**PYTHON 3**

1. Print
   1. print(“Hello world!”)
   2. print(10//4) #ans. 2 truncated operator
   3. print(10%3) #ans. 1 modulus operator
   4. print(4 \*\* 2) #ans. 1 power
   5. print(2 \*\* 3 \*\* 2) # the right-most \*\* operator gets done first!
   6. Print( type(30.12) ) # <class ‘float’>
2. Type Conversion Functions
   1. int() # it doesn’t round off
      1. print(**int(3.99)**) # ans. 3
      2. print(int(-3.99)) # ans. -3
   2. float()
   3. str()
3. Length
   1. print( len(“Hello”) ) # ans. 5
4. Input
   1. X= **input(“Enter the value: ”)** # always return string, use Typecasting
5. For Loop
   1. **for** \_ **in** range(10):

doSomething()

* 1. **for** loop\_var **in** [“Joe”, “Harry”, “Parth”, “Amy”]:

print(“Hello ”+ loop\_var)

* 1. **for** loop\_var **in** S:

print(“Hello ”+ loop\_var)

* 1. **for** loop\_var **in** myList:

print(“Hello ”+ loop\_var)

* 1. **for** loop\_var **in** myTuple:

print(“Hello ”+ loop\_var)

* 1. **for** loop\_var **in range(5):** # **range(5)** = [0, 1, 2, 3, **4**]

print(loop\_var)

* 1. range() is an iterable, it doesn’t return a list
  2. To get a list, typecast as **list( range(5) )**
  3. **range(1, 5)** = [1, 2, 3, **4**]

1. While Loop
   1. **while** condition**:**

do\_something

* 1. Use **break** or **continue** in the loops if required.

1. Random
   1. **import random**
   2. print( **random.random()** ) #can give any real numbers b/w 0&1
   3. print ( **random.randrange(1,7**) ) # int between [1,7)
   4. **from random import randrange, random**
   5. print( random() )
   6. print ( randrange(1,7) )
   7. **import random as rnd**
   8. print( rnd.random() )
   9. print ( rnd.randrange(1,7) )
2. Math
   1. **math.sqrt()**
3. Collection Data Types
   1. Strings (**Immutable**)
   2. List (**Mutable**)
   3. Tuples (**Immutable**)
   4. Dictionaries (**Mutable**)
4. String
   1. S= “Hello World”
   2. S= ‘Hello World’
   3. m = “””

This is a Multi-Line

String.

“””

* 1. m = ‘’’

This is a Multi-Line

String.

‘’’

* 1. print( **S[0]** ) # index possible
  2. **len (s)**  # no. of items
  3. print ( S[len(S) -1] ) = print ( S[-1] ) # negative indices possible
  4. print ( S[2:**6**] ) #Slicing # print S[2] to **S[5]**
  5. print ( S[:**6**] ) #Slicing # print S[0] to **S[5]**
  6. print ( S[**3**:] ) #Slicing # print S**[3]** to S[-1]
  7. **Slice always returns List**
  8. print( S + “abc” ) # Concatenation
  9. print(S \*3) # Repetition # Concatenation 3 times
  10. print( **S.count(“ri”)** ) # Counts no. of instances of “ri” in the given string S

# count item is **Case Sensitive**

* 1. print( **S.index(“ri”)** ) # returns index of **first** instance where 1st char of “ri” i.e. “r” #appears
  2. If index item is not present then Run Time Error.
  3. print( **S.split()** ) # Split # remove spaces in S and return list of Words

# [“Hello”, “World”]

* 1. print( **S.split(“o”)** ) # Split with “o” i.e. [“Hell”, “ W”, “rld”]
  2. print( **“o”.join([“Hell”, “ W”, ”rld”]**) #join # joins list of string with given string (here “o”)

# “Hello World”

* 1. A = “banana”

B = “banana”

# since string immutable # **IS operator checks if pointing to same object**

print( A **is** B ) # True

1. List
   1. myList = [“apple”, 5, “Banana”, 10]
   2. myList1 = list( range(4))
   3. print( **myList[0]** )
   4. **len( myList)**
   5. print (myList[ len(myList) -1] ) = print (myList [-1] )
   6. print ( myList[2:**6**] ) #Slicing # print myList[2] to myList**[5]**
   7. print ( myList [:**6**] ) #Slicing # print myList [0] to myList **[5]**
   8. print ( myList [**3**:] ) #Slicing # print myList **[3]** to myList[-1]
   9. **Slice always returns List**
   10. print( myList + [“abc”] ) # Concatenation
   11. print( **myList.append(“abc”)** ) # Concatenation
   12. print(myList \*3) # Repetition # Concatenation 3 times
   13. print( **myList .count(10)** ) # Counts no. of instances of 10 in the given list myList

# count item is **Case Sensitive**

* 1. print( **myList.index(“Banana”)** ) # returns index of **first** instance where

