

Practice work 6 Working with lists. Operations on lists Python

Objective: Exploring one-dimensional arrays in Python.

Arrays (lists) in Python are a certain number of elements of the same type that have a common name, and each element has its own index - a serial number.

Often, lists are used to work with arrays.

List (list) is a data structure for storing objects of various types.

Lists are ordered sequences that consist of different types of data, enclosed in square brackets [] and separated from each other by a comma.

Creating lists in Python.

There are several ways to create a list

1. Obtaining a list by assigning specific values.

This is what an empty list looks like in Python code:

```
s = [] # Empty list
```

Examples of creating lists with values:

```
l=[5,75,-4,7,-51] # список целых чисел
l=[1.13,5.34,12.63,4.6,34.0,12.8] # список из вещественных чисел
l=["Оля", "Владимир", "Михаил", "Дарья"] # список из строк
l=["Москва", "Иванов", 12, 124] # смешанный список
l=[[0, 0, 0], [1, 0, 1], [1, 1, 0]] # список, состоящий из списков
l=['s', 'p', ['isok'], 2] # список из значений и списка
```

Lists can be added (concatenated) using the "+" sign:

```
l=[1, 3]+[4,23]+[5]
print('l=[1, 3]+[4,23]+[5] =',l)
```

Result:

```
>>>
l=[1, 3]+[4,23]+[5] = [1, 3, 4, 23, 5]
>>> |
```

2. Creating a list using the Split() function.

Using the split function in Python, you can get a list from a string. stroka ="Hello country"

```
lst=stroka.split(",")
```

```
stroka = "Здравствуй, Дедушка Мороз" #stroka - строка
lst=stroka.split(",") #lst - список
print('stroka = ',stroka)
print('lst=stroka.split(","):',lst)
```

Result:

```
===== RESTART: C:/Users/maxim/Desktop/ex_list_
stroka = Здравствуй, Дедушка Мороз
lst=stroka.split(","): ['Здравствуй', ' Дедушка Мороз']
```

3. List generators.

In Python, you can also create a list using generators.

First way.

Addition of identical lists is replaced by multiplication:

List of 10 items filled with ones l = [1]*10

The second way.

Example 1

```
l = [i for i in range(10)]
```

Example 2

```
c = [c * 3 for c in 'list']
print (c) # ['lll', 'iii', 'sss', 'ttt']
```

```

Создание списка из строки.
l = list (строка):
['c', 'т', 'р', 'о', 'к', 'а']

Создание списка при помощи функции Split().
stroka=" Hello, friend "
lst=stroka.split(","):
['Hello', ' friend']

Генераторы списков.
Первый способ.
l = [1]*10:
[1, 1, 1, 1, 1, 1, 1, 1, 1, 1]

Второй способ. Пример 1.
l = [i for i in range(10)]:
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

Второй способ. Пример 2.
c=[c*3 for c in "list"]:
['lll', 'iii', 'sss', 'ttt']

```

Examples of using list generators. Example 1

Fill the list with squares of numbers from 0 to 9 using the list generator. Solution:

```
l = [i*i for i in range(10)]
```

Example 2

Fill the list with numbers, where each subsequent number is greater than 2. $l = [(i+1)+i \text{ for } i \text{ in range}(10)]$

```
print(l)
```

```

Заполнить список квадратами чисел от 0 до 9, используя генератор списка.
l = [i*i for i in range(10)]:
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]

Заполнить список числами, где каждое последующее число больше на 2.
l = [(i+1)+i for i in range(10)]:
[1, 3, 5, 7, 9, 11, 13, 15, 17, 19]

```

The random module provides functions for generating random numbers, letters, random selection of sequence elements.

random.randint(A, B) - random integer N , $A \leq N \leq B$. random.random()

- random number between 0 and 1.

Random numbers in the list:

10 randomly generated numbers in the range (10,80) from random import randint

```
l = [randint(10,80) for x in range(10)]
```

10 numbers randomly generated in the range (0,1) `l = [random() for i in range(10)]`

```
from random import *
l = [randint(10,80) for i in range(10)]
print('10 чисел, сгенерированных случайным образом в диапазоне (10,80).')
print('l = [randint(10,80) for x in range(10)]:')
print(l)
print()

l = [random() for i in range(10)]
print('10 чисел сгенерированных в диапазоне от 0 до 1.')
print('l = [random() for i in range(10)]:')
for i in range(len(l)):
    print ('{:.2f}'.format(l[i]), end = " ")

10 чисел, сгенерированных случайным образом в диапазоне (10,80).
l = [randint(10,80) for x in range(10)]:
[70, 33, 79, 61, 34, 27, 11, 55, 52, 31]

10 чисел сгенерированных в диапазоне от 0 до 1.
l = [random() for i in range(10):
0.66 0.97 0.87 0.57 0.54 0.83 0.57 0.65 0.04 0.07
```

