CHAPTER 2

Python String

Python string is the collection of the characters surrounded by single quotes, double quotes, or triple quotes. The computer does not understand the characters; internally, it stores manipulated character as the combination of the 0's and 1's.

Each character is encoded in the ASCII or Unicode character. So we can say that Python strings are also called the collection of Unicode characters.

In Python, strings can be created by enclosing the character or the sequence of characters in the quotes. Python allows us to use single quotes, double quotes, or triple quotes to create the string.

Consider the following example in Python to create a string.

Syntax:

```
str = "Hi Python !"
```

Here, if we check the type of the variable **str** using a Python script

```
print(type(str)), then it will print a string (str).
```

In Python, strings are treated as the sequence of characters, which means that Python doesn't support the character data-type; instead, a single character written as 'p' is treated as the string of length 1.

Creating String in Python

We can create a string by enclosing the characters in single-quotes or double- quotes. Python also provides triple-quotes to represent the string, but it is generally used for multiline string or **docstrings**.

```
#Using single quotes
str1 = 'Hello Python'
print(str1)
#Using double quotes
str2 = "Hello Python"
print(str2)

#Using triple quotes
str3 = '''Triple quotes are generally used for
   represent the multiline or
   docstring'''
print(str3)
```

Output:

Hello Python

Hello Python

Triple quotes are generally used for

represent the multiline or

docstring

Triple Quotes

Python's triple quotes comes to the rescue by allowing strings to span multiple lines, including verbatim NEWLINEs, TABs, and any other special characters.

The syntax for triple quotes consists of three consecutive single or double quotes.

```
#!/usr/bin/python
para_str = """this is a long string that is made up of
several lines and non-printable characters such as
TAB ( \t ) and they will show up that way when displayed.
NEWLINEs within the string, whether explicitly given like
this within the brackets [ \n ], or just a NEWLINE within
the variable assignment will also show up.
"""
print para_str
```

When the above code is executed, it produces the following result. Note how every single special character has been converted to its printed form, right down to the last NEWLINE at the end of the string between the "up." and closing triple quotes. Also note that NEWLINEs occur either with an explicit carriage return at the end of a line or its escape code (\n) −

```
this is a long string that is made up of
several lines and non-printable characters such as
TAB (    ) and they will show up that way when displayed.
NEWLINEs within the string, whether explicitly given like
this within the brackets [
 ], or just a NEWLINE within
the variable assignment will also show up.
```

Strings indexing and splitting

Like other languages, the indexing of the Python strings starts from 0. For example, The string "HELLO" is indexed as given in the below figure.

str[0] = 'H'

str[1] = 'E'

str[2] = 'L'

str[3] = 'L'

str[4] = 'O'

Consider the following example:

```
str = "HELLO"
print(str[0])
print(str[1])
print(str[2])
print(str[3])
print(str[4])
# It returns the IndexError because 6th index doesn't exist
print(str[6])
```

Output

H

E

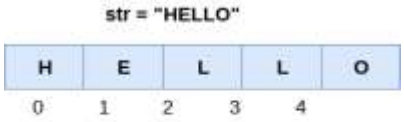
L

L

O

IndexError: string index out of range

As shown in Python, the slice operator [] is used to access the individual characters of the string. However, we can use the : (colon) operator in Python to access the substring from the given string. Consider the following example.



str[0] = 'H'

str[1] = 'E'

str[2] = 'L'

str[3] = 'L'

str[4] = 'O'

str[:] = 'HELLO'

str[0:] = 'HELLO'

str[:5] = 'HELLO'

str[:3] = 'HEL'

str[0:2] = 'HE'

str[1:4] = 'ELL'

Here, we must notice that the upper range given in the slice operator is always exclusive i.e., if str = 'HELLO' is given, then str[1:3] will always include str[1] = 'E', str[2] = 'L' and nothing else.

