sum is", add_numbers(5, 20))
   ```

   Output:

```
The sum is 25
```

Parameters and arguments:

Parameters are passed during the definition of function while Arguments are passed during the function call**.**

Example:

```
#here a and b are parameters

def add(a,b): #//function definition
 return a+b

#12 and 13 are arguments
#function call
result=add(12,13)
print(result)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/paraarg.py

25
```

Some examples on functions:

# To display vandemataram by using function use no args no return type

```
#function defination
def display():
    print("vandemataram")
print("i am in main")

#function call
display()
print("i am in main")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
i am in main
vandemataram
```

```
i am in main
```

#Type1 : No parameters and no return type

```
def Fun1() :
   print("function 1")
Fun1()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py function

1
```

#Type 2: with param with out return type

```
def fun2(a) :
    print(a)
fun2("hello")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py

Hello
```

#Type 3: without param with return type

```
def fun3():
   return "welcome to python"
print(fun3())
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py

welcome to python
```

#Type 4: with param with return type

```
def fun4(a):
    return a
print(fun4("python is better then c"))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py python

is better then c
```

There are three types of Python function arguments using which we can call a function.

1. Default Arguments
2. Keyword Arguments
3. Variable-length Arguments

Syntax:

```
def functionname():
    statements
      .
      .
      .
functionname()
```

Function definition consists of following components:

1. Keyword **def** indicates the start of function header.
2. A function name to uniquely identify it. Function naming follows the same rules of writing identifiers in Python.
3. Parameters (arguments) through which we pass values to a function. They areoptional.
4. A **colon (:)** to mark the end of function header.
5. Optional documentation string (docstring) to describe what the function does.
6. One or more valid python statements that make up the function body. Statements musthave same indentation level (usually 4 spaces).
7. An optional return statement to return a value from the function.

Example:

```
def hf():
    hello world

hf()
```

In the above example we are just trying to execute the program by calling the function. So it will not display any error and no output on to the screen but gets executed.

To get the statements of function need to be use print().

#calling function in python:

```
def hf():

    print("hello world")

hf()
```

Output:

```
hello world
```

- - - - - - - - - - - - - - - - - - - -

```
def hf(): print("hw")

    print("ghkfjg 66666")

hf()

hf()

hf()
```

Output:

```
hw
ghkfjg 66666
hw
ghkfjg 66666
hw
ghkfjg 66666
```

- -.

```
def add(x,y):
    c=x+y
    print(c)
add(5,4)
```

Output:

```
9
```

```
def add(x,y):
    c=x+y
    return c
print(add(5,4))
```

Output:

```
9
```

```
- - - - - - - - - - - - - - - - - - - - - - -
```

```
def add_sub(x,y):
    c=x+y
    d=x-y
    return c,d
print(add_sub(10,5))
```

Output:

```
 (15, 5)
```

The **return** statement is used to exit a function and go back to the place from where it was called. This statement can contain expression which gets evaluated and the value is returned. If there is no expression in the statement or the return statement itself is not present inside a function, then the function will return the **None** object.

```
def hf():
    return "hw"

print(hf())
```

Output:

```
hw
```

- - - - - - - - - - - - - - - - - -

```
def hf():

    return "hw"

hf()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu.py

>>>
```

- -

```
def hello_f():

    return "hellocollege"

print(hello_f().upper())
```

Output:

```
HELLOCOLLEGE
```

#Passing Arguments

```
def hello(wish):

    return '{}'.format(wish)

print(hello(""))
```

Output:

- -

Here, the function wish() has two parameters.Since, we have called this function with two arguments, it runs smoothly and we do not get any error.If we call it with different number of arguments, the interpreter will give errors.

```
def          wish(name,msg):

   """This function greets to

   the person with the provided message"""

print("Hello",name + ' ' + msg)

wish("","Good morning!") Output:

Hello  Good morning!
```

Below is a call to this function with one and no arguments along with their respective error messages.

```
>>>wish("")    # only one argument
TypeError: wish() missing 1 required positional argument: 'msg'
>>>wish()    # no arguments
TypeError: wish() missing 2 required positional arguments: 'name' and 'msg'
```

- -

```
def hello(wish,hello):

    return “hi” '{},{}'.format(wish,hello)

print(hello("","college"))
```

Output:

```
hi,college
```

#Keyword Arguments

When we call a function with some values, these values get assigned to the arguments according to their position.

Python allows functions to be called using keyword arguments. When we call functions in this way, the order (position) of the arguments can be changed.

(Or)

If you have some functions with many parameters and you want to specify only some of them, then you can give values for such parameters by naming them - this is called **keyword arguments** - we use the name (keyword) instead of the position (which we have been using all along) to specify the arguments to the function.

There are two *advantages* - one, using the function is easier since we do not need to worry about the order of the arguments. Two, we can give values to only those parameters which we want, provided that the other parameters have default argument values.

```
def func(a, b=5, c=10):
        print 'a is', a, 'and b is', b, 'and c is', c

func(3,  7)
func(25, c=24)
func(c=50, a=100)
```

Output:

```
a is 3 and b is 7 and c is 10
a is 25 and b is 5 and c is 24
a is 100 and b is 5 and c is 50
```

Note:

The function named func has one parameter without default argument values, followed by two parameters with default argument values.

In the first usage, func(3, 7), the parameter a gets the value 3, the parameter b gets the value 5 and c gets the default value of 10.

In the second usage func(25, c=24), the variable a gets the value of 25 due to the position of the argument. Then, the parameter c gets the value of 24 due to naming i.e. keyword arguments. The variable b gets the defaultvalue of 5.

In the third usage func(c=50, a=100), we use keyword arguments completely to specify the values. Notice, that we are specifying value for parameter c before that for a even though a is defined before c in the function definition.

For example: if you define the function like below

```
def func(b=5, c=10,a):  # shows error : non-default argument follows default argument
```

- -

```
def print_name(name1, name2):

  """ This function prints the name """

  print (name1 + " and " + name2 + " are friends")

#calling the function

print_name(name2 = 'A',name1 = 'B')
```

Output:

```
B and A are friends
```

#Default Arguments

Function arguments can have default values in Python.

We can provide a default value to an argument by using the assignment operator (=)

```
def hello(wish,name='you'):

    return '{},{}'.format(wish,name)

print(hello("good morning"))
```

Output:

```
good morning,you
```

- -

```
def hello(wish,name='you'):

    return '{},{}'.format(wish,name)     //print(wish + „ „ + name)

print(hello("good morning","nirosha"))   //hello("good morning","nirosha")
```

Output:

```
good morning,nirosha   //     good morning  nirosha
```

Note: Any number of arguments in a function can have a default value. But once we have a default argument, all the arguments to its right must also have default values.

This means to say, non-default arguments cannot follow default arguments. For example, if we had defined the function header above as:

```
def hello(name='you', wish):
```

Syntax Error: non-default argument follows default argument

```
def sum(a=4, b=2): #2 is supplied as default argument

  """ This function will print sum of two numbers

      if the arguments are not supplied

      it will add the default value """

  print (a+b)

sum(1,2) #calling with arguments

sum( )    #calling without arguments
```

Output:

```
3

6
```

Variable-length arguments

Sometimes you may need more arguments to process function then you mentioned in the definition. If we don‟t know in advance about the arguments needed in function, we can use variable-length arguments also called arbitrary arguments.

For this an asterisk (*) is placed before a parameter in function definition which can hold non-keyworded variable-length arguments and a double asterisk (**) is placed before a parameter in function which can hold keyworded variable-length arguments.

If we use one asterisk (*) like *var, then all the positional arguments from that point till the end are collected as a tuple called „var‟ and if we use two asterisks (**) before a variable like **var, then all the positional arguments from that point till the end are collected as a dictionary called „var‟.

```
def wish(*names):
   """This function greets all
   the person in the names tuple."""

   # names is a tuple with arguments
   for name in names:
       print("Hello",name)

wish("","CSE","SIR","MADAM")
```

Output:

```
Hello  Hello

CSE Hello

SIR

Hello MADAM
```

#Program to find area of a circle using function use single return value function with argument.

```
pi=3.14
def areaOfCircle(r):

    return pi*r*r
r=int(input("Enter radius of circle"))
```

```
print(areaOfCircle(r))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
Enter radius of circle 3
28.259999999999998
```

#Program to write sum different product and using arguments with return value function.