4. List (array) input in Python.

To enter the elements of a list, use the for loop and the range() command: for i in range(N):

```
x[i] = int( input() )
```

An easier way to enter a list:

```
x = [ int(input()) for i in range(N) ]
```

```
print('Ввод списка. Пример 1:')
x=[]
for i in range(4):
    x.append(int(input()))
print(x)

x=[]
print('Ввод списка. Пример 2:')
x = [ int(input()) for i in range(4) ]
print(x)
```

```

Ввод списка. Пример 1:
45
4
85
2
[45, 4, 85, 2]
Ввод списка. Пример 2:
4
5
7
8
[4, 5, 7, 8]

```

The int function is used here to convert the string entered by the user to integers.

5. Outputting a list (array) in Python. Output of a whole list (array):

```
print(L)
```

Element-by-element output of a list (array):

```
for i in range(N):
```

```
print ( L[i], end = " " )
```

```

'''
Вывод целого списка (массива)
[1, 56, 6, 3, 6, 7, 3, 37, 7, 37, 37]

Позлементный вывод списка (массива)
1 56 6 3 6 7 3 37 7 37 37
'''

```

2. List methods.

| Method | What is he doing |
|---|---|
| list.append(x) | Adds an element to the end of the list |
| list.extend(L) | Extends list , adding all elements to the end list L |
| list.insert(i, x) | Inserts x value before i-th element |
| list.remove(x) | Removes the first element in the list that has the value x. ValueError if no such element exists |
| list.pop([i]) | Removes the i-th element and returns it. If index not specified, the last element is removed |
| list.index(x, [start [, end]]) | Returns the position of the first element with value x (while searching from start to end) |

| | |
|-----------------------|---|
| list.count(x) | Returns the number of elements with value x |
| list.reverse() | Expands the list |
| list.copy() | Shallow copy of the list |
| list.clear() | Clears the list |

Below is a program that demonstrates how lists work.

```

a=[0,2,2,2,4] #список a
b=[5,6,7,2,9] #список b
print('Исходный список a:',a)
print('Исходный список b:',b)
x=99
y=5

a.append(x)
print('a.append(x):',a)

a.extend(b)
print('a.extend(b):',a)

a.insert(3,x)
print('a.insert(3,x):',a)

a.remove(x)
print('a.remove(x):',a)

print('a.pop(5):',a.pop(5))
print(a)

print('a.index(y,0,len(a)):',a.index(y,0,len(a)))

print('a.count(2):',a.count(2))

a.reverse()
print('a.reverse():',a)

z=a.copy()
print('z=a.copy():',z)

z.clear()
print('z.clear():')
print('z =',z)

```

Python Program Example

```

Исходный список a: [0, 2, 2, 2, 4]
Исходный список b: [5, 6, 7, 2, 9]
a.append(x): [0, 2, 2, 2, 4, 99]
a.extend(b): [0, 2, 2, 2, 4, 99, 5, 6, 7, 2, 9]
a.insert(3,x): [0, 2, 2, 99, 2, 4, 99, 5, 6, 7, 2, 9]
a.remove(x): [0, 2, 2, 2, 4, 99, 5, 6, 7, 2, 9]
a.pop(5): 99
[0, 2, 2, 2, 4, 5, 6, 7, 2, 9]
a.index(y,0,len(a)): 5
a.count(2): 4
a.reverse(): [9, 2, 7, 6, 5, 4, 2, 2, 2, 0]
z=a.copy(): [9, 2, 7, 6, 5, 4, 2, 2, 2, 0]
z.clear():
z = []

```

The result of the program execution

Task 0

1. From an array X of length n, among the elements of which there are positive, negative and equal to zero, form a new array Y, taking into it only those elements from X that are greater in modulus of the given number M. Display the number M, given and received arrays.

Solution:

```

n=int(input('Введите длину массива\n'))
m=int(input('Введите число M\n'))
x=[]
y=[]
for i in range(n):
    print('Введите ',i,'элемент:')
    x.append(int(input()))
for i in range(n):
    if abs(x[i])>m:
        y.append(x[i])
print('Введённое число M:',m)
print('Массив X:',x)
print('Массив Y:',y)

```

```

Введите длину массива
5
Введите число M
20
Введите 0 элемент:
21
Введите 1 элемент:
22
Введите 2 элемент:
5
Введите 3 элемент:
6
Введите 4 элемент:
8
Введённое число M: 20
Массив X: [21, 22, 5, 6, 8]
Массив Y: [21, 22]

```

2. In an array of integers, replace all negative elements with positive ones. Output the original array and the resulting one.