# “Banana”appears

* 1. If index item is not present then **Run Time Error**.
  2. **del** myList[1] # **delete** myList [1]
  3. **del** myList[1:3] # **delete** myList [1:3]
  4. A = [81, 82, 83]

B = [81, 82, 83]

# since List is mutable # different copies are made for each even if value same

print( A **is** B ) # False

print( A **==** B ) # True

# id operator gives back the id of the allocations

print( **id**(A) , **id**(B) ) # return diff. IDs

* 1. A = [81, 82, 83]

**B = A** # Aliasing

print(A **is** B) # **True**

# **B now point to the same object as A**

* 1. A = [81, 82, 83]

**B = A[ : ]** # Cloning

print(A **is** B) # **False**

* 1. A = [81, 82, 83]

B = A

* + 1. **B = B + [84]**

Print( A **is** B ) # **False**

# makes a new object entirely and reassigns to object B

* + 1. **B += [84] # avoid this with Lists**

Print( A **is** B ) # **True**

# modifies same object B

1. Tuple
   1. myTuple = (“apple”, 5, “Banana”, 10)
   2. myTuple = (500) # int not Tuple
   3. myTuple = (500,) # now it’s a Tuple
   4. myTuple = () # Empty Tuple
   5. myTuple = “apple”, 5, “Banana”, 10 **# python implicitly pack this to form a Tuple #OK** # No parenthesis
   6. fruit1, n1, fruit2, n2 = myTuple # **Unpacking**
   7. a, b, c, d = 1, 2, 3, 4 # **OK**
   8. print( **myTuple[0]** )
   9. **len( myTuple)**
   10. print (myTuple [ len(myTuple) -1] ) = print (myTuple [-1] )
   11. print ( myTuple [2:**6**] ) #Slicing # print myTuple [2] to myTuple **[5]**
   12. print ( myTuple [:**6**] ) #Slicing # print myTuple [0] to myTuple **[5]**
   13. print ( myTuple [**3**:] ) #Slicing # print myTuple **[3]** to myTuple [-1]
   14. **Slice always returns List**
   15. print( myTuple + “abc” ) # Concatenation
   16. print(myTuple \*3) # Repetition # Concatenation 3 times
   17. print( **myTuple.count(10)** ) # Counts no. of instances of 10 in

# the given tuple myTuple # count item is **Case Sensitive**

* 1. print( **myTuple.index(“Banana”)** ) # returns index of **first** instance where

# “Banana”appears

* 1. If index item is not present then **Run Time Error**.
  2. (a, b) = (b, a) # neat **swapping** of variables
  3. fruits = ['apple', 'pear', 'apricot', 'cherry', 'peach']

for item in **enumerate**( fruits ): # enumerate **returns tuple** of index

print(item[0], item[1]) # & value

**Output:**

0 apple

1 pear

2 apricot

3 cherry

4 peach

1. Strings II
   1. S.**upper()** # return uppercased # non-mutating
   2. S**.lower()** # return lowercased # non-mutating
   3. S.**count(‘l’)** # return no. of instances of ‘l’ in the string # non-mutating
   4. S.**strip()**  # removes any white spaces at the **beginning** & the **end**

# non-mutating

# Whitespaces in the **middle** are **not** removed

# not same as S.**split()**

* 1. S= S.**replace(‘o’, ‘\*’)** # replace any ‘o’s with ‘\*’ # non-mutating
  2. person = input( “Enter your name: “ )

print( “ Hello **{}**! ”**.format( person )** )

# replaces {} with entries in .format() # non-mutating

# It is important to pass arguments to the format method in the correct order, because they are matched positionally into the {} places for interpolation where there is more than one.

# Format strings can give further information inside the braces showing how to specially format data. In particular floats can be shown with a specific number of decimal places.

* 1. For two decimal places, put **:.2f** inside the braces for the monetary values:

# round-off

price = input( “Enter the price: “ )

print( “ Hello **{ :.2f }**! ”**.format( price )** ) # print float with 2 decimal places

1. List II
   1. myList**.append(5)** # mutation
   2. myList.**insert(1, 12)** # inserts 12 at myList[1] # mutation
   3. myList.**count(12)** # return no. of 12s in the list
   4. myList.**index(12)** # return index of first instance of no. 12
   5. myList.**reverse()** # reverse the whole list # mutation
   6. myList.**sort()** # ascending sort # mutation
   7. **del** myList[2] # deletes by **index** # mutation
   8. myList**.remove(12)** # deletes all **values** 12 # mutation
   9. myList.**pop()** # **return** & **delete** last value of list # mutation

It is important to remember that methods like append, sort, and reverse all return **None**

* 1. myList**.sort()** # Returns None # sort # mutation
  2. sList = **sorted(** myList **)** # Returns new sorted list # myList unchanged
  3. **sorted() can be applied to any data structure # preferred**
  4. sList = **sorted(** myList, **reverse = True )** # reverse sort
  5. def **absolute**(x): **# define a function & pass it as a key**

if x>=0: **# to sorted() # IMPORTANT**

return x # function passed as parameter

else:

return -x

sList = **sorted(** myList, **key = absolute )** # **sort according to absolute values**