Consider the following example:

```
# Given String
str = "JAVATPOINT"
# Start 0th index to end
print(str[0:])
# Starts 1th index to 4th index
print(str[1:5])
# Starts 2nd index to 3rd index
print(str[2:4])
# Starts 0th to 2nd index
print(str[:3])
#Starts 4th to 6th index
print(str[4:7])
```

Output:

JAVATPOINT

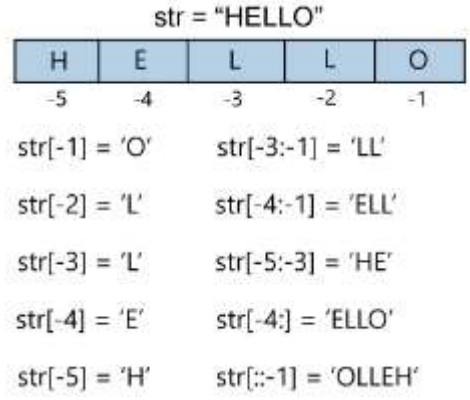
AVAT

VA

JAV

TPO

We can do the negative slicing in the string; it starts from the rightmost character, which is indicated as -1. The second rightmost index indicates -2, and so on. Consider the following image.



Consider the following example

```
str = 'JAVATPOINT'
print(str[-1])
print(str[-3])
print(str[-2:])
print(str[-4:-1])
print(str[-7:-2])
# Reversing the given string
print(str[::-1])
print(str[-12])
```

Output:

```
T
I
NT
OIN
ATPOI
TNIOPTAVAJ
IndexError: string index out of range
```

Reassigning Strings

Updating the content of the strings is as easy as assigning it to a new string. The string object doesn't support item assignment i.e., A string can only be replaced with new string since its content cannot be partially replaced. Strings are immutable in Python.

Consider the following example.

Example 1

```
1. str = "HELLO"
2. str[0] = "h"
3. print(str)
```

Output:

```
Traceback (most recent call last):
  File "12.py", line 2, in <module>
    str[0] = "h";
TypeError: 'str' object does not support item assignment
```

However, in example 1, the string **str** can be assigned completely to a new content as specified in the following example.

Example 2

```
str = "HELLO"
print(str)
str = "hello"
print(str)
```

Output:

```
HELLO
hello
```

Deleting the String

As we know that strings are immutable. We cannot delete or remove the characters from the string. But we can delete the entire string using the **del** keyword.

```
1. str = "JAVATPOINT"
2. del str[1]
```

Output:

```
TypeError: 'str' object doesn't support item deletion
```

Now we are deleting entire string.

```
str1 = "JAVATPOINT"
del str1
print(str1)
```

Output:

```
NameError: name 'str1' is not defined
```

String Operators

Operator	Description
+	It is known as concatenation operator used to join the strings given either side of the operator.
*	It is known as repetition operator. It concatenates the multiple copies of the same string.

[]	It is known as slice operator. It is used to access the sub-strings of a particular string.
[:]	It is known as range slice operator. It is used to access the characters from the specified range.
in	It is known as membership operator. It returns if a particular sub-string is present in the specified string.
not in	It is also a membership operator and does the exact reverse of in. It returns true if a particular substring is not present in the specified string.
r/R	It is used to specify the raw string. Raw strings are used in the cases where we need to print the actual meaning of escape characters such as "C://python". To define any string as a raw string, the character r or R is followed by the string.
%	It is used to perform string formatting. It makes use of the format specifiers used in C programming like %d or %f to map their values in python. We will discuss how formatting is done in python.