```
def calculete(a,b):

    total=a+b

    diff=a-b

    prod=a*b

    div=a/b

    mod=a%b

    return total,diff,prod,div,mod

a=int(input("Enter a value"))

b=int(input("Enter b value"))

#function call

s,d,p,q,m = calculete(a,b)

print("Sum= ",s,"diff= ",d,"mul= ",p,"div= ",q,"mod= ",m)

#print("diff= ",d)

#print("mul= ",p)

#print("div= ",q)

#print("mod= ",m)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
Enter a value 5
Enter b value 6
Sum=  11 diff=  -1 mul=  30 div=  0.8333333333333334 mod=  5
```

#program to find biggest of two numbers using functions.

```
def biggest(a,b):
    if a>b :
        return a
    else :
        return b



a=int(input("Enter a value"))
b=int(input("Enter b value"))
#function call
big=              biggest(a,b)
print("big number= ",big)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
Enter a value 5
Enter b value-2
big number=  5
```

#program to find biggest of two numbers using functions.(nested if)

```
def biggest(a,b,c):
    if a>b :
        if a>c :
            return a
        else :
            return c
    else :
        if b>c :
            return b
        else :
            return c
```

```
a=int(input("Enter  a  value"))
b=int(input("Enter b  value"))
c=int(input("Enter c value"))
#function call
big=           biggest(a,b,c)
print("big number= ",big)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
Enter a value 5
Enter b value -6
Enter c value 7
big number=  7
```

#Writer a program to read one subject mark and print pass or fail use single return values function with argument.

```
def result(a):
    if a>40:
       return "pass"
    else:
        return "fail"
a=int(input("Enter one subject marks"))

print(result(a))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
Enter one subject marks 35
fail
```

#Write a program to display mrecetcse dept 10 times on the screen.(while loop)

```
def usingFunctions():
    count =0
    while count<10:
        print("csedept",count)
        count=count+1
```

```
usingFunctions()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py cse dept
0
cse dept 1 cse
dept 2
cse dept 3
cse  dept  4  cse
dept  5  cse  dept
6 cse dept 7 cse
dept 8
cse dept 9
```

Anonymous Functions:

Anonymous function is a function i.e. defined without name.

While normal functions are defined using the **def keyword**.
Anonymous functions are defined using **lambda keyword** hence anonymous functions are also called **lambda functions**.

Syntax:lambda arguments: expression

- Lambda function can have any no. of arguments for any one expression.
- The expression is evaluated and returns.

Use of Lambda functions:

- Lambda functions are used as nameless functions for a short period of time.
- In python lambda functions are an argument to higher order functions.
- Lambda functions are used along with built-in functions like filter(),map() and reduce()etc….

# Write a program to double a given number

```
double = lambda x:2*x

print(double(5))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
10
```

#Write a program to sum of two numbers

```
add = lambda x,y:x+y

print(add(5,4))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
9
```

#Write a program to find biggest of two numbers

```
biggest = lambda x,y: a if x>y else y

print(biggest(20,30))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py

30
```

Powerful Lamda function in python:

Lambda functions are used along with built-in functions like filter(),map() and reduce()etc….

Filter():

- The filter functions takes list as argument.
- The filter() is called when new list is returned which contains items for which the function evaluates to true.
- Filter:The filter() function returns an iterator were the items are filteredthrough a function to test if the item is accepted or not.

Syntax: filter(function, iterable)

#Write a program to filter() function to filter out only even numbers from the given list

```
myList =[1,2,3,4,5,6]

newList = list(filter(lambda x: x%2 ==0,myList ))
print(newList)
```

Output:

```
C:\Users\\AppData\Local\Programs\Python\Python38-32\pyyy\fu1.py

[2, 4, 6]
```

#Write a program for filter() function to print the items greater than 4

```
list1 = [10,2,8,7,5,4,3,11,0, 1]

result = filter (lambda x: x > 4, list1)

print(list(result))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/m1.py = [10, 8,

7, 5, 11]
```

Map() :

- Map() function in python takes a function & list.
- The function is called with all items in the list and a new list is returned which contains items returned by that function for each item.
- Map applies a function to all the items in an list.
- The advantage of the lambda operator can be seen when it is used incombination with the map() function.
- map() is a function with two arguments:

  Syntax: r = map(func, seq)

#Write a program for map() function to double all the items in the list

```
myList =[1,2,3,4,5,6,7,8,9,10]
newList = list(map(lambda x: x*2,myList))
print(newList)
```

Output:

```
C:\Users\\AppData\Local\Programs\Python\Python38-32\pyyy\fu1.py

[2, 4, 6, 8, 10, 12, 14, 16, 18, 20]
```

# Write a program to seperate the letters of the word "hello" and add the letters as items of the list.

```
letters = []
letters = list(map(lambda x:x,"hello"))
print(letters)
```

Output:

```
C:\Users\\AppData\Local\Programs\Python\Python38-32\pyyy\fu1.py

['h', 'e', 'l', 'l', 'o']
```

#Write a program for map() function to double all the items in the list?

```
def addition(n):

    return n + n

numbers = (1, 2, 3, 4)

result = map(addition, numbers)

print(list(result))
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/m1.py = [2, 4, 6,

8]
```

Reduce():

- Applies the same operation to items of sequence.
- Use the result of the first operation for the next operation
- Returns an item, not alist.
- Reduce: Thereduce(fun,seq)function is used to apply a particular
- function passed in its argument to all of the list elementsmentioned in thesequence passed along.This function isdefined in “functools” module.

#Write a program to find some of the numbers for the elements of the list by using reduce()

```
import functools
myList =[1,2,3,4,5,6,7,8,9,10]
print(functools.reduce(lambda x,y: x+y,myList))
```

Output:

```
C:\Users\\AppData\Local\Programs\Python\Python38-32\pyyy\fu1.py

55
```

#Write a program for reduce() function to print the product of items in a list

```
from functools import reduce

list1 = [1,2,3,4,5]

product = reduce (lambda x, y: x*y, list1)

print(product)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/m1.py =

120
```

Fruitful functions:

We write functions that return values, which we will call fruitful functions. We have seen the return statement before, but in a fruitful function the return statement includes a return value. This statement means: "Return immediately from this function and use the following expression as a return value."

(or)

Any function that returns a value is called Fruitful function. A Function that does not return a value is called a void function

Return values:

The Keyword return is used to return back the value to the called function.

# returns the area of a circle with the given radius:

```
def area(radius):
  temp = 3.14 * radius**2
return  temp
print(area(4))
```

(or)

```
def area(radius):
return 3.14 * radius**2
print(area(2))
```

Sometimes it is useful to have multiple return statements, one in each branch of a conditional:

```
def absolute_value(x):
    if x < 0:
        return -x
    else:
        return x
```

Since these return statements are in an alternative conditional, only one will be executed.

As soon as a return statement executes, the function terminates without executing any subsequent statements. Code that appears after a return statement, or any other place the flow of execution can never reach, is called dead code.

In a fruitful function, it is a good idea to ensure that every possible path through the program hits a return statement. For example:

```
def absolute_value(x):
    if x < 0:
        return -x
    if x > 0:
        return x
```

This function is incorrect because if x happens to be 0, both conditions is true, and the function ends without hitting a return statement. If the flow of execution gets to the end of a function, the return value is None, which is not the absolute value of 0.

```
>>> print absolute_value(0)
None
```

By the way, Python provides a built-in function called abs that computes absolute values.

# Write a Python function that takes two lists and returns True if they have at least one common member.

```
def common_data(list1, list2):
    for x in list1:
        for y in list2:
            if x == y:
                result = True
                return result
print(common_data([1,2,3,4,5], [1,2,3,4,5]))
print(common_data([1,2,3,4,5], [1,7,8,9,510]))
print(common_data([1,2,3,4,5], [6,7,8,9,10]))
```

Output:

```
C:\Users\\AppData\Local\Programs\Python\Python38-32\pyyy\fu1.py
True
True
None
```

#_____________

```
def area(radius):

    b = 3.14159 * radius**2

    return b
```

Local and Global scope:

Local Scope:

A variable which is defined inside a function is local to that function. It is accessible from the point at which it is defined until the end of the function, and exists for as long as the function is executing

Global Scope:

A variable which is defined in the main body of a file is called a global variable. It will be visible throughout the file, and also inside any file which imports that file.

- The variable defined inside a function can also be made global by using the global statement.

