Python List

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In this tutorial, we'll learn everything about Python lists, how they are created, slicing of a list, adding or removing elements from them and so on.

Python offers a range of compound data types often referred to as sequences. List is one of the most frequently used and very versatile data types used in Python.

How to create a list?

In Python programming, a list is created by placing all the items (elements) inside square brackets `[]`, separated by commas.

It can have any number of items and they may be of different types (integer, float, string etc.).

```
# empty list
my_list = []

# list of integers
my_list = [1, 2, 3]

# list with mixed data types
my_list = [1, "Hello", 3.4]
```

A list can also have another list as an item. This is called a nested list.

```
# nested list
my_list = ["mouse", [8, 4, 6], ['a']]
```

Access List Elements

There are various ways in which we can access the elements of a list.

List Index

We can use the index operator `[]` to access an item in a list. In Python, indices start at 0. So, a list having 5 elements will have an index from 0 to 4.

Trying to access indexes other than these will raise an `IndexError`. The index must be an integer. We can't use float or other types, this will result in `TypeError`.

Nested lists are accessed using nested indexing.

```
# List indexing

my_list = ['p', 'r', 'o', 'b', 'e']

# Output: p
print(my_list[0])

# Output: o
print(my_list[2])

# Output: e
print(my_list[4])

# Nested List
n_list = ["Happy", [2, 0, 1, 5]]

# Nested indexing
print(n_list[0][1])

print(n_list[1][3])

# Error! Only integer can be used for indexing
print(my_list[4.0])
```

Output

```
p
o
e
a
5
Traceback (most recent call last):
  File "<string>", line 21, in <module>
TypeError: list indices must be integers or slices, not float
```

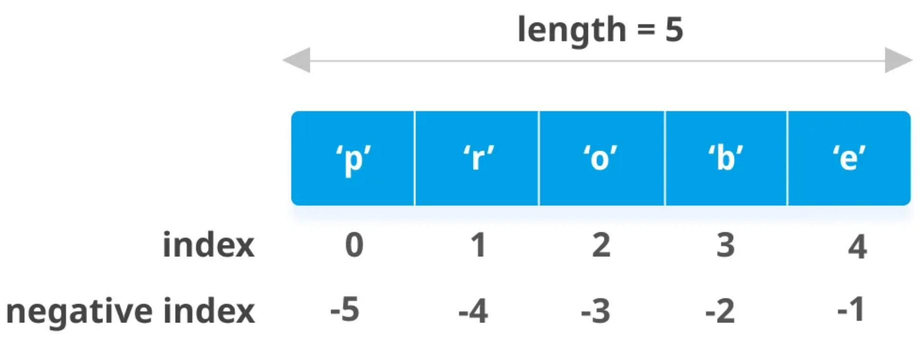
Negative indexing

Python allows negative indexing for its sequences. The index of -1 refers to the last item, -2 to the second last item and so on.

```
# Negative indexing in lists
my_list = ['p','r','o','b','e']

print(my_list[-1])

print(my_list[-5])
```

When we run the above program, we will get the following output:

```
e
p
```



List indexing in Python

How to slice lists in Python?

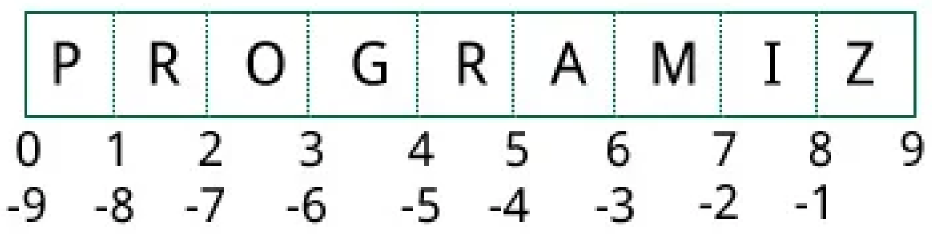
We can access a range of items in a list by using the slicing operator `:` (colon).

```
# List slicing in Python

my_list = ['p','r','o','g','r','a','m','i','z']

# elements 3rd to 5th
print(my_list[2:5])

# elements beginning to 4th
print(my_list[:-5])

# elements 6th to end
print(my_list[5:])

# elements beginning to end
print(my_list[:])
```

Output

```
['o', 'g', 'r']
['p', 'r', 'o', 'g']
['a', 'm', 'i', 'z']
['p', 'r', 'o', 'g', 'r', 'a', 'm', 'i', 'z']
```

Slicing can be best visualized by considering the index to be between the elements as shown below. So if we want to access a range, we need two indices that will slice that portion from the list.



Element Slicing from a list in Python

Add/Change List Elements

Lists are mutable, meaning their elements can be changed unlike string or tuple.

We can use the assignment operator `=` to change an item or a range of items.

```
# Correcting mistake values in a list
odd = [2, 4, 6, 8]

# change the 1st item
odd[0] = 1

print(odd)

# change 2nd to 4th items
odd[1:4] = [3, 5, 7]

print(odd)
```

Output

```
[1, 4, 6, 8]
[1, 3, 5, 7]
```

We can add one item to a list using the `append()` method or add several items using `extend()` method.

```
# Appending and Extending lists in Python
odd = [1, 3, 5]

odd.append(7)

print(odd)

odd.extend([9, 11, 13])

print(odd)
```

Output

```
[1, 3, 5, 7]
[1, 3, 5, 7, 9, 11, 13]
```

We can also use `+` operator to combine two lists. This is also called concatenation.