Example

Consider the following example to understand the real use of Python operators.

```
1. str = "Hello"
2. str1 = " world"
3. print(str*3) # prints HelloHelloHello
4. print(str+str1)# prints Hello world
5. print(str[4]) # prints o
6. print(str[2:4]); # prints ll
7. print('w' in str) # prints false as w is not present in str
8. print('wo' not in str1) # prints false as wo is present in str1.
9. print(r'C://python37') # prints C://python37 as it is written
10. print("The string str : %s"%(str)) # prints The string str : Hello
```

Output:

```
HelloHelloHello
Hello world
o
ll
False
False
C://python37
The string str : Hello
```

Python String functions

Python provides various in-built functions that are used for string handling. Many String fun

Method	Description
capitalize()	It capitalizes the first character of the String. This function is deprecated in python3
casefold()	It returns a version of s suitable for case-less comparisons.
center(width ,fillchar)	It returns a space padded string with the original string centred with equal number of left and right spaces.
count(string,begin,end)	It counts the number of occurrences of a substring in a String between begin and end index.
decode(encoding = 'UTF8', errors = 'strict')	Decodes the string using codec registered for encoding.
encode()	Encode S using the codec registered for encoding. Default encoding is 'utf-8'.
endswith(suffix ,begin=0,end=len(string))	It returns a Boolean value if the string terminates with given suffix between begin and end.
expandtabs(tabsize = 8)	It defines tabs in string to multiple spaces. The default space value is 8.
find(substring ,beginIndex, endIndex)	It returns the index value of the string where substring is found between begin index and end index.
format(value)	It returns a formatted version of S, using the passed value.
index(subsring, beginIndex, endIndex)	It throws an exception if string is not found. It works same as find() method.
isalnum()	It returns true if the characters in the string are alphanumeric i.e., alphabets or numbers and there is at least 1 character. Otherwise, it returns false.
isalpha()	It returns true if all the characters are alphabets and there is at least one character, otherwise False.
isdecimal()	It returns true if all the characters of the string are decimals.
isdigit()	It returns true if all the characters are digits and there is at least one character, otherwise False.
isidentifier()	It returns true if the string is the valid identifier.
islower()	It returns true if the characters of a string are in lower case, otherwise false.

isnumeric()	It returns true if the string contains only numeric characters.
isprintable()	It returns true if all the characters of s are printable or s is empty, false otherwise.
isupper()	It returns false if characters of a string are in Upper case, otherwise False.
isspace()	It returns true if the characters of a string are white-space, otherwise false.
istitle()	It returns true if the string is titled properly and false otherwise. A title string is the one in which the first character is upper-case whereas the other characters are lower-case.
isupper()	It returns true if all the characters of the string(if exists) is true otherwise it returns false.
join(seq)	It merges the strings representation of the given sequence.
len(string)	It returns the length of a string.
ljust(width[,fillchar])	It returns the space padded strings with the original string left justified to the given width.
lower()	It converts all the characters of a string to Lower case.
lstrip()	It removes all leading whitespaces of a string and can also be used to remove particular character from leading.
partition()	It searches for the separator sep in S, and returns the part before it, the separator itself, and the part after it. If the separator is not found, return S and two empty strings.
maketrans()	It returns a translation table to be used in translate function.
replace(old,new[,count])	It replaces the old sequence of characters with the new sequence. The max characters are replaced if max is given.
rfind(str,beg=0,end=len(str))	It is similar to find but it traverses the string in backward direction.
rindex(str,beg=0,end=len(str))	It is same as index but it traverses the string in backward direction.
rjust(width,[,fillchar])	Returns a space padded string having original string right justified to the number of characters specified.
rstrip()	It removes all trailing whitespace of a string and can also be used to remove particular character from trailing.

rsplit(sep=None, maxsplit = -1)	It is same as split() but it processes the string from the backward direction. It returns the list of words in the string. If Separator is not specified then the string splits according to the white-space.
split(str,num=string.count(str))	Splits the string according to the delimiter str. The string splits according to the space if the delimiter is not provided. It returns the list of substring concatenated with the delimiter.
splitlines(num=string.count('\n'))	It returns the list of strings at each line with newline removed.
startswith(str,beg=0,end=len(str))	It returns a Boolean value if the string starts with given str between begin and end.
strip([chars])	It is used to perform lstrip() and rstrip() on the string.
swapcase()	It inverts case of all characters in a string.
title()	It is used to convert the string into the title-case i.e., The string **meEruT** will be converted to Meerut.
translate(table,deletechars = '')	It translates the string according to the translation table passed in the function .
upper()	It converts all the characters of a string to Upper Case.
zfill(width)	Returns original string leftpadded with zeros to a total of width characters; intended for numbers, zfill() retains any sign given (less one zero).
rpartition()	

Python List

A list in Python is used to store the sequence of various types of data. Python lists are mutable type its mean we can modify its element after it created. However, Python consists of six data-types that are capable to store the sequences, but the most common and reliable type is the list.