```
def function_name(args):
  .............
  global x  #declaring global variable inside a function
  ..............
```

```
# create a global variable

x = "global"

def f():
    print("x inside :", x)

f()
print("x outside:", x)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py x inside

: global

x outside: global
```

```
# create a local variable

def f1():
    y = "local"

    print(y)

f1()
```

Output:

```
local
```

- If we try to access the local variable outside the scope for example,

```
def f2():
    y = "local"

f2()
print(y)
```

Then when we try to run it shows an error,

```
Traceback (most recent call last):
  File "C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py", line
6, in <module>
    print(y)
NameError: name 'y' is not defined
```

The output shows an error, because we are trying to access a local variable y in a global scope whereas the local variable only works inside f2() or local scope.

# use local and global variables in same code

```
x = "global"

def f3():
    global x
    y = "local"
    x = x * 2
    print(x)
    print(y)

f3()
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py
globalglobal
local
```

- In the above code, we declare x as a global and y as a local variable in the f3(). Then, we use multiplication operator * to modify the global variable x and we print both x and y.
- After calling the f3(), the value of x becomes global global because we used the x * 2 to print two times global. After that, we print the value of local variable y i.e local.

```
# use Global variable and Local variable with same name

x = 5

def f4():
    x = 10
    print("local x:", x)

f4()
print("global x:", x)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/fu1.py local x:
10
global x: 5
```

Brief on other functions like sort, sorted and range:

The sort() method sorts the elements of a given list in a specific ascending or descending order.

The syntax of the sort() method is:

```
list.sort(key=..., reverse=...)
```

Example:

```
L1=[2,4,6,8,1,3,5]

L1.sort()
```

```
L2=[9,11,13,10,12,15,14]

L2.sort()
```

The sorted() function returns a sorted list of the specified iterable object.

You can specify ascending or descending order. Strings are sorted alphabetically, and numbers are sorted numerically.

Note: You cannot sort a list that contains BOTH string values AND numeric values.

Syntax:

```
sorted(iterable, key=key, reverse=reverse)
```

Example:

```
a = (1, 11, 2)

x = sorted(a)

print(x)
```

The built-in function range() generates the integer numbers between the given start integer to the stop integer, i.e., It returns a range object. Using for loop, we can iterate over a sequence of numbers produced by the range() function

range() function in for loop to iterate over numbers defined by range().

How to use range():

range(n) : will generate numbers from 0 to (n-1)

For example: range(8) is equivalent to [0, 1, 2, 3, 4, 5, 6, 7]

range(x, y) : will generate numbers from x to (y-1)

For example: range(5, 9) is equivalent to [5, 6, 7, 8]

range(start, end, step_size) : will generate numbers from start to end with step_size as incremental factor in each iteration. step_size is default if not explicitly mentioned.

For example: range(1, 10, 2) is equivalent to [1, 3, 5, 7, 9]

Example:

```
x=10

for i in range(6,x):

    print(i)
```

Output:

```
 6

7

8

9
```

UNIT –V

I/O and Error Handling in Python

Introduction, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods introduction to Errors and Exceptions, Handling IO Exceptions, Run Time Errors, Handling Multiple Exceptions. Other topics: Modules, some Standard Modules – sys, math, time

File I/O:

A file is some information or data which stays in the computer storage devices. Python gives you easy ways to manipulate these files. Generally files divide in two categories, text file and binary file. Text files are simple text where as the binary files contain binary data which is only readable by computer.

- **Text files:** In this type of file, Each line of text is terminated with a special character called EOL (End of Line), which is the new line character („\n‟) in python by default.
- **Binary files:** In this type of file, there is no terminator for a line and the data is stored after converting it into machine understandable binary language.

Text files:

We can create the text files by using the syntax:

Variable name=open ("file.txt", file mode)

For ex: f= open ("hello.txt","w+")

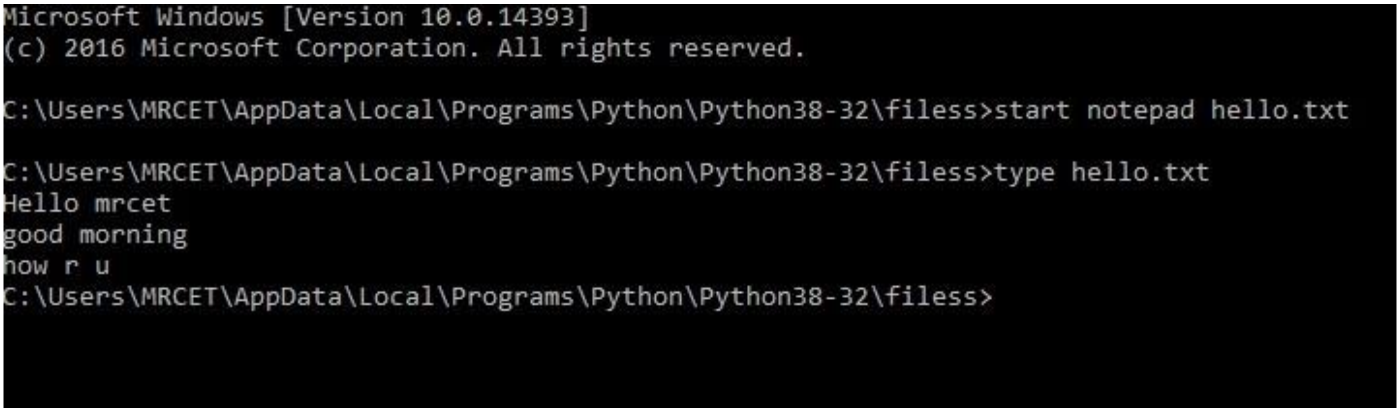
- We declared the variable f to open a file named hello.txt. **Open** takes 2 arguments, the file that we want to open and a string that represents the kinds of permission or operation we want to do on the file
- Here we used "w" letter in our argument, which indicates write and the plus sign that means it will create a file if it does not exist in library
- The available option beside "w" are "r" for read and "a" for append and plus sign means if it is not there then create it

File Modes in Python:

Mode	Description
'r'	This is the default mode. It Opens file for reading.
'w'	This Mode Opens file for writing. If file does not exist, it creates a new file. If file exists it truncates the file.
'x'	Creates a new file. If file already exists, the operation fails.
'a'	Open file in append mode. If file does not exist, it creates a new file.
't'	This is the default mode. It opens in text mode.
'b'	This opens in binary mode.
'+'	This will open a file for reading and writing (updating)

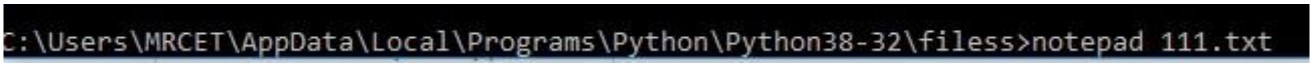
Reading and Writing files:

The following image shows how to create and open a text file in notepad from command prompt



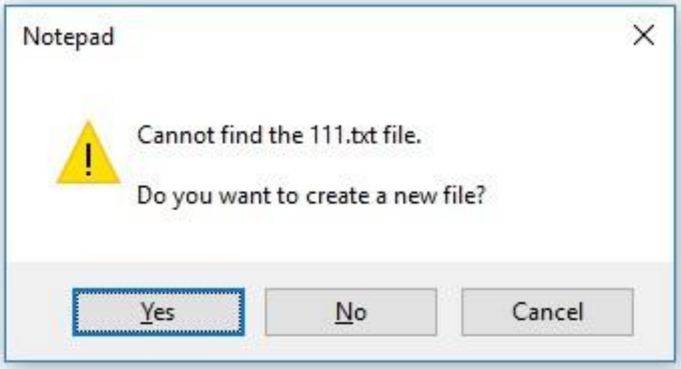
```
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>start notepad hello.txt

C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type hello.txt
Hello mrcet
good morning
how r u
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>
```

(or)



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>notepad 111.txt
```

Hit on enter then it shows the following whether to open or not?



Notepad

Cannot find the 111.txt file.

Do you want to create a new file?