Solution:

```

n=int(input('Введите длину массива:'))
a=[]
for i in range(n):
    print('Введите',i,'элемент:')
    a.append(int(input()))
print('Исходный массив:',a)
for i in range(n):
    if a[i]<0:
        a[i]=-a[i]
print('Полученный массив:',a)

```

```

Введите длину массива:5
Введите 0 элемент:
-5
Введите 1 элемент:
-4
Введите 2 элемент:
-6
Введите 3 элемент:
5
Введите 4 элемент:
-7
Исходный массив: [-5, -4, -6, 5, -7]
Полученный массив: [5, 4, 6, 5, 7]

```

Independent work

Task 1

1. Given a one-dimensional array consisting of N integer elements. Enter an array from the keyboard. Find the maximum element. Display array on screen

reverse order.

2. In an array of real numbers, replace all zero elements with the arithmetic mean of all elements of the array.

Task 2

1. Given a one-dimensional array consisting of N integer elements. Enter an array from the keyboard. Find the minimum element. Display the index of the minimum element on the screen.

2. Given an array of integers. Rewrite all positive elements in the second array, and the rest - in the third.

Task 3

1. In a one-dimensional numeric array D of length n, calculate the sum of elements with odd indices. Display the array D, the resulting amount.

2. Given a one-dimensional array of 8 elements. Replace all array elements less than 15 with twice their values. Display the converted array on the monitor screen.

Task 4

1. Given an array of integers. Find the maximum element of the array and its ordinal number.

2. Given a one-dimensional array of integer type. Get another array consisting only of odd numbers in the original array, or report that there are no such numbers. Output the resulting array in descending order of elements.

Task 5

1. Given a one-dimensional array of 10 integers. Print pairs of negative numbers next to each other.

2. Given an integer array of size 10. Create a new array by deleting all identical elements, leaving them 1 time.

Task 6

1. Given a one-dimensional array of 10 integers. Find the maximum element and compare other elements with it. Output the number of less than the maximum and greater than the maximum element.

2. Fill in a one-dimensional array of 10 integers from the keyboard, determine the sum of those numbers that are >5 .

Task 7

1. Given an array of integers. Find the sum of elements with even numbers and the product of elements with odd numbers. Withdraw the amount and

work.

2. Swap the minimum element and the maximum element in a one-dimensional array.

Task 8

1. Find the sum and product of the elements of the list. Display the results on the screen.
2. In an array of real numbers, replace all zero elements with the arithmetic mean of all elements of the array.

Task 9

1. Given a one-dimensional array consisting of N real elements. Enter an array from the keyboard. Find and display the minimum modulo element. Display the array in reverse order.
2. Given arrays A and B of the same size 10. Print the original arrays. Swap their contents and print the elements of the transformed array A first, and then the elements of the transformed array B.

Task 10

1. Determine if there are duplicate elements in the list, if so, display this value, otherwise a message about their absence.
2. Given a one-dimensional array of 15 elements. Array elements less than 10 are assigned zero values, and elements greater than 20 are assigned 1. Display the original and converted arrays in a line on the monitor screen.

Task 11

- 1 Find the largest element of the list that is divisible by 2 without a remainder and display it on the screen.
2. Given a one-dimensional array of integer type. Get another array consisting only of even numbers of the original array less than 10, or report that there are no such numbers. Output the resulting array in ascending order of elements.

Task 12

1. Find the smallest odd element in the list and display it on the screen.
2. Given arrays A and B of the same size 10. Swap their contents and output first the elements of the transformed array A, and then
— elements of the converted array B.

Task 13

1. Given a one-dimensional array of integers. Check if it contains the same elements. Print these elements and their indices.
2. Given a one-dimensional array of 8 elements. Replace all elements of an array

less than 15 by their doubled values. Display the converted array on the monitor screen.

Task 14

1. Find the maximum element of a numerical array and swap it with the minimum.
2. The program fills a one-dimensional array of 10 integers with numbers read from the keyboard. Determine the arithmetic mean of all numbers in the array. Replace array elements greater than the arithmetic mean by 1.

Task 15

1. Determine if there are duplicate elements in the list, if so, display these values.
2. Given a one-dimensional array of integer type. Get another array consisting only of odd numbers in the original array, or report that there are no such numbers. Output the resulting array in descending order of elements.