A list can be defined as a collection of values or items of different types. The items in the list are separated with the comma (,) and enclosed with the square brackets [].

A list can be define as below

1. L1 = ["John", 102, "USA"]
2. L2 = [1, 2, 3, 4, 5, 6]

If we try to print the type of L1, L2, and L3 using type() function then it will come out to be a list.

1. **print**(type(L1))
2. **print**(type(L2))

Output:

```
<class 'list'>
<class 'list'>
```

Characteristics of Lists

The list has the following characteristics:

- The lists are ordered.
- The element of the list can access by index.
- The lists are the mutable type.
- A list can store the number of various elements.

Let's check the first statement that lists are the ordered.

```
a = [1,2,"Peter",4.50,"Ricky",5,6]
b = [1,2,5,"Peter",4.50,"Ricky",6]
a ==b
```

Output:

```
False
```

Both lists have consisted of the same elements, but the second list changed the index position of the 5th element that violates the order of lists. When compare both lists it returns the false.

Lists maintain the order of the element for the lifetime. That's why it is the ordered collection of objects.

```
1. a = [1, 2,"Peter", 4.50,"Ricky",5, 6]
2. b = [1, 2,"Peter", 4.50,"Ricky",5, 6]
3. a == b
```

Output:

```
True
```

Let's have a look at the list example in detail.

```
1. emp = ["John", 102, "USA"]
2. Dep1 = ["CS",10]
3. Dep2 = ["IT",11]
4. HOD_CS = [10,"Mr. Holding"]
5. HOD_IT = [11, "Mr. Bewon"]
6. print("printing employee data...")
7. print("Name : %s, ID: %d, Country: %s"%(emp[0],emp[1],emp[2]))
8. print("printing departments...")
9. print("Department 1:\nName: %s, ID: %d\nDepartment 2:\nName: %s, ID: %s"%(Dep
   1[0],Dep2[1],Dep2[0],Dep2[1]))
10. print("HOD Details ....")
11. print("CS HOD Name: %s, Id: %d"%(HOD_CS[1],HOD_CS[0]))
12. print("IT HOD Name: %s, Id: %d"%(HOD_IT[1],HOD_IT[0]))
13. print(type(emp),type(Dep1),type(Dep2),type(HOD_CS),type(HOD_IT))
```

Output:

```
printing employee data...
Name : John, ID: 102, Country: USA
printing departments...
Department 1:
Name: CS, ID: 11
Department 2:
Name: IT, ID: 11
HOD Details ....
CS HOD Name: Mr. Holding, Id: 10
IT HOD Name: Mr. Bewon, Id: 11
<class 'list'> <class 'list'> <class 'list'> <class 'list'> <class 'list'>
```

In the above example, we have created the lists which consist of the employee and department details and printed the corresponding details. Observe the above code to understand the concept of the list better.

List indexing and splitting

The indexing is processed in the same way as it happens with the strings. The elements of the list can be accessed by using the slice operator [].

The index starts from 0 and goes to length - 1. The first element of the list is stored at the 0th index, the second element of the list is stored at the 1st index, and so on.