Click on “yes” to open else “no” to cancel

# Write a python program to open and read a file

a=open(“one.txt”,”r”)

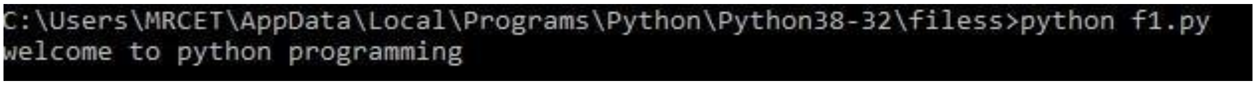
print(a.read())

a.close()

Output:

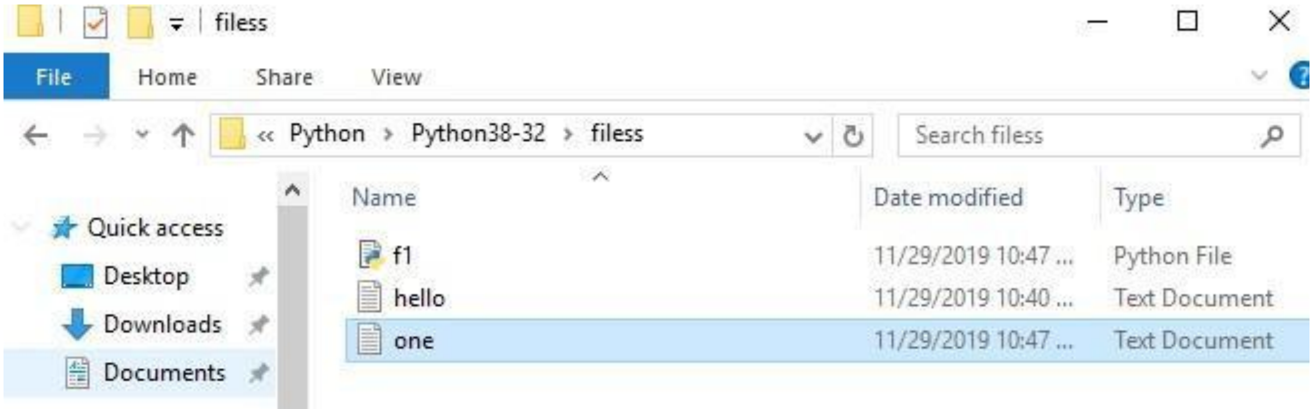
C:/Users//AppData/Local/Programs/Python/Python38-32/filess/f1.py
welcome to python programming

(or)



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>python f1.py
welcome to python programming
```

Note: All the program files and text files need to saved together in a particular file then only the program performs the operations in the given file mode



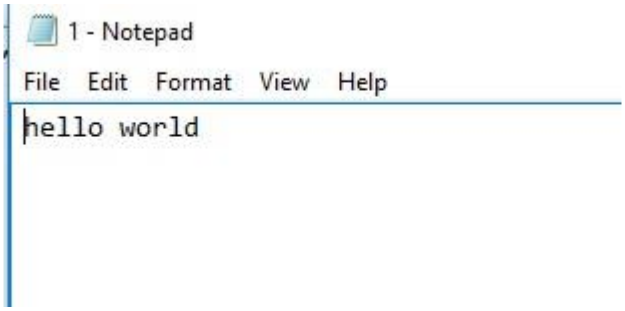
Name	Date modified	Type
f1	11/29/2019 10:47 ...	Python File
hello	11/29/2019 10:40 ...	Text Document
one	11/29/2019 10:47 ...	Text Document

f.close() ----This will close the instance of the file somefile.txt stored

# Write a python program to open and write “hello world” into a file?

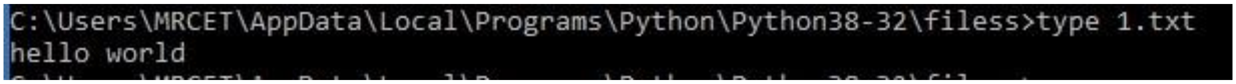
```
f=open("1.txt","a")

f.write("hello world")

f.close()
```

Output:



```
hello world
```

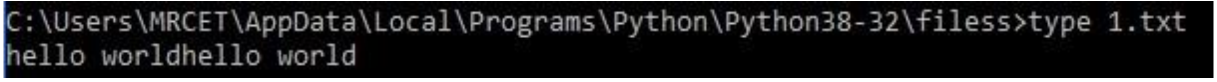
(or)



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type 1.txt
hello world
```

Note: In the above program the 1.txt file is created automatically and adds hello world into txt file

If we keep on executing the same program for more than one time then it append the data that many times



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type 1.txt
hello worldhello world
```

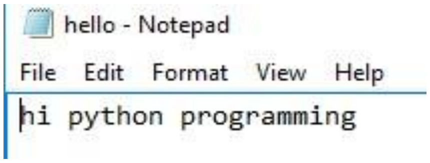
# Write a python program to write the content “hi python programming” for the existing file.

f=open("1.txt",'w')

f.write("hi python programming")

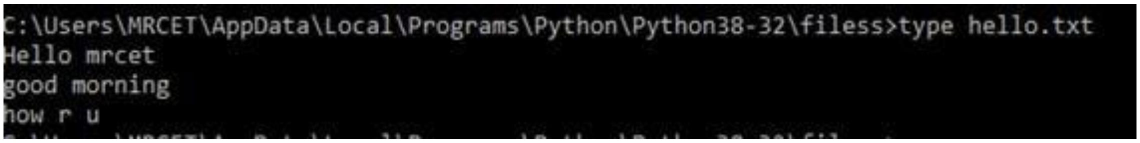
f.close()

Output:



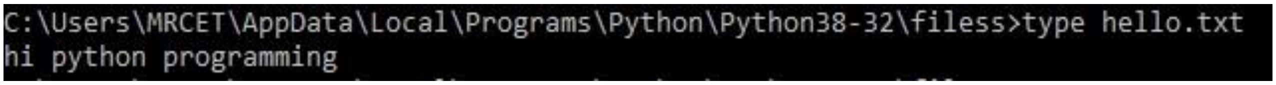
```
hi python programming
```

In the above program the hello txt file consist of data like



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type hello.txt
Hello mrcet
good morning
how r u
```

But when we try to write some data on to the same file it overwrites and saves with the current data (check output)



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type hello.txt
hi python programming
```

# Write a python program to open and write the content to file and read it.

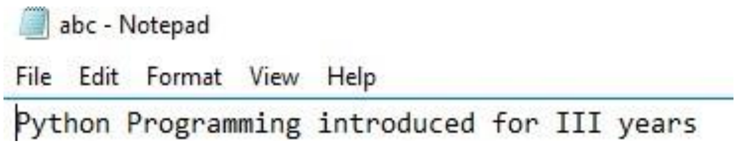
fo=open("abc.txt","w+")

fo.write("Python Programming")

print(fo.read())

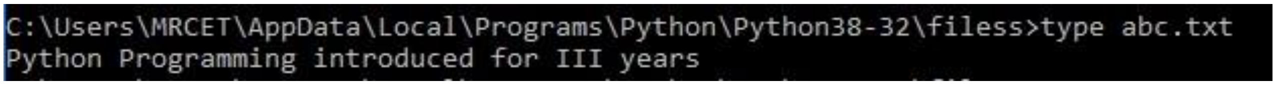
fo.close()

Output:



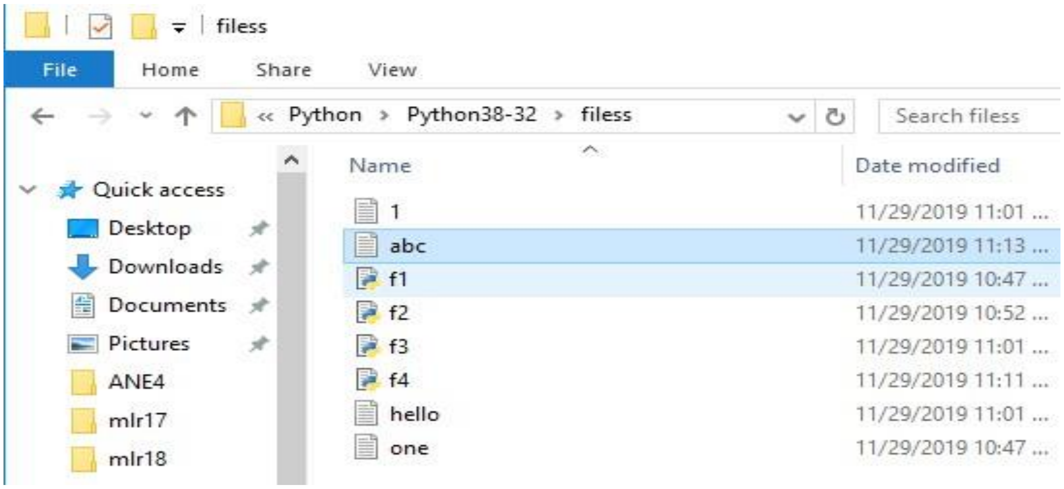
```
Python Programming introduced for III years
```

(or)