* 1. sList = **sorted(** myList, reverse = True, **key = absolute )** # reverse absolute sort
  2. sList = sorted( myList, **key = lambda x: abs(x)** ) # pass **lambda function** as Key
  3. if ( **type(**x**) is list**) # to check if x is a list

1. Boolean
   1. Literal
      1. print( type(**False**) ) # <class ‘bool’>
      2. print( type(**True**) ) # <class ‘bool’>
      3. Boolean takes either True or False
   2. Comparison Operator
      1. print( 5==6 ) # False
      2. **==**
      3. **!=**
      4. **>**
      5. **>=**
      6. **<**
      7. **<=**
   3. Logical Operators (X &Y are Boolean values)
      1. X **and** Y # remember && from cpp
      2. X **or** Y # remember || from cpp
      3. **not** X # remember ! from cpp
   4. In/ Not In operator
      1. print( ‘p’ **in** ‘paper’) # True as ‘p’ is a substring of ‘paper’
      2. print( ‘p’ **in** ‘mango’) # False as ‘p’ not a substr of ‘mango’
      3. print( ‘’ **in** ‘apple’) # **True** as empty string
      4. print( ‘p’ **not in** ‘mango’) # True
      5. print( ‘pa’ **not in** ‘paper’) # False
      6. ‘apple’ **in** [‘apple’, ‘mango’] # True
2. Precedence Order
   1. Parentheses
   2. Exponent
   3. Multiplication, Division (\*, /, //, %)
   4. Subtraction, Addition
   5. Comparison Operator (==, !=, >=,<=,>,<)
   6. NOT Operator (not X)
   7. AND (and)
   8. OR (or)
3. Conditional Execution
   1. **If x%2 == 0**:

print( x, “is even”)

**else:**

print( x, “is odd”)

* 1. Chained Conditionals (ELIF)
     1. **if** x > y:

print(“greater”)

**elif** x <y:

print(“lower”)

**else**:

print(“equal”)

1. Mutation
   1. Changing the values either by making a copy or Modifying the original.
   2. Fruit = [“apple”, “banana”, “cherry”]
   3. Fruit[0] = “pear” # mutation
   4. Fruit[-1]=”orange” # mutation
   5. Fruit[1:3] = [ “pear”, ”orange”] # slice mutation
   6. **Fruit[1:3] = [ ]** # Deletes Fruit[1] to Fruit[2] # slice mutation
      1. len(Fruit) = 1 # since two items deleted
   7. **del** Fruit[1] # **delete** Fruit[1]
   8. **del** Fruit[1:3] # **deletes** Fruit[1:3]
   9. **Fruit[1:1] = [“pear”, “orange” ]** # Insert
      1. Print(Fruit)
      2. [“apple”, “pear”, “orange”, “banana”, “cherry”]
   10. greeting = “Hello World!”
       1. greeting[0] = ‘J’ # ERROR # Strings immutable
       2. new\_greeting = ‘J’ + greetings[1: ] # **Allowed**

# Jello World!

* 1. A = “banana”

B = “banana”

# since string immutable # **IS operator checks if pointing to same object**

print( A **is** B ) # True

* 1. A = [81, 82, 83]

B = [81, 82, 83]

# since List is mutable # different copies are made for each even if value same

print( A **is** B ) # False

print( A **==** B ) # True

# id operator gives back the id of the allocations

print( **id**(A) , **id**(B) ) # return diff. IDs

1. **Aliasing** ( Important )
   1. A = [81, 82, 83]

B = A

print(A **is** B) # **True**

# **B now point to the same object as A**

* 1. A = [81,82,83]

B = [81,82,83]

print(A **is** B) # False

B = A

print(A == B)

print(A **is** B) # True

**B[0] = 5**

**print(A)**

Output:

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

* 1. A = [81, 82, 83]

B = A[ : ] # Cloning

print(A is B) # **False**

* 1. A = [81, 82, 83]

B = A

* + 1. **B = B + [84]**

Print( A **is** B ) # **False**

# makes a new object entirely and reassigns to object B

* + 1. **B += [84]**

Print( A **is** B ) # **True**

# modifies same object B

1. Working with Data Files
   1. File1 = **open(“Olympics.txt”, “r")** # open a file # read only
   2. File1 = **open(“Olympics.txt”, “w”)** #also open a new file # open a file # writing
   3. File1.**close()** # File use complete
   4. Contents = File1**.read()** # **entire content** in olympics.txt as a **single string**
      1. Print( Contents[:100] )
   5. Contents\_List = File1.**readlines()** # returns list of **each lines of the entire content**

# each line also **include ‘\n’ at the end**

* + 1. print( Contents\_List[:10] ) # Print first 10 lines of the files as a list
    2. **for** line **in** Contents\_List[:10]:

print(line) # Print first 10 lines exactly as in the file

* + 1. **for** line **in** Contents\_List[:10]:

print( **line.strip()** ) # Use .strip() to **remove ‘\n’** at each line end

* 1. **for** line **in** File1: # preferred when large data compared to readlines()

print( line.strip() ) # Use file variable directly to traverse over the whole file