List = [0, 1, 2, 3, 4, 5]

0	1	2	3	4	5

List[0] = 0

List[1] = 1

List[2] = 2

List[3] = 3

List[4] = 4

List[5] = 5

List[0:] = [0,1,2,3,4,5]

List[:] = [0,1,2,3,4,5]

List[2:4] = [2, 3]

List[1:3] = [1, 2]

List[:4] = [0, 1, 2, 3]

We can get the sub-list of the list using the following syntax.

list_varible(start:stop:step)

- The **start** denotes the starting index position of the list.
- The **stop** denotes the last index position of the list.
- The **step** is used to skip the nth element within a **start:stop**

Consider the following example:

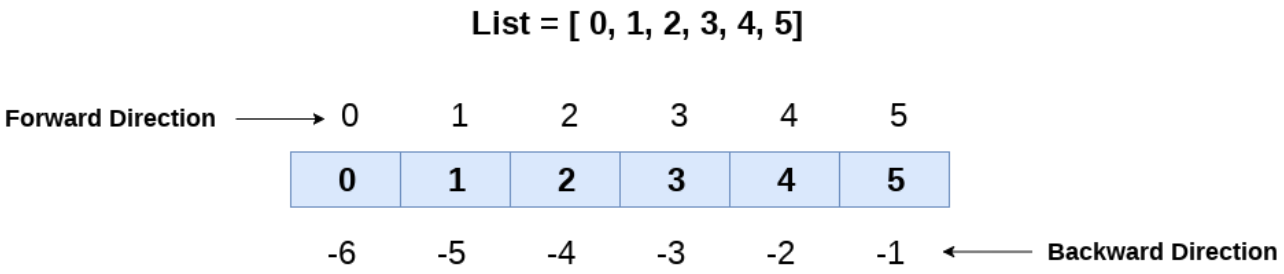
1. list = [1,2,3,4,5,6,7]

2. **print**(list[0])
3. **print**(list[1])
4. **print**(list[2])
5. **print**(list[3])
6. # Slicing the elements
7. **print**(list[0:6])
8. # By default the index value is 0 so its starts from the 0th element and go for index -1.
9. **print**(list[:])
10. **print**(list[2:5])
11. **print**(list[1:6:2])

Output:

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

Unlike other languages, Python provides the flexibility to use the negative indexing also. The negative indices are counted from the right. The last element (rightmost) of the list has the index -1; its adjacent left element is present at the index -2 and so on until the left-most elements are encountered.



Let's have a look at the following example where we will use negative indexing to access the elements of the list.

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

1. **print**(list[-1])
2. **print**(list[-3:])
3. **print**(list[:-1])
4. **print**(list[-3:-1])

Output:

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

As we discussed above, we can get an element by using negative indexing. In the above code, the first print statement returned the rightmost element of the list. The second print statement returned the sub-list, and so on.

Updating List values

Lists are the most versatile data structures in Python since they are mutable, and their values can be updated by using the slice and assignment operator.

Python also provides append() and insert() methods, which can be used to add values to the list.

Consider the following example to update the values inside the list.

```
1. list = [1, 2, 3, 4, 5, 6]
2. print(list)
3. # It will assign value to the value to the second index
4. list[2] = 10
5. print(list)
6. # Adding multiple-element
7. list[1:3] = [89, 78]
8. print(list)
9. # It will add value at the end of the list
10. list[-1] = 25
11. print(list)
```

Output:

```
[1, 2, 3, 4, 5, 6]
[1, 2, 10, 4, 5, 6]
[1, 89, 78, 4, 5, 6]
[1, 89, 78, 4, 5, 25]
```

The list elements can also be deleted by using the **del** keyword. Python also provides us the **remove()** method if we do not know which element is to be deleted from the list.

Consider the following example to delete the list elements.

```
1. list = [1, 2, 3, 4, 5, 6]
2. print(list)
3. # It will assign value to the value to second index
4. list[2] = 10
```

```
5. print(list)
6. # Adding multiple element
7. list[1:3] = [89, 78]
8. print(list)
9. # It will add value at the end of the list
10. list[-1] = 25
11. print(list)
```

Output:

```
[1, 2, 3, 4, 5, 6]
[1, 2, 10, 4, 5, 6]
[1, 89, 78, 4, 5, 6]
[1, 89, 78, 4, 5, 25]
```

Python List Operations

The concatenation (+) and repetition (*) operators work in the same way as they were working with the strings.