```
C:\Users\MRCET\AppData\Local\Programs\Python\Python38-32\filess>type abc.txt
Python Programming introduced for III years
```

Note: It creates the abc.txt file automatically and writes the data into it



Name	Date modified
1	11/29/2019 11:01 ...
abc	11/29/2019 11:13 ...
f1	11/29/2019 10:47 ...
f2	11/29/2019 10:52 ...
f3	11/29/2019 11:01 ...
f4	11/29/2019 11:11 ...
hello	11/29/2019 11:01 ...
one	11/29/2019 10:47 ...

Exception Handling:

Errors and Exceptions:

An exception is an event, which occurs during the execution of a program that disrupts the normal flow of the program's instructions. In general, when a Python script encounters a situation that it cannot cope with, it raises an exception. An exception is a Python object that represents an error.

Python Errors and Built-in Exceptions: Python (interpreter) raises exceptions when it encounters **errors.** When writing a program, we, more often than not, will encounter errors. Error caused by not following the proper structure (syntax) of the language is called syntax error or parsing error

ZeroDivisionError:

ZeroDivisionError in Python indicates that the second argument used in a division (or modulo) operation was zero**.**

OverflowError:

OverflowError in Python indicates that an arithmetic operation has exceeded the limits of the current Python runtime. This is typically due to excessively large float values, as integer values that are too big will opt to raise memory errors instead.

ImportError:

It is raised when you try to import a module which does not exist. This may happen if you made a typing mistake in the module name or the module doesn't exist in its standard path. In the example below, a module named "non_existing_module" is being imported but it doesn't exist, hence an import error exception is raised.

IndexError:

An IndexError exception is raised when you refer a sequence which is out of range. In the example below, the list abc contains only 3 entries, but the 4th index is being accessed, which will result an IndexError exception.

TypeError:

When two unrelated type of objects are combined, TypeErrorexception is raised.In example below, an int and a string is added, which will result in TypeError exception.

IndentationError:

Unexpected indent. As mentioned in the "expected an indentedblock" section, Python not only insists on indentation, it insists on consistentindentation. You are free to choose the number of spaces of indentation to use, but you then need to stick with it.

Syntax errors:

These are the most basic type of error. They arise when the Python parser is unable to understand a line of code. Syntax errors are almost always fatal, i.e. there is almost never a way to successfully execute a piece of code containing syntax errors.

Run-time error:

A run-time error happens when Python understands what you are saying, but runs into trouble when following your instructions.

Key Error:

Python raises a KeyError whenever a dict() object is requested (using the format a = adict[key]) and the key is not in the dictionary.

Value Error:

In Python, a value is the information that is stored within a certain object. To encounter a ValueError in Python means that is a problem with the content of the object you tried to assign the value to.

Python has many built-in exceptions which forces your program to output an error when something in it goes wrong. In Python, users can define such exceptionsby creating a new class. This exception class has to be derived, either directly or indirectly, from Exception class.

Different types of exceptions:

- ArrayIndexOutOfBoundException.
- ClassNotFoundException.
- FileNotFoundException.
- IOException.
- InterruptedException.

- NoSuchFieldException.
- NoSuchMethodException

Handling Exceptions:

The cause of an exception is often external to the program itself. For example, an incorrect input, a malfunctioning IO device etc. Because the program abruptly terminates on encountering an exception, it may cause damage to system resources, such as files. Hence, the exceptions should be properly handled so that an abrupt termination of the program is prevented.

Python uses try and except keywords to handle exceptions. Both keywords are followed by indented blocks.

Syntax:

```
try :

   #statements in try block

except :

   #executed when error in try block
```

Typically we see, most of the times

- **Syntactical errors** (wrong spelling, colon (:) missing ….),
  At developer level and compile level it gives errors.

- **Logical errors** (2+2=4, instead if we get output as 3 i.e., wrong output …..,),
  As a developer we test the application, during that time logical error may obtained.

- **Run time error** (In this case, if the user doesn‟t know to give input, 5/6 is ok but if the user say 6 and 0 i.e.,6/0 (shows error a number cannot be divided by zero))
  This is not easy compared to the above two errors because it is not done by the system, it is (mistake) done by the user.

The things we need to observe are:

1. You should be able to understand the mistakes; the error might be done by user, DB connection or server.
2. Whenever there is an error execution should not stop.

Ex: Banking Transaction

3. The aim is execution should not stop even though an error occurs.

For ex:

```
a=5 b=2

print(a/b)

print("Bye")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex1.py

2.5

Bye
```

- **The above is normal execution with no error, but if we say when b=0, it is a critical and gives error, see below**

```
a=5 b=0

print(a/b)

print("bye")  #this has to be printed, but abnormal termination
```

Output:

```
Traceback (most recent call last):

  File "C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex2.py", line
3, in <module>

    print(a/b)

ZeroDivisionError: division by zero
```

- **To overcome this we handle exceptions using except keyword**

```
a=5
b=0
try:
   print(a/b)
except Exception:
   print("number can not be divided by zero")
   print("bye")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex3.py number

can not be divided by zero

bye
```

- **The except block executes only when try block has an error, check it below**

```
a=5

b=2

try:

   print(a/b)

except Exception:

   print("number can not be divided by zero")

   print("bye")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex4.py

2.5
```

- **For example if you want to print the message like what is an error in a program then we use "e" which is the representation or object of an exception.**

```
a=5

b=0
```

```
try:
    print(a/b)
except Exception as e:
    print("number can not be divided by zero",e)
print("bye")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex5.py number
can not be divided by zero division by zero
bye
```

(Type of error)

Let us see some more examples:

I don‟t want to print bye but I want to close the file whenever it is opened.

```
a=5
b=2
try:
    print("resource opened")
    print(a/b)
    print("resource closed")
except Exception as e:
    print("number can not be divided by zero",e)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex6.py resource
opened
2.5
```

```
resource closed
```

- **Note: the file is opened and closed well, but see by changing the value of b to 0,**

```
a=5

b=0

try:

   print("resource opened")

   print(a/b)

   print("resource closed")

except Exception as e:

   print("number can not be divided by zero",e)
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex7.py resource

opened

number can not be divided by zero division by zero
```

- **Note: resource not closed**
- **To overcome this, keep print(“resource closed”) in except block, see it**

```
a=5

b=0

try:

   print("resource opened")

   print(a/b)

except Exception as e:

      print("number can not be divided by zero",e)

      print("resource closed")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex8.py resource

opened

number can not be divided by zero division by zero

resource closed
```

- **The result is fine that the file is opened and closed, but again change the value of b to back (i.e., value 2 or other than zero)**

```
a=5
b=2
try:
   print("resource opened")
   print(a/b)
except Exception as e:
       print("number can not be divided by zero",e)
       print("resource closed")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex9.py resource

opened

2.5
```

- **But again the same problem file/resource is not closed**
- **To overcome this python has a feature called finally:**

This block gets executed though we get an error or not

Note: Except block executes, only when try block has an error, but finally block executes, even though you get an exception.

```
a=5
b=0
```

```
try:
        print("resource open")
        print(a/b)
        k=int(input("enter a number"))
        print(k)
except ZeroDivisionError as e:
        print("the value can not be divided by zero",e)
finally:
        print("resource closed")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex10.py resource
open
the value can not be divided by zero division by zero
resource closed
```

- **change the value of b to 2 for above program, you see the output like**

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex10.py resource
open
2.5
enter a number 6
6
resource closed
```

- **Instead give input as some character or string for above program, check the output**

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex10.py resource
open
2.5
enter a number p
resource closed
Traceback (most recent call last):
  File "C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex10.py", line
7, in <module>
    k=int(input("enter a number"))
ValueError: invalid literal for int() with base 10: ' p'
```

```
#_______________
a=5
b=0

try:
        print("resource open")
        print(a/b)
        k=int(input("enter a number"))
        print(k)
except ZeroDivisionError as e:
        print("the value can not be divided by zero",e)
except ValueError as e:
        print("invalid input")
except Exception as e:
        print("something went wrong...",e)

finally:
        print("resource closed")
```

Output:

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex11.py resource
open
the value can not be divided by zero division by zero
resource closed
```

- **Change the value of b to 2 and give the input as some character or string (other than int)**

```
C:/Users//AppData/Local/Programs/Python/Python38-32/pyyy/ex12.py
resource open
2.5
enter a number p
invalid input
resource closed
```

DATA STRUCTURES:

Data Structures in Python provides / include Python list, Python Tuple, Python set, and Python dictionaries with their syntax and examples.