# return each lines

* 1. **for** line **in** File1[:10]: # **Error**  # only File1 allowed # only whole file
  2. File1.**readline()** # return next line
  3. File1.**readlines()**  # return list of lines
  4. File1.**read(10)** # read first 10 chars
  5. File1.**write(“Something!!”)** # Add string to the end of the file
  6. File1.**write ( str() )** # the argument has to be string
  7. File1.**write( str() + “\n” )**  # add new line for formatting
  8. Specifying File Path
     1. Relative
        1. You have to use ‘ **../** ’. This implies go to parent directory
        2. **open(‘../myData/ file2.txt’ , ‘r’)**
     2. Absolute
        1. **open(‘/e/folder1/myData/file2.txt’, ‘r’ )**
        2. Absolute path starts with **‘/’**
  9. File1 = **open(“Olympics.txt”, “r")**
  10. **with** open(“Olympics.txt”, “r") **as** File1: # needs **indentation** after this line

# with/ as is same as previous open but **doesn’t require** a File1.**close**()

# with/ as is the **preferred way** to open a file

1. CSV Format (Comma Separated Values)
   1. Conventions
      1. Comma Separated “,”
      2. First line defines column names
      3. All other rows or lines follows the same above structure
   2. Text = [ (1,2,3) , (4,5,6) , (7,8,9) ] # csv format for writing on file
   3. If there’s a comma used in the data then use “” to enclose each data
2. Dictionaries
   1. **Unordered** Data Collection unlike String, List, Tuple
   2. Stores Key, Value pair
   3. nameAge = **{}** **# declare a dictionary by { }**

nameAge[ ‘Adam’ ] = ‘24’ # key: ‘Adam’ Value: ‘24’

nameAge[ ‘Steve ] = ‘31’

nameAge[ ‘Java ] = ‘14’

or you can directly declare:

nameAge = {‘Adam’ **:**  ’24 ’ **,**  ‘Steve’ **:** ’31’ **,**  ‘Java’ **:** ‘14’}

* 1. **print(nameAge)**

>> {‘Adam’ **:**  ’24 ’ **,**  ‘Steve’ **:** ’31’ **,**  ‘Java’ **:** ‘14’}

* 1. print( **nameAge[‘Steve’]** )

>> 31

* 1. **nameAge[‘Steve’] = ‘35’**  # **mutable**
  2. **del** nameAge[‘Steve’] # deletes key: Steve & value: 31
  3. **len(**nameAge**)** # return no. of key value pairs
  4. nameAge**.keys()** # return all Keys (not List but **Iterable**)
  5. **for** key **in** nameAge**.keys():**

print( **nameAge[key]** )

* 1. **for** key **in** **nameAge:**

print( **nameAge[key]** ) # same as previous

* 1. **for** **k, v in** **nameAge.items():**

**print( k, v )**  **# Tuple Unpacking**

* 1. key\_list = list( nameAge.keys() ) # Typecast to list of keys
  2. nameAge**.values()** # return all values
  3. list( nameAge**.values() )** # return list of values
  4. nameAge**.items()** # return key/value pair as Tuple
  5. list( nameAge**.items()** ) # return list of key/value Tuples
  6. **print(** ‘Steve’ **in** nameAge **)** **# only for keys** # return Boolean TRUE/ FALSE
  7. print( nameAge**.get(** ‘Steve’ **)** ) # return value of key in argument
  8. print( nameAge.**get(** ‘Mark’ **)** ) # returns **“None”** if key doesn’t exist
  9. print( nameAge**[** ‘Mark’ **]** ) # Run Time **Error**
  10. print( nameAge.**get(** ‘Mark’ , 0 **)**) # returns **0** if key doesn’t exist
  11. nameAge\_alias = nameAge # alias points the same object here

print(nameAge\_alias **is** nameAge) # returns True

* 1. nameAge\_copy = nameAge**.copy()** # makes a copy instead of alias
  2. **sorted** **(** nameAge.keys() **)** # **sort** Dictionary **Keys**
  3. **sorted** **(** nameAge **)** # **sort** Dictionary **Keys # same**
  4. **sorted (nameAge.keys(), key = lambda x: nameAge[x] )** # **sort** Dictionary **Values**
  5. sorted (nameAge.keys(), reverse = True, key = lambda x: nameAge[x] )

# **reverse sort** Dictionary **Values**

* 1. Key of the dictionary has to be a Immutable object (So no List, Dictionary as key)

1. Functions
   1. **def** name**( parameters ):**

statements

* 1. **def** name**( parameters ):**

statements

**return** something

* 1. Returns **None** if no return specified.
  2. **def** name**( parameters ):**