Let's see how the list responds to various operators.

1. Consider a Lists l1 = [1, 2, 3, 4], **and** l2 = [5, 6, 7, 8] to perform operation.

Operator	Description	Example
Repetition	The repetition operator enables the list elements to be repeated multiple times.	L1*2 = [1, 2, 3, 4, 1, 2, 3, 4]
Concatenation	It concatenates the list mentioned on either side of the operator.	l1+l2 = [1, 2, 3, 4, 5, 6, 7, 8]
Membership	It returns true if a particular item exists in a particular list otherwise false.	print(2 in l1) prints True.
Iteration	The for loop is used to iterate over the list elements.	for i in l1: print(i) **Output** 1 2 3 4
Length	It is used to get the length of the list	len(l1) = 4

Iterating a List

A list can be iterated by using a for - in loop. A simple list containing four strings, which can be iterated as follows.

```
1. list = ["John", "David", "James", "Jonathan"]
2. for i in list:
3.     # The i variable will iterate over the elements of the List and contains each element i
   n each iteration.
4.     print(i)
```

Output:

```
John
David
James
Jonathan
```

Adding elements to the list

Python provides append() function which is used to add an element to the list. However, the append() function can only add value to the end of the list.

Consider the following example in which, we are taking the elements of the list from the user and printing the list on the console.

```
1. #Declaring the empty list
2. l =[]
3. #Number of elements will be entered by the user
4. n = int(input("Enter the number of elements in the list:"))
5. # for loop to take the input
6. for i in range(0,n):
7.     # The input is taken from the user and added to the list as the item
8.     l.append(input("Enter the item:"))
9. print("printing the list items..")
10. # traversal loop to print the list items
11. for i in l:
12.     print(i, end = "  ")
```

Output:

```
Enter the number of elements in the list:5
Enter the item:25
Enter the item:46
Enter the item:12
Enter the item:75
Enter the item:42
printing the list items
25  46  12  75  42
```

Removing elements from the list

Python provides the **remove()** function which is used to remove the element from the list. Consider the following example to understand this concept.

Example -

```
1. list = [0,1,2,3,4]
2. print("printing original list: ");
3. for i in list:
4.     print(i,end=" ")
5. list.remove(2)
6. print("\nprinting the list after the removal of first element...")
7. for i in list:
8.     print(i,end=" ")
```

Output:

```
printing original list:
0 1 2 3 4
printing the list after the removal of first element...
0 1 3 4
```

Python List Built-in functions

Python provides the following built-in functions, which can be used with the lists.

SN	Function	Description	Example
1	cmp(list1, list2)	It compares the elements of both the lists.	This method is not used in the Python 3 and the above versions.
2	len(list)	It is used to calculate the length of the list.	L1 = [1,2,3,4,5,6,7,8] print(len(L1)) 8
3	max(list)	It returns the maximum element of the list.	L1 = [12,34,26,48,72] print(max(L1)) 72
4	min(list)	It returns the minimum element of the list.	L1 = [12,34,26,48,72] print(min(L1)) 12
5	list(seq)	It converts any sequence to the list.	str = "Johnson" s = list(str)

			print(type(s)) <class list>

Let's have a look at the few list examples.

Example: 1- Write the program to remove the duplicate element of the list.

```
list1 = [1,2,2,3,55,98,65,65,13,29]
# Declare an empty list that will store unique values
list2 = []
for i in list1:
    if i not in list2:
        list2.append(i)
print(list2)
```

Output:

```
[1, 2, 3, 55, 98, 65, 13, 29]
```

Example:2- Write a program to find the sum of the element in the list.

```
list1 = [3,4,5,9,10,12,24]
sum = 0
for i in list1:
    sum = sum+i
print("The sum is:",sum)
```

Output:

```
The sum is: 67
```

Example: 3- Write the program to find the lists consist of at least one common element.

```
list1 = [1,2,3,4,5,6]
list2 = [7,8,9,2,10]
for x in list1:
    for y in list2:
        if x == y:
            print("The common element is:",x)
```

Output:

```
The common element is: 2
```

Python Tuple

Python Tuple is used to store the sequence of immutable Python objects. The tuple is similar to lists since the value of the items stored in the list can be changed, whereas the tuple is immutable, and the value of the items stored in the tuple cannot be changed.