Here in this data structure we will come to know as a way of organizing and storing data such that we can access and modify it efficiently

List:

- It is a general purpose most widely used in data structures
- List is a collection which is ordered and changeable and allows duplicate members. (Grow and shrink as needed, sequence type, sortable).
- To use a list, you must declare it first. Do this using square brackets and separate values with commas.
- We can construct / create list in many ways.

Ex:

```
>>> list1=[1,2,3,'A','B',7,8,[10,11]]

>>> print(list1)

[1, 2, 3, 'A', 'B', 7, 8, [10, 11]]

- - - - - - - - - - - - - -

>>> x=list()

>>> x

[]

- - - - - - - - - - - - - - - - -

>>> tuple1=(1,2,3,4)

>>> x=list(tuple1)

>>> x

[1, 2, 3, 4]
```

The list data type has some more methods. Here are all of the methods of list objects:

List Operations:

- Del()
- Append()
- Extend()
- Insert()
- Pop()
- Remove()
- Reverse()
- Sort()

Delete: Delete a list or an item from a list

```
>>> x=[5,3,8,6]

>>> del(x[1])          #deletes the index position 1 in a list

>>> x

[5, 8, 6]

- - - - - - - -

>>> del(x)

>>> x                  # complete list gets deleted
```

Append: Append an item to a list

```
>>> x=[1,5,8,4]

>>> x.append(10)

>>> x

[1, 5, 8, 4, 10]
```

Extend: Append a sequence to a list.

```
>>> x=[1,2,3,4]

>>> y=[3,6,9,1]

>>> x.extend(y)

>>> x

[1, 2, 3, 4, 3, 6, 9, 1]
```

Insert: To add an item at the specified index, use the insert () method:

```
>>> x=[1,2,4,6,7]

>>> x.insert(2,10)   #insert(index no, item to be inserted)

>>> x

[1, 2, 10, 4, 6, 7]

-----------------

>>> x.insert(4,['a',11])

>>> x

[1, 2, 10, 4, ['a', 11], 6, 7]
```

Pop: The pop() method removes the specified index, (or the last item if index is not specified) or simply pops the last item of list and returns the item.

```
>>> x=[1, 2, 10, 4, 6, 7]

>>> x.pop()

7

>>> x

[1, 2, 10, 4, 6]

------------------------

>>> x=[1, 2, 10, 4, 6]

>>> x.pop(2)

10

>>> x

[1, 2, 4, 6]
```

Remove: The **remove()** method removes the specified item from a given list.

```
>>> x=[1,33,2,10,4,6]
>>> x.remove(33)

>>> x

[1, 2, 10, 4, 6]

>>> x.remove(4)

>>> x

[1, 2, 10, 6]
```

Reverse: Reverse the order of a given list.

```
>>> x=[1,2,3,4,5,6,7]

>>> x.reverse()

>>> x

[7, 6, 5, 4, 3, 2, 1]
```

Sort: Sorts the elements in ascending order

```
>>> x=[7, 6, 5, 4, 3, 2, 1]

>>> x.sort()

>>> x

[1, 2, 3, 4, 5, 6, 7]

- - - - - - - - - - - - - - -

>>> x=[10,1,5,3,8,7]

>>> x.sort()

>>> x

[1, 3, 5, 7, 8, 10]
```

Slicing: Slice out substrings, sub lists, sub Tuples using index.

[Start: stop: steps]

- Slicing will start from index and will go up to **stop** in **step** of steps.

- Default value of start is 0,
- Stop is last index of list
- And for step default is 1

Example:

```
>>> x='computer'
>>> x[1:4]
'omp'
>>> x[1:6:2]
'opt'
>>> x[3:]
'puter'
>>> x[:5]
'compu'
>>> x[-1]
'r'
>>> x[-3:]
'ter'
>>> x[:-2]
'comput'
>>> x[::-2]
'rtpo'
>>> x[::-1]
'retupmoc'
```

List:

```
>>> list1=range(1,6)
>>> list1
range(1, 6)
```

```
>>> print(list1)

range(1, 6)

>>> list1=[1,2,3,4,5,6,7,8,9,10]

>>> list1[1:]

[2, 3, 4, 5, 6, 7, 8, 9, 10]

>>> list1[:1]

[1]

>>> list1[2:5]

[3, 4, 5]

>>> list1[:6]

[1, 2, 3, 4, 5, 6]

>>> list1[1:2:4]

[2]

>>> list1[1:8:2]

[2, 4, 6, 8]
```

Tuple:

```
>>> list1=(11,12,13,14)

>>> list1[:2]

(11, 12)
```

To create a slice:

```
>>> print(slice(3))

slice(None, 3, None)

>>> print(slice(2))

slice(None, 2, None)

>>> print(slice(1,6,4))

slice(1, 6, 4)
```

To get substring from a given string using slice object:

```
>>> pystr='python'
>>> x=slice(3)
>>> print(pystr[x])
Pyt
```

Using –ve index:

```
>>> pystr='python'
>>> x=slice(1,-3,1)
>>> print(pystr[x])
>>> yt
```

To get sublist and sub-tuple from a given list and tuple respectively:

```
>>> list1=['m','r','c','e','t']
>>> tup1=('c','o','l','l','e','g','e')
>>> x=slice(1,4,1)
>>> print(tup1[x])
('o', 'l', 'l')
>>> print(list1[x])
['r', 'c', 'e']
>>> x=slice(1,5,2)
>>> print(list1[x])
['r', 'e']
>>> print(tup1[x])
('o', 'l')
>>> x=slice(-1,-4,-1)  #negative index
>>> print(list1[x])
['t', 'e', 'c']
>>> x=slice(-1,-4,-1) #negative index
>>> print(tup1[x])
```

```
('e', 'g', 'e')

>>> print(list1[0:3]) #extending indexing syntax

['m', 'r', 'c']
```

Tuples:

A tuple is a collection which is ordered and unchangeable. In Python tuples are written with round brackets.

- Supports all operations for sequences.
- Immutable, but member objects may be mutable.
- If the contents of a list shouldn‟t change, use a tuple to prevent items from accidently being added, changed, or deleted.
- Tuples are more efficient than list due to python‟s implementation.

We can construct tuple in many ways:

```
X=()     #no item tuple
X=(1,2,3)
X=tuple(list1)
X=1,2,3,4
```

Example:

```
>>> x=(1,2,3)
>>> print(x)
(1, 2, 3)
>>> x
(1, 2, 3)
- - - - - - - - - - - - - - - -
>>> x=()
>>> x
()
- - - - - - - - - - - - - - - - - - -
>>> x=[4,5,66,9]
>>> y=tuple(x)
>>> y
(4, 5, 66, 9)
- - - - - - - - - - - - - - - - - - - -
```

```
>>> x=1,2,3,4
>>> x
(1, 2, 3, 4)
```

Some of the operations of tuple are:

- Access tuple items
- Change tuple items
- Loop through a tuple
- Count()
- Index()
- Length()

Access tuple items: Access tuple items by referring to the index number, inside square brackets

```
>>> x=('a','b','c','g')
>>> print(x[2])
c
```

Change tuple items: Once a tuple is created, you cannot change its values. Tuples are unchangeable.

```
>>> x=(2,5,7,'4',8)
>>> x[1]=10
Traceback (most recent call last):
  File "<pyshell#41>", line 1, in <module>
    x[1]=10
TypeError: 'tuple' object does not support item assignment
>>> x
(2, 5, 7, '4', 8)     # the value is still the same
```

Loop through a tuple: We can loop the values of tuple using for loop

```
>>> x=4,5,6,7,2,'aa'
>>> for i in x:
        print(i)


4
5
```

```
6
7
2
aa
```

Count (): Returns the number of times a specified value occurs in a tuple

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> x.count(2)
4
```

Index (): Searches the tuple for a specified value and returns the position of where it was found

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> x.index(2)
1
```

(Or)

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=x.index(2)
>>> print(y)
1
```

Length (): To know the number of items or values present in a tuple, we use len().

```
>>> x=(1,2,3,4,5,6,2,10,2,11,12,2)
>>> y=len(x)
>>> print(y)
12
```

Set:

A set is a collection which is unordered and unindexed with no duplicate elements. In Python sets are written with curly brackets.

- To create an empty set we use **set()**
- Curly braces „{}‟ or the set() function can be used to create sets

We can construct tuple in many ways:

```
X=set()
X={3,5,6,8}
```

```
X=set(list1)
```

Example:

```
>>> x={1,3,5,6}
>>> x
{1, 3, 5, 6}
- - - - - - - - - - - - - - -
>>> x=set()
>>> x
set()
- - - - - - - - - - - - - - -
>>> list1=[4,6,"dd",7]
>>> x=set(list1)
>>> x
{4, 'dd', 6, 7}
```

- We cannot access items in a set by referring to an index, since sets are unordered the items has no index.
- But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

Some of the basic set operations are:

- Add()
- Remove()
- Len()
- Item in x
- Pop
- Clear

Add (): To add one item to a set use the add () method. To add more than one item to a set use the update () method.