**global any\_variable** # If you want global variable access

statements

**return** something

* 1. **def** name**( c ):**

a = b + c # if b is global then **OK**

**return** a

b = 3

name (5)

* 1. **def** name**( c ):**

a = b + c # **ERROR** since 1st local ? If yes:

b = 2 # defined later in function

**return** something # no global access here

b = 3

name (5)

* 1. **IMP:** Variable can be local but objects like List, Dictionary (Mutable) are passed as global scope. Hence the **function will mutate the original list or Dictionary**.
  2. **How To avoid:**
     1. New\_list = func ( **list( original\_list)** )
     2. New\_Dict = func ( **dict( original\_Dict)** )
     3. The function **list() & dict() returns a new copy of the argument**. Pass this as a parameter to the function to avoid mutation.
  3. **def** name**( b, c ): #** only one item can be returned

a = b + c

**return** (a,b,c) **# Use Tuple to return more than 1 values**

* 1. **def** name**( b, c ):**

a = b + c #return Tuple

**return** a,b,c **# Implicit packing** into a Tuple **# OK**

**x, y, z = name (5,4)** # **Tuple Unpacking**

* 1. **return [a, b, c]** is not the preferred method because it **returns a, b and c in a mutable list rather than a tuple** which is more efficient. But it is workable.
  2. **def** name**( b, c ):**

a = b + c

**return** a,b,c

**tup = 5,4**

**x, y, z =** name(**\*tup**) #  **\* => automatic Unpacking**

* 1. **def** name**( b, c ):**

a = b + c

**return** a,b,c

**tup = 5,4**

**x, y, z =** name(**tup**) #  **ERROR**

* 1. initial = 7 # **IMP**

def f(x, y =3, z=initial): **# Optional Parameter**

print("x, y, z, are: " + str(x) + ", " + str(y) + ", " + str(z))

initial = 10

f(2)

**Output:**

x, y, z, are: 2, 3, 7

* 1. def f (a, L=[] ): #**IMP**

L.append(a) # **Mutation**

return L # L optional

print( f(1) )

print( f(2) )

print( f(3) )

print( f(4, ["Hello"]) )

print( f(5, ["Hello"]) )

**Output:**

[1]

[1, 2]

[1, 2, 3] # Local L mutable

['Hello', 4]

['Hello', 5]

* 1. initial = 7 # **IMP**

**def f( x, y =3, z = initial):** **# Optional Parameter**

print("x, y, z, are: " + str(x) + ", " + str(y) + ", " + str(z))

initial = 10

**f(2, z = 8) # Keyword Parameter**

**# f(2, , 8) will give an error**

**# f(x=2, z=8) OK**

**# f(z=8, x=2) OK No order required**

**Output:**

x, y, z, are: 2, 3, 8

* 1. def func (args):

return ret\_val

* 1. **Lambda Function**

**func = lambda args: ret\_val** # Other way to write above function

**lambda args: ret\_val** # Anonymous function # **OK**

* 1. **L = [**fun1, fun2, lambda x: abs(x) **]** # You can create list of functions too

**Print ( L[0](parameter) )**

1. Advance Sorting (Second Sorting or Sorting on more than 1 property)
   1. Make **Tuple** of all the properties & sort these Tuples.
   2. Tuple sorting: Sort according to 1st element.
   3. Tie break: If 1st same, sort according to 2nd and so on
   4. Utilize above for advance sorting
   5. fruits = ['peach', 'kiwi', 'apple', 'blueberry', 'papaya', 'mango', 'pear']

**# sort according to length and letter**

new\_order = **sorted(**fruits, **key=lambda fruit\_name: (len(fruit\_name), fruit\_name))**

**output:**

kiwi

pear

apple

mango

peach

papaya

blueberry

* 1. fruits = ['peach', 'kiwi', 'apple', 'blueberry', 'papaya', 'mango', 'pear']

**# reverse sort according to length and letter**

new\_order = **sorted(**fruits, **key=lambda fruit\_name: (len(fruit\_name), fruit\_name, reverse = True))**

**output:**

blueberry

papaya

peach

mango

apple

pear

kiwi

* 1. fruits = ['peach', 'kiwi', 'apple', 'blueberry', 'papaya', 'mango', 'pear']

**# reverse sort according to length but ascending letter**

new\_order = **sorted(**fruits, **key=lambda fruit\_name: (-len(fruit\_name), fruit\_name))**

**output:**

blueberry

papaya

apple # alphabetical order retained

mango

peach

kiwi

pear

1. JSON ( Java Script Object Notation )
   1. Standard format to share Nested Lists & Dictionaries.
   2. It’s **List of Dictionaries**
   3. Difference from Python:
      1. Null (instead of None)
      2. true/ false (instead if True/ False)
   4. **import** **json**
   5. **json.loads(**any\_string\_input**)** # takes string (Json) as input & return either

# Dictionary / List depending on string

* 1. **json.dumps(**any\_List\_or\_Dictionary**)** # opposite of loads()