Creating a tuple

A tuple can be written as the collection of comma-separated (,) values enclosed with the small () brackets. The parentheses are optional but it is good practice to use. A tuple can be defined as follows.

```
1. T1 = (101, "Peter", 22)
2. T2 = ("Apple", "Banana", "Orange")
3. T3 = 10,20,30,40,50
4. print(type(T1))
5. print(type(T2))
6. print(type(T3))
```

Output:

```
<class 'tuple'>
<class 'tuple'>
<class 'tuple'>
```

Note: The tuple which is created without using parentheses is also known as tuple packing.

An empty tuple can be created as follows.

Difference between JDK, JRE, and JVM

```
T4 = ()
```

Creating a tuple with single element is slightly different. We will need to put comma after the element to declare the tuple.

```
1. tup1 = ("JavaTpoint")
2. print(type(tup1))
3. #Creating a tuple with single element
4. tup2 = ("JavaTpoint",)
5. print(type(tup2))
```

Output:

```
<class 'str'>
<class 'tuple'>
```

A tuple is indexed in the same way as the lists. The items in the tuple can be accessed by using their specific index value.

Consider the following example of tuple:

Example - 1

```
1. tuple1 = (10, 20, 30, 40, 50, 60)
2. print(tuple1)
3. count = 0
4. for i in tuple1:
5.     print("tuple1[%d] = %d"%(count, i))
```

```
6.      count = count+1
```

Output:

```
(10, 20, 30, 40, 50, 60)
tuple1[0] = 10
tuple1[1] = 20
tuple1[2] = 30
tuple1[3] = 40
tuple1[4] = 50
tuple1[5] = 60
```

Example - 2

```
1. tuple1 = tuple(input("Enter the tuple elements ..."))
2. print(tuple1)
3. count = 0
4. for i in tuple1:
5.     print("tuple1[%d] = %s"%(count, i))
6.     count = count+1
```

Output:

```
Enter the tuple elements ...123456
('1', '2', '3', '4', '5', '6')
tuple1[0] = 1
tuple1[1] = 2
tuple1[2] = 3
tuple1[3] = 4
tuple1[4] = 5
tuple1[5] = 6
```

A tuple is indexed in the same way as the lists. The items in the tuple can be accessed by using their specific index value.

We will see all these aspects of tuple in this section of the tutorial.

Tuple indexing and slicing

The indexing and slicing in the tuple are similar to lists. The indexing in the tuple starts from 0 and goes to length(tuple) - 1.

The items in the tuple can be accessed by using the index [] operator. Python also allows us to use the colon operator to access multiple items in the tuple.

Consider the following image to understand the indexing and slicing in detail.

Tuple = (0, 1, 2, 3, 4, 5)

0	1	2	3	4	5

Tuple[0] = 0

Tuple[1] = 1

Tuple[2] = 2

Tuple[3] = 3

Tuple[4] = 4

Tuple[5] = 5

Tuple[0:] = (0, 1, 2, 3, 4, 5)

Tuple[:] = (0, 1, 2, 3, 4, 5)

Tuple[2:4] = (2, 3)

Tuple[1:3] = (1, 2)

Tuple[:4] = (0, 1, 2, 3)

Consider the following example:

```
1. tup = (1,2,3,4,5,6,7)
2. print(tup[0])
3. print(tup[1])
4. print(tup[2])
5. # It will give the IndexError
6. print(tup[8])
```

Output:

```
1
2
3
tuple index out of range
```

In the above code, the tuple has 7 elements which denote 0 to 6. We tried to access an element outside of tuple that raised an **IndexError**.

```
1. tuple = (1,2,3,4,5,6,7)
2. #element 1 to end
3. print(tuple[1:])
4. #element 0 to 3 element
5. print(tuple[:4])
6. #element 1 to 4 element
7. print(tuple[1:5])
8. # element 0 to 6 and take step of 2
9. print(tuple[0:6:2])
```

Output:

```
(2, 3, 4, 5, 6, 7)
(1, 2, 3, 4)
```

```
(1, 2, 3, 4)
(1, 3, 5)
```

Negative Indexing

The tuple element can also access by using negative indexing. The index of -1 denotes the rightmost element and -2 to the second last item and so on.