The `*` operator repeats a list for the given number of times.

```
# Concatenating and repeating lists
odd = [1, 3, 5]

print(odd + [9, 7, 5])

print(["re"] * 3)
```

Output

```
[1, 3, 5, 9, 7, 5]
['re', 're', 're']
```

Furthermore, we can insert one item at a desired location by using the method `insert()` or insert multiple items by squeezing it into an empty slice of a list.

```
# Demonstration of list insert() method
odd = [1, 9]
odd.insert(1,3)

print(odd)

odd[2:2] = [5, 7]

print(odd)
```

Output

```
[1, 3, 9]
[1, 3, 5, 7, 9]
```

Delete/Remove List Elements

We can delete one or more items from a list using the keyword `del`. It can even delete the list entirely.

```
# Deleting list items
my_list = ['p', 'r', 'o', 'b', 'l', 'e', 'm']

# delete one item
del my_list[2]

print(my_list)

# delete multiple items
del my_list[1:5]

print(my_list)

# delete entire list
del my_list

# Error: List not defined
print(my_list)
```

Output

```
['p', 'r', 'b', 'l', 'e', 'm']
['p', 'm']
Traceback (most recent call last):
  File "<string>", line 18, in <module>
NameError: name 'my_list' is not defined
```

We can use `remove()` method to remove the given item or `pop()` method to remove an item at the given index.

The `pop()` method removes and returns the last item if the index is not provided. This helps us implement lists as stacks (first in, last out data structure).

We can also use the `clear()` method to empty a list.

```
my_list = ['p','r','o','b','l','e','m']
my_list.remove('p')

# Output: ['r', 'o', 'b', 'l', 'e', 'm']
print(my_list)

# Output: 'o'
print(my_list.pop(1))

# Output: ['r', 'b', 'l', 'e', 'm']
print(my_list)

# Output: 'm'
print(my_list.pop())

# Output: ['r', 'b', 'l', 'e']
print(my_list)

my_list.clear()

# Output: []
print(my_list)
```

Output

```
['r', 'o', 'b', 'l', 'e', 'm']
o
['r', 'b', 'l', 'e', 'm']
m
['r', 'b', 'l', 'e']
[]
```

Finally, we can also delete items in a list by assigning an empty list to a slice of elements.

```
>>> my_list = ['p','r','o','b','l','e','m']
>>> my_list[2:3] = []
>>> my_list
['p', 'r', 'b', 'l', 'e', 'm']
>>> my_list[2:5] = []
>>> my_list
['p', 'r', 'm']
```

Python List Methods

Methods that are available with list objects in Python programming are tabulated below.

They are accessed as `list.method()`. Some of the methods have already been used above.

Python List Methods
append() - Add an element to the end of the list
extend() - Add all elements of a list to the another list
insert() - Insert an item at the defined index
remove() - Removes an item from the list
pop() - Removes and returns an element at the given index
clear() - Removes all items from the list
index() - Returns the index of the first matched item
count() - Returns the count of the number of items passed as an argument
sort() - Sort items in a list in ascending order
reverse() - Reverse the order of items in the list
copy() - Returns a shallow copy of the list

Some examples of Python list methods:

```
# Python list methods
my_list = [3, 8, 1, 6, 0, 8, 4]

# Output: 1
print(my_list.index(8))

# Output: 2
print(my_list.count(8))

my_list.sort()

# Output: [0, 1, 3, 4, 6, 8, 8]
print(my_list)

my_list.reverse()

# Output: [8, 8, 6, 4, 3, 1, 0]
print(my_list)
```

Output

```
1
2
[0, 1, 3, 4, 6, 8, 8]
[8, 8, 6, 4, 3, 1, 0]
```

List Comprehension: Elegant way to create Lists

List comprehension is an elegant and concise way to create a new list from an existing list in Python.

A list comprehension consists of an expression followed by for statement inside square brackets.

Here is an example to make a list with each item being increasing power of 2.

```
pow2 = [2 ** x for x in range(10)]
print(pow2)
```

Output

```
[1, 2, 4, 8, 16, 32, 64, 128, 256, 512]
```

This code is equivalent to:

```
pow2 = []
for x in range(10):
   pow2.append(2 ** x)
```

A list comprehension can optionally contain more `for` or if statements. An optional `if` statement can filter out items for the new list. Here are some examples.

```
>>> pow2 = [2 ** x for x in range(10) if x > 5]
>>> pow2
[64, 128, 256, 512]
>>> odd = [x for x in range(20) if x % 2 == 1]
>>> odd
[1, 3, 5, 7, 9, 11, 13, 15, 17, 19]
>>> [x+y for x in ['Python ','C '] for y in ['Language','Programming']]
['Python Language', 'Python Programming', 'C Language', 'C Programming']
```

Other List Operations in Python

List Membership Test

We can test if an item exists in a list or not, using the keyword `in`.

```
my_list = ['p', 'r', 'o', 'b', 'l', 'e', 'm']

# Output: True
print('p' in my_list)

# Output: False
print('a' in my_list)

# Output: True
print('c' not in my_list)
```

Output

```
True
False
True
```

Iterating Through a List

Using a `for` loop we can iterate through each item in a list.

```
for fruit in ['apple','banana','mango']:
    print("I like",fruit)
```

Output

```
I like apple
I like banana
I like mango
```