# takes List or Dictionary and return (JSON)

# string

* 1. json**.dumps(** obj, **sort\_keys = True**, **indent =2**) # if dictionary input, sort\_key

# available

* 1. **Use** [**jsoneditoronline.org**](jsoneditoronline.org) **to understand JSON data in levels.**

1. Shallow & Deep Copy (Important)
   1. When there are multi-level nesting in a list & you try to make a copy of it by:
   2. New\_list = original\_list [:] **# it will make 1st level true copy only # rest levels are aliasing # This is called a shallow copy**
   3. x=4

y=2

z=3

myList = [[x,y,z],0,0]

print(myList)

x=6

print(myList)

**Output:**

[[4, 2, 3], 0, 0]

[[4, 2, 3], 0, 0]

* 1. original = [['dogs', 'puppies'], ['cats', "kittens"]]

copied\_version = original[:]

print(copied\_version)

print(copied\_version is original)

print(copied\_version == original)

original[0].append(["canines"])

print(original)

print("-------- Now look at the copied version -----------")

print(copied\_version)

**Output:**

[['dogs', 'puppies'], ['cats', 'kittens']]

[['dogs', 'puppies', ['canines']], ['cats', 'kittens']]

-------- Now look at the copied version -----------

[['dogs', 'puppies'], ['cats', 'kittens']]

* 1. original = [['dogs', 'puppies'], ['cats', "kittens"]]

copied\_outer\_list = []

for inner\_list in original:

copied\_inner\_list = inner\_list[:]

copied\_outer\_list.append(copied\_inner\_list)

print(copied\_outer\_list)

original[0].append(["canines"])

print(original)

print("-------- Now look at the copied version -----------")

print(copied\_outer\_list)

**Output:**

[['dogs', 'puppies'], ['cats', 'kittens']]

[['dogs', 'puppies', ['canines']], ['cats', 'kittens']]

-------- Now look at the copied version -----------

[['dogs', 'puppies'], ['cats', 'kittens']]

* 1. **Important**

**import copy**

original = [['canines', ['dogs', 'puppies']], ['felines', ['cats', 'kittens']]]

shallow\_copy\_version = original[:]

deeply\_copied\_version = **copy.deepcopy(**original**)**

original.append("Hi there")

original[0].append(["marsupials"])

print("-------- Original -----------")

print(original)

print("-------- deep copy -----------")

print(deeply\_copied\_version)

print("-------- shallow copy -----------")

print(shallow\_copy\_version)

**Output:**

-------- Original -----------

[['canines', ['dogs', 'puppies'], [**'marsupials']],** ['felines', ['cats', 'kittens']], **'Hi there'**]

-------- deep copy -----------

[['canines', ['dogs', 'puppies']], ['felines', ['cats', 'kittens']]]

-------- shallow copy -----------

[['canines', ['dogs', 'puppies'], [**'marsupials']],** ['felines', ['cats', 'kittens']]]

1. MAP
   1. Function that changes the list items and return new list.
   2. Function (modifying) as 1st parameter and Sequence as 2nd parameter.
   3. new\_list = **map(** **lambda x: 2\*x** , **myList** **)**
   4. new\_list = map( double, myList ) # define a function double()
2. Filter
   1. Start with some items and end up with fewer items.
   2. Gives back an iterable object.
   3. new\_seq = **filter(** **lambda x: x%2==0 , myList )** # only choose even numbers
   4. new\_seq = list( new\_seq )
   5. lst2 = **filter( lambda w: “o” in w , myList** **)** # choose words with letter ‘o’
3. List Comprehension (Better than Map & Filter) # preferred over map & filter
   1. new\_list = **[** 2\*x **for** x **in** myList **] #MAP** # doubles each no. in myList
   2. new\_list = **[** x **for** x **in** myList **if** x%2==0 **] # FILTER** even nos.
4. ZIP ( Zipping two or more sequences, pair wise comparison )
   1. Take a lists as the parameter and **zip together forming a list of Tuples.**
   2. Each Tuple of the list will have that positional element of all the lists.
   3. L1 = **[1,2,3]** L2 = **[4,5,6]** => L3 = **[ (1,4) , (2,5), (3,6) ]**
   4. L3 = **list(** **zip( L1, L2 )** **)**
   5. for (x1, x2) in L3:

L4.append(x1+x2) # Here you can define operation

* 1. print(L4) => [5,7,9]