The elements from left to right are traversed using the negative indexing. Consider the following example:

```
1. tuple1 = (1, 2, 3, 4, 5)
2. print(tuple1[-1])
3. print(tuple1[-4])
4. print(tuple1[-3:-1])
5. print(tuple1[:-1])
6. print(tuple1[-2:])
```

Output:

```
5
2
(3, 4)
(1, 2, 3, 4)
(4, 5)
```

Deleting Tuple

Unlike lists, the tuple items cannot be deleted by using the **del** keyword as tuples are immutable. To delete an entire tuple, we can use the **del** keyword with the tuple name.

Consider the following example.

```
1. tuple1 = (1, 2, 3, 4, 5, 6)
2. print(tuple1)
3. del tuple1[0]
4. print(tuple1)
5. del tuple1
6. print(tuple1)
```

Output:

```
(1, 2, 3, 4, 5, 6)
Traceback (most recent call last):
  File "tuple.py", line 4, in <module>
    print(tuple1)
NameError: name 'tuple1' is not defined
```

Basic Tuple operations

The operators like concatenation (+), repetition (*), Membership (in) works in the same way as they work with the list. Consider the following table for more detail.

Let's say Tuple t = (1, 2, 3, 4, 5) and Tuple t1 = (6, 7, 8, 9) are declared.

Operator	Description	Example
Repetition	The repetition operator enables the tuple elements to be repeated multiple times.	T1*2 = (1, 2, 3, 4, 5, 1, 2, 3, 4, 5)
Concatenation	It concatenates the tuple mentioned on either side of the operator.	T1+T2 = (1, 2, 3, 4, 5, 6, 7, 8, 9)
Membership	It returns true if a particular item exists in the tuple otherwise false	print (2 in T1) prints True.
Iteration	The for loop is used to iterate over the tuple elements.	for i in T1: print(i) **Output** 1 2 3 4 5
Length	It is used to get the length of the tuple.	len(T1) = 5

Python Tuple inbuilt functions

SN	Function	Description
1	cmp(tuple1, tuple2)	It compares two tuples and returns true if tuple1 is greater than tuple2 otherwise false.
2	len(tuple)	It calculates the length of the tuple.
3	max(tuple)	It returns the maximum element of the tuple
4	min(tuple)	It returns the minimum element of the tuple.
5	tuple(seq)	It converts the specified sequence to the tuple.

Where use tuple?

Using tuple instead of list is used in the following scenario.

1. Using tuple instead of list gives us a clear idea that tuple data is constant and must not be changed.

2. Tuple can simulate a dictionary without keys. Consider the following nested structure, which can be used as a dictionary.

1. [(101, "John", 22), (102, "Mike", 28), (103, "Dustin", 30)]

List vs. Tuple

SN	List	Tuple
1	The literal syntax of list is shown by the [].	The literal syntax of the tuple is shown by the ().
2	The List is mutable.	The tuple is immutable.
3	The List has the a variable length.	The tuple has the fixed length.
4	The list provides more functionality than a tuple.	The tuple provides less functionality than the list.
5	The list is used in the scenario in which we need to store the simple collections with no constraints where the value of the items can be changed.	The tuple is used in the cases where we need to store the read-only collections i.e., the value of the items cannot be changed. It can be used as the key inside the dictionary.
6	The lists are less memory efficient than a tuple.	The tuples are more memory efficient because of its immutability.

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