```
>>> x={"","college","cse","dept"}
>>> x.add("autonomous")
>>> x
{'', 'dept', 'autonomous', 'cse', 'college'}

- - -
>>> x={1,2,3}
>>> x.update("a","b")
>>> x
{1, 2, 3, 'a', 'b'}


- - - - - - - - - - -
>>> x={1,2,3}
>>> x.update([4,5],[6,7,8])
>>> x
{1, 2, 3, 4, 5, 6, 7, 8}
```

Remove (): To remove an item from the set we use remove or discard methods.

```
>>> x={1, 2, 3, 'a', 'b'}
>>> x.remove(3)
>>> x
{1, 2, 'a', 'b'}
```

Len (): To know the number of items present in a set, we use len().

```
>>> z={'', 'dept', 'autonomous', 'cse', 'college'}
>>> len(z)
5
```

Item in X: you can loop through the set items using a for loop.

```
>>> x={'a','b','c','d'}
>>> for item in x:
        print(item)

c
d
a
b
```

pop (): This method is used to remove an item, but this method will remove the **last** item. Remember that sets are unordered, so you will not know what item that gets removed.

```
>>> x={1, 2, 3, 4, 5, 6, 7, 8}
>>> x.pop()
1
>>> x
{2, 3, 4, 5, 6, 7, 8}
```

Clear (): This method will the set as empty.

```
>>> x={2, 3, 4, 5, 6, 7, 8}
>>> x.clear()
>>> x
```

```
set()
```

The set also consist of some mathematical operations like:

Intersection	AND	&
Union	OR	|
Symmetric Diff	XOR	^
Diff	In set1 but not in set2	set1-set2
Subset	set2 contains set1	set1<=set2
Superset	set1 contains set2	set1>=set2

Some examples:

```
>>> x={1,2,3,4}
>>> y={4,5,6,7}
>>> print(x|y)
{1, 2, 3, 4, 5, 6, 7}
```

```
>>> x={1,2,3,4}
>>> y={4,5,6,7}
>>> print(x&y)
{4}
```

```
>>> A = {1, 2, 3, 4, 5}
>>> B = {4, 5, 6, 7, 8}
>>> print(A-B)
{1, 2, 3}
```

```
>>> B = {4, 5, 6, 7, 8}
>>> A = {1, 2, 3, 4, 5}
>>> print(B^A)
{1, 2, 3, 6, 7, 8}
```

Dictionaries:

A dictionary is a collection which is unordered, changeable and indexed. In Python dictionaries are written with curly brackets, and they have keys and values.

- Key-value pairs
- Unordered

We can construct or create dictionary like:

```
X={1:‟A‟,2:‟B‟,3:‟c‟}
X=dict([(„a‟,3) („b‟,4)]
X=dict(„A‟=1,‟B‟ =2)
```

Examples:

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1
{'brand': '', 'model': 'college', 'year': 2004}
- - - - - - - - - - - - -
```

To access specific value of a dictionary, we must pass its key,

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> x=dict1["brand"]
>>> x
''

- - - - - - - - - - - - - -
```

To access keys and values and items of dictionary:

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1.keys()
dict_keys(['brand', 'model', 'year'])
>>> dict1.values()
dict_values(['', 'college', 2004])
>>> dict1.items()
dict_items([('brand', ''), ('model', 'college'), ('year', 2004)])
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
>>> for items in dict1.values():
        print(items)



college
2004

>>> for items in dict1.keys():
        print(items)


brand
model
year

>>> for i in dict1.items():
        print(i)
```

```
('brand', ")
('model', 'college')
('year', 2004)
```

Some of the operations are:

- Add/change
- Remove
- Length
- Delete

Add/change values: You can change the value of a specific item by referring to its key name

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> dict1["year"]=2005
>>> dict1
{'brand': ", 'model': 'college', 'year': 2005}
```

Remove(): It removes or pop the specific item of dictionary.

```
>>> dict1 = {"brand":"","model":"college","year":2004}
>>> print(dict1.pop("model"))
college
>>> dict1
{'brand': ", 'year': 2005}
```

Delete: Deletes a particular item.

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> del x[5]
>>> x
```

Length: we use len() method to get the length of dictionary.

```
>>>{1: 1, 2: 4, 3: 9, 4: 16}
{1: 1, 2: 4, 3: 9, 4: 16}
>>> y=len(x)
>>> y
4
```

Iterating over (key, value) pairs:

```
>>> x = {1:1, 2:4, 3:9, 4:16, 5:25}
>>> for key in x:
        print(key, x[key])



1 1
2 4
3 9
4 16
5 25
>>> for k,v in x.items():
        print(k,v)



1 1
2 4
3 9
4 16
5 25
```

List of Dictionaries:

```
>>> customers = [{"uid":1,"name":"John"},
    {"uid":2,"name":"Smith"},
           {"uid":3,"name":"Andersson"},
            ]
>>> >>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'Andersson'}]

## Print the uid and name of each customer
>>> for x in customers:
        print(x["uid"], x["name"])



1 John
2 Smith
3 Andersson

## Modify an entry, This will change the name of customer 2 from Smith to Charlie
>>> customers[2]["name"]="charlie"
>>> print(customers)
[{'uid': 1, 'name': 'John'}, {'uid': 2, 'name': 'Smith'}, {'uid': 3, 'name': 'charlie'}]
```

```
## Add a new field to each entry

>>> for x in customers:
        x["password"]="123456" # any initial value



>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 2, 'name': 'Smith', 'password':
'123456'}, {'uid': 3, 'name': 'charlie', 'password': '123456'}]

## Delete a field
>>> del customers[1]
>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}, {'uid': 3, 'name': 'charlie', 'password':
'123456'}]

>>> del customers[1]
>>> print(customers)
[{'uid': 1, 'name': 'John', 'password': '123456'}]

## Delete all fields

>>> for x in customers:
        del x["uid"]



>>> x
{'name': 'John', 'password': '123456'}
```

Sequences:

A sequence is a succession of values bound together by a container that reflects their type. Almost every stream that you put in python is a sequence. Some of them are:

- String
- List
- Tuples
- Range object

String: A string is a group of characters. Since Python has no provision for arrays, we simply use strings. This is how we declare a string. We can use a pair of single or double quotes. Every string object is of the type „str‟.

```
>>> type("name")
<class 'str'>
>>> name=str()
>>> name
''
>>> a=str('')
>>> a
''
>>> a=str()
>>> a[2]
'c'
```

<u>List:</u> A list is an ordered group of items. To declare it, we use square brackets.

```
>>> college=["cse","it","eee","ece","mech","aero"]
>>> college[1]
'it'
>>> college[:2]
['cse', 'it']
>>> college[:3]
['cse', 'it', 'eee']
>>> college[3:]
['ece', 'mech', 'aero']
>>> college[0]="csedept"
>>> college
['csedept', 'it', 'eee', 'ece', 'mech', 'aero']
```

<u>Tuple:</u> It is an immutable group of items. When we say immutable, we mean we cannot change a single value once we declare it.

```
>>> x=[1,2,3]
>>> y=tuple(x)
>>> y
(1, 2, 3)

>>> hello=tuple(["","college"])
>>> hello
('', 'college')
```

<u>Range object:</u> A range() object lends us a range to iterate on; it gives us a list of numbers.

```
>>> a=range(4)
>>> type(a)
<class 'range'>

>>> for i in range(1,6,2):
        print(i)



1
3
5
```

Some of the python sequence operations and functions are:

1. Indexing
2. Slicing
3. Adding/Concatenation
4. Multiplying
5. Checking membership
6. Iterating
7. Len()
8. Min()
9. Max()
10. Sum()
11. Sorted()
12. Count()
13. Index()

1. Indexing

   Access any item in the sequence using its index.

string	List

>>> x="
>>> print(x[2])
c
	>>> x=['a','b','c']
	>>> print(x[1])
	b

2. Slicing

   Slice out substrings, sub lists, sub tuples using index
   [start : stop : step size]

```
>>> x='computer'

>>> x[1:4]

'omp'

>>> x[1:6:2]

'opt'

>>> x[3:]

'puter'

>>> x[:5]

'compu'

>>> x[-1]

'r'

>>> x[-3:]

'ter'

>>> x[:-2]

'comput'

>>> x[::-2]

'rtpo'

>>> x[::-1]

'retupmoc'
```