1. REST API (Application Programming Interface)
   1. REST – Representational State Transfer
   2. REST API specifies how external programs can make HTTP requests to a web site in order to request that some computation be carried out and data returned as output. When a website is designed to accept requests generated by other computer programs, and produce outputs to be consumed by other programs, it is sometimes called a **web service**, as opposed to a web site which produces output meant for humans to consume in a web browser.
   3. A common pattern used in REST APIs, there is a **base URL** that defines an “**endpoint**”, and then additional information is appended to the URL as **query parameters**, and the response comes back not as HTML but as a format called **JSON**.
   4. {protocol}://{server}/{arguments}
   5. arguments could be key: value
   6. ex: /**list?filter =** **tags:Art** **,&range=2018-10-01 # endpoint: list # Query Parameters**
   7. GET List of events that are tagged “art” & starting 01.10.2018
   8. A protocol specifies the order in which parties will speak and the format of what they say and the content of appropriate responses
   9. HTTP is the protocol that specifies how web browsers or other programs communicate with web servers
   10. IETF RFCs (Request for Comments)
       1. Step 1: the **client** makes a request to the server.
          1. If the request only involves fetching data, the client sends a message of the form **GET** <path>, where <path> is the path part of the URL
          2. If the request involves sending some data (e.g., a file upload, or some authentication information), the message starts with **POST**
          3. In either case, the client sends some **HTTP headers**. These include:
             1. **The type of client program**. This allows the server to send back different things to small mobile devices than desktop browsers (a “responsive” website)
             2. **Any cookies** that the server previously asked the client to hold onto. This allows the server to continue previous interactions, rather than treating every request as stand-alone. It also allows ad networks to place personalized ads.
          4. After the HTTP headers, for a POST type communication, there is some data (the **body** of the request).
       2. Step 2: the **server** responds to the client.
          1. The server first sends back some **HTTP headers**. These include:
             1. a **response code** indicating whether the server thinks it has fulfilled the request or not.
             2. a **description** of the type of **content** it is sending back (e.g., text/html when it is sending html-formatted text).
             3. any **cookies** it would like the client to hold onto and send back the next time it communicates with the server.
          2. After the headers come the contents. This is the stuff that you would see if you ask to “View Source” in a browser
2. Fetching Data (Requests Module)
   1. **import requests**
   2. page= **requests.get(“**https://api.somewebsite.com/**endpoint**?some\_**key**=some\_**value**”**)**
   3. request.get() #returns a **Response class object** with following attributes
   4. If the call to requests.get produces an error, you won’t get a Response object, so you’ll need some other way to see what URL was produced.
   5. **def** **requestURL(**baseurl, params = {}**)**:

req = **requests.Request(method = 'GET', url = baseurl, params = params)**

prepped = req**.prepare()**

return **prepped.url**

# It returns url without fetching # useful for **debugging**

* 1. **requests.requestURL()**
  2. print( **page.text[:**150**]** ) # Print first 150 characters
  3. print ( **page.url** ) # print url that was fetched
  4. X = **page.json()** # **turns page.text to python object # same as**

**# json.loads(page.text)**

* 1. print (**json.dumps(x, indent =2)** ) # to print properly
  2. page.**status\_code** # return status code
     1. 200 – request completed by server
     2. 404 – requested data doesn’t exist
     3. 301 – page has moved to different location
        1. GET will automatically fetch data from the new address if 301
     4. 401 – Not authorized Access
     5. 451 – Not available due to legal reason (Ex: Censored Data)
        1. 451 is a reference for novel Fahrenheit 451
        2. At 451 F the page of books auto-ignites
  3. page**.headers** # dictionary of keys & values # print(page.headers.keys())

# to find all the header keys or attributes

* 1. page**.history**  # return list of previous responses (if redirects made)
  2. Parameter Encoding
     1. **d = {'q': '"violins and guitars"', 'tbm': 'isch'} # Dictionary**

results = requests.get(**"https://google.com/search", params=d** )

print(results.url)

output:

https://www.google.com/search**?q=%22**violins**+**and**+**guitars**%22&**tbm=isch

# **Automatic Encoding** of parameters when **params** is used

* 1. To open a link in browser use, **webbrowser.open( url )**

1. Caching API Response
   1. **import** **requests\_with\_caching**
   2. If same request as before take value from cache
   3. If different request as before, fetch fresh value
   4. res = **requests\_with\_caching.get(**“base\_url”, **permanent\_cache\_file =** “fileC.txt”, **temp\_cache\_file** = “fileCT.txt”**)**
   5. Now there are two type of cache **Permanent** & **Temporary files.**
   6. request\_with\_caching.get() looks into both the cache files
   7. Temporary Caching is page specific so whence reload it erases all temp. cache
2. Classes
   1. **class** Class\_name**:**

pass # Empty Class

* 1. x = **class\_name()** # Creating **Instance**
  2. class Point:

**def** getX( **self** ): # **method**

return **self.x**

point1 = Point()

**point1.x = 5** # **instance Variable**

print( point1.getX() )

**Output:**

5

Note: **Methods always contain at least 1 argument unlike functions**

* 1. **Every class should have a** **method with the special name** **\_\_init\_\_.** This initializer method, often referred to as the **constructor**, is automatically called whenever a new instance of Point is created. It gives the programmer the opportunity to set up the attributes required within the new instance by giving them their initial state values
  2. The **self** parameter (you could choose any other name, but nobody ever does!) is automatically **set to reference** the newly created object that needs to be initialized
  3. class Point:

**def \_\_init\_\_(self): # CONSTRUCTOR**

self.x = 0

self.y = 0

**p = Point()** # Instantiate an object of type Point **# Instantiation**

q = Point() # and make a second point

* 1. **def \_\_init\_\_(self, x, y): # CONSTRUCTOR with Parameters**

**self.x = x**

**self.y = y**

p = Point() # Error

**p = Point(5, 10)**

print(p) < \_\_main\_\_.Point object>

* 1. **def \_\_str\_\_(self):**

**return** “Specify how you want to print {} {}”.format( self.x , self.y )

# \_\_str\_\_ is an OPTIONAL method that can be used to return String when Instantiation is done

p = Point(5, 10)

print(p) => “Specify how.....5 10”

* 1. **def \_\_add\_\_( self, otherPoint):**

return **Point( self.x + otherPoint.x , self.y + otherPoint.y)**

P1 = Point (5,10)

P2 = Point (-5, 10)

**P3 = P1 + P2** => **P3 : [0,0]**

* 1. **def \_\_sub\_\_( self, otherPoint):**

return **Point( self.x - otherPoint.x , self.y - otherPoint.y)**

P1 = Point (5,10)

P2 = Point (-5, 10)

**P3 = P1 - P2** => **P3 : [10,20]**

* 1. class Fruit():

def \_\_init\_\_(self, name, price):

self.name = name

self.price = price

**def sort\_priority(self):**

**return self.price**

L = [Fruit("Cherry", 10), Fruit("Apple", 5), Fruit("Blueberry", 20)]

print("-----**sorted by price, referencing a class method**-----")

for f in **sorted**(L, key=**Fruit.sort\_priority**):

print(f.name)

print("---- **one more way to do the same thing**-----")

for f in **sorted**(L, **key=lambda x: x.sort\_priority()):**

print(f.name)

1. Inheritance
   1. **class Student( Person ):** # Inherit from class Person

**def \_\_init\_\_(self, other\_parameters):**

**Person.\_\_init\_\_(self, paramters)** # invoke parent method

**# super().\_\_init\_\_(self, parameter)** #**another way** to invoke parent method

1. Testing
   1. The benefit of test cases is that it let us test a piece of the whole code instead of waiting for the whole code to run
   2. **assert** x==y
      1. Run time error # if False
      2. Nothing Happens # if True
2. Exception Handling
   1. **try:**

body

**except:**

# body print(“ Something!”)

* 1. **try:**

body

**except error\_type\_here:** # You can also specify what kind of

# body print(“ Something!”) # error you want to handle

* + 1. **Exception** – **Handles all Run Time Error**
    2. **IndexError** – Handles out of index calls
    3. **ZeroDivisionError**
    4. **ArithmeticError**
    5. **KeyError** # missing key from dictionary
  1. **try:**

body # first error in try block & break

**except IndexError: # only one of the following except will execute**

# body print(“ Something!”)

**except ZeroDivisionError:**

# body print(“ Something!”)

**except Exception:**

# body print(“ Something!”)

* 1. **try:**

body

**except Exception as e:** # You can also specify what kind of

# body print(“ Something!”)

**print(e)** # prints error message

NOTES

1. Some general errors:
   1. Syntax Error
   2. Logic Error
   3. Compilation Error
   4. Run time Error
   5. Resource Error
   6. Interface Error
2. Python is an Interpreted Language.
3. Workflow:
   1. Compiler
      1. Source Code
      2. Compiler
      3. Object Code or the executable
      4. Executor
      5. Output
   2. Interpreters
      1. Source Code
      2. Interpreter
      3. Output
4. Variables
   1. Can only start with a letter
   2. Can only contain letters and numbers.
   3. Underscore is also allowed.
   4. Variable names can never contain spaces.
   5. It should not be a Python Keyword (Ex: class)
5. The input function returns a string value
6. Functions imported as part of a module live in their own **namespace**. A namespace is simply a space within which all names are distinct from each other. The same name can be reused in different namespaces but two objects can’t have the same name within a single namespace.
7. Python Libraries <https://docs.python.org/3.6/library/index.html>
   1. <https://docs.python.org/3.6/py-modindex.html>
8. Don’t overwrite standard library modules!
9. It is important to note that random number generators are based on a deterministic algorithm — repeatable and predictable. So they’re called **pseudo-random generators** — they are not genuinely random. They start with a seed value. Each time you ask for another random number, you’ll get one based on the current seed attribute, and the state of the seed (which is one of the attributes of the generator) will be updated. The good news is that each time you run your program, the seed value is likely to be different, meaning that even though the random numbers are being created algorithmically, you will likely get random behaviour each time you execute.
10. \* operator in repetition of concatenation follows the same preference rule as of Multiplication
11. Mutation operations are often called **Destructive** operations as they change the values.
12. Python has the notion of a **context manager** that automates the process of doing common operations at the start of some task, as well as automating certain operations at the end of some task. For reading and writing a file, the normal operation is to open the file and assign it to a variable. At the end of working with a file the common operation is to make sure that file is closed.