3. Adding/concatenation:
   Combine 2 sequences of same type using +.

string	List

>>> x='' + 'college'
>>> print(x)
college
	>>> x=['a','b'] + ['c']
	>>> print(x)
	['a', 'b', 'c']

4. Multiplying:
   Multiply a sequence using *.

string	List

>>> x="*3
>>> x
"
	>>> x=[3,4]*2
	>>> x
	[3, 4, 3, 4]

5. Checking Membership:
   Test whether an item is in or not in a sequence.

string	List

>>> x="
>>> print('c' in x)
True
	>>> x=['a','b','c']
	>>> print('a' not in x)
	False

6. Iterating:
   Iterate through the items in asequence

```
>>> x=[1,2,3]
>>> for item in x:
        print(item*2)



2
4
6
```

If we want to display the items of a given list with index then we have to use “enumerate” keyword.

```
>>> x=[5,6,7]
>>> for item,index in enumerate(x):
        print(item,index)



0 5
1 6
2 7
```

7. len():

It will count the number of items in a given sequence.

string	List

>>> x=""
>>> print(len(x))
5
	>>> x=["aa","b",'c','cc']
	>>> print(len(x))
	4

8. min():
   Finds the minimum item in a given sequence lexicographically.

string	List

>>> x=""
>>> print(min(x))
c
	>>> x=["apple","ant1","ant"]
	>>> print(min(x))
	ant

It is an alpha-numeric type but cannot mix types.

```
>>> x=["apple","ant1","ant",11]
>>> print(min(x))

Traceback (most recent call last):
  File "<pyshell#73>", line 1, in <module>
    print(min(x))
TypeError: '<' not supported between instances of 'int' and 'str'
```

9. max():
   Finds the maximum item in a given sequence

string	List

>>> x='cognizant'
>>> print(max(x))
z
	>>> x=["hello","yummy","zebra"]
	>>> print(max(x))
	zebra

It is an alpha-numeric type but cannot mix types.

```
>>> x=["hello","yummy1","zebra1",22]
>>> print(max(x))

Traceback (most recent call last):
  File "<pyshell#79>", line 1, in <module>
    print(max(x))
```

```
TypeError: '>' not supported between instances of 'int' and 'str'
```

10.Sum:

Finds the sum of items in a sequence

```
>>> x=[1,2,3,4,5]
>>> print(sum(x))
15

>>> print(sum(x[-2:]))
9
```

Entire string must be numeric type.

```
>>> x=[1,2,3,4,5,""]
>>> print(sum(x))

Traceback (most recent call last):
  File "<pyshell#83>", line 1, in <module>
    print(sum(x))
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

11.Sorted():

Returns a new list of items in sorted order but does not change the original list.

string	List

>>> x='college'
>>> print(sorted(x))
['c', 'e', 'e', 'g', 'l', 'l', 'o']
	>>> x=['a','r','g','c','j','z']
	>>> print(sorted(x))
	['a', 'c', 'g', 'j', 'r', 'z']

12.Count():

It returns the count of an item

string	List

>>> x='college'
>>> print(x.count('l'))
2
>>> 'college'.count('l')
2
	>>> x=['a','b','a','a','c','a']
	>>> print(x.count('a'))
	4

13.Index()

Returns the index of first occurrence

string	List

>>> x='college'
>>> print(x.index('l'))
2
	>>> x=['a','b','a','a','c','a']
	>>> print(x.index('a'))
	0

Comprehensions:

List:

List comprehensions provide a concise way to create lists. Common applications are to make new lists where each element is the result of some operations applied to each member of another sequence or iterable, or to create a subsequence of those elements that satisfy a certain condition.

For example, assume we want to create a list of squares, like:

```
>>> list1=[]

>>> for x in range(10):

        list1.append(x**2)

>>> list1

[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

(or)

This is also equivalent to

```
>>> list1=list(map(lambda x:x**2, range(10)))

>>> list1

[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

(or)

Which is more concise and redable.

```
>>> list1=[x**2 for x in range(10)]

>>> list1

[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

Similarily some examples:

```
>>> x=[m for m in range(8)]
>>> print(x)
[0, 1, 2, 3, 4, 5, 6, 7]

>>> x=[z**2 for z in range(10) if z>4]
>>> print(x)
[25, 36, 49, 64, 81]

>>> x=[x ** 2  for x in range (1, 11)   if x % 2 == 1]
>>> print(x)
[1, 9, 25, 49, 81]

>>> a=5
>>> table = [[a, b, a * b] for b in range(1, 11)]
>>> for i in table:
        print(i)


[5, 1, 5]
[5, 2, 10]
[5, 3, 15]
[5, 4, 20]
[5, 5, 25]
[5, 6, 30]
[5, 7, 35]
[5, 8, 40]
[5, 9, 45]
[5, 10, 50]
```

Tuple:

Tuple Comprehensions are special: The result of a tuple comprehension is special. You might expect it to produce a tuple, but what it does is produce a special "generator" object that we can iterate over.

For example:

```
>>> x = (i for i in 'abc')  #tuple comprehension
>>> x
<generator object <genexpr> at 0x033EEC30>

>>> print(x)
<generator object <genexpr> at 0x033EEC30>
```

You might expect this to print as ('a', 'b', 'c') but it prints as <generator object <genexpr> at 0x02AAD710> The result of a tuple comprehension is not a tuple: it is actually a generator. The only thing that you need to know now about a generator now is that you can iterate over it, but ONLY ONCE.

So, given the code

```
>>> x = (i for i in 'abc')
>>> for i in x:
        print(i)

a
b
c
```

Create a list of 2-tuples like (number, square):

```
>>> z=[(x, x**2) for x in range(6)]
>>> z
[(0, 0), (1, 1), (2, 4), (3, 9), (4, 16), (5, 25)]
```

Set:

Similarly to list comprehensions, set comprehensions are also supported:

```
>>> a = {x for x in 'abracadabra' if x not in 'abc'}
>>> a
{'r', 'd'}

>>> x={3*x for x in range(10) if x>5}
>>> x
```

```
{24, 18, 27, 21}
```

Dictionary:

Dictionary comprehensions can be used to create dictionaries from arbitrary key and value expressions:

```
>>> z={x: x**2 for x in (2,4,6)}
>>> z
{2: 4, 4: 16, 6: 36}

>>> dict11 = {x: x*x for x in range(6)}
>>> dict11
{0: 0, 1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
```

Stacks:

Stack works on the principle of “Last-in, first-out”. Also, the inbuilt functions in Python make the code short and simple. To add an item to the top of the list, i.e., to push an item, we use append() function and to pop out an element we use pop() function.

# Python code to demonstrate Implementing stack using list

```
stack = ["Amar", "Akbar", "Anthony"]
stack.append("Ram")
stack.append("Iqbal")
print(stack)
print(stack.pop())
print(stack)
print(stack.pop())
print(stack)
```

Output:

```
['Amar', 'Akbar', 'Anthony', 'Ram', 'Iqbal']
Iqbal
['Amar', 'Akbar', 'Anthony', 'Ram']
Ram
['Amar', 'Akbar', 'Anthony']
```

Queues:

Queue works on the principle of “First-in, first-out”. Time plays an important factor here. We saw that during the implementation of stack we used append() and pop() function which was efficient and fast because we inserted and popped elements from the end of the list, but in queue when insertion and pops are made from the beginning of the list, it is slow. This occurs due to the properties of list, which is fast at the end operations but slow at the beginning operations, as all other elements have to be shifted one by one. So, we prefer the use of collections. Deque over list, which was specially designed to have fast appends and pops from both the front and back end.

#Python code to demonstrate Implementing Queue using deque and list

```
from collections import deque
queue = deque(["Ram", "Tarun", "Asif", "John"])
print(queue)
queue.append("Akbar")
print(queue)
queue.append("Birbal")
print(queue)
print(queue.popleft())
print(queue.popleft())
print(queue)
```

Output:

```
deque(['Ram', 'Tarun', 'Asif', 'John'])
deque(['Ram', 'Tarun', 'Asif', 'John', 'Akbar'])
deque(['Ram', 'Tarun', 'Asif', 'John', 'Akbar', 'Birbal'])
Ram
Tarun
deque(['Asif', 'John', 'Akbar', 'Birbal'])
```