

Python内置数据结构

讲师：Wayne

从业十余载，漫漫求知路

元组tuple

- 一个有序的元素组成的集合
- 使用小括号 () 表示
- 元组是**不可变**对象

元组的定义 初始化

□ 定义

- `tuple()` -> empty tuple

- `tuple(iterable)` -> tuple initialized from iterable's items

`t = tuple()` # 工厂方法

`t = ()`

`t = tuple(range(1,7,2))` # iterable

`t = (2,4,6,3,4,2)`

`t = (1,)` # 一个元素元组的定义，注意有个逗号

`t = (1,)*5`

`t = (1,2,3) * 6`

元组元素的访问

- 支持索引（下标）
 - 正索引：从左至右，从0开始，为列表中每一个元素编号
 - 负索引：从右至左，从-1开始
 - 正负索引不可以超界，否则引发异常IndexError
-
- 元组通过索引访问
 - `tuple[index]`，index就是索引，使用中括号访问

`t[1]`

`t[-2]`

`t[1] = 5`

元组查询

- ❑ `index(value,[start,[stop]])`
 - ❑ 通过值value，从指定区间查找列表内的元素是否匹配
 - ❑ 匹配第一个就立即返回索引
 - ❑ 匹配不到，抛出异常ValueError
- ❑ `count(value)`
 - ❑ 返回列表中匹配value的次数
- ❑ 时间复杂度
 - ❑ `index`和`count`方法都是 $O(n)$
 - ❑ 随着列表数据规模的增大，而效率下降
- ❑ `len(tuple)`
 - ❑ 返回元素的个数

元组其它操作

- 元组是只读的，所以增、改、删方法都没有

命名元组namedtuple

- ▣ 帮助文档中，查阅namedtuple，有使用例程
- ▣ namedtuple(typename, field_names, verbose=False, rename=False)
 - ▣ 命名元组，返回一个元组的子类，并定义了字段
 - ▣ field_names可以是空白符或逗号分割的字段的字符串，可以是字段的列表

```
from collections import namedtuple
```

```
Point = namedtuple('_Point',['x','y']) # Point为返回的类
```

```
p = Point(11, 22)
```

```
Student = namedtuple('Student', 'name age')
```

```
tom = Student('tom', 20)
```

```
jerry = Student('jerry', 18)
```

```
tom.name
```

练习

- 依次接收用户输入的3个数，排序后打印
 1. 转换int后，判断大小排序。使用分支结构完成
 2. 使用max函数
 3. 使用列表的sort方法
 4. 冒泡法

冒泡法

□ 冒泡法

- 属于交换排序
- 两两比较大小，交换位置。如同水泡咕嘟咕嘟往上冒
- 结果分为升序和降序排列

□ 升序

- n 个数从左至右，编号从0开始到 $n-1$ ，索引0和1的值比较，如果索引0大，则交换两者位置，如果索引1大，则不交换。继续比较索引1和2的值，将大值放在右侧。直至 $n-2$ 和 $n-1$ 比较完，第一轮比较完成。第二轮从索引0比较到 $n-2$ ，因为最右侧 $n-1$ 位置上已经是最大值了。依次类推，每一轮都会减少最右侧的不参与比较，直至剩下最后2个数比较。

□ 降序

- 和升序相反

冒泡法

□ 初始

1	9	8	5	6	7	4	3	2
---	---	---	---	---	---	---	---	---

□ 第一趟

1	8	9	5	6	7	4	3	2
---	---	---	---	---	---	---	---	---

1	8	5	9	6	7	4	3	2
---	---	---	---	---	---	---	---	---

1	8	5	6	9	7	4	3	2
---	---	---	---	---	---	---	---	---

1	8	5	6	7	9	4	3	2
---	---	---	---	---	---	---	---	---

1	8	5	6	7	4	9	3	2
---	---	---	---	---	---	---	---	---

1	8	5	6	7	4	3	9	2
---	---	---	---	---	---	---	---	---

1	8	5	6	7	4	3	2	9
---	---	---	---	---	---	---	---	---

□ 第二趟

1	8	5	6	7	4	3	2	9
---	---	---	---	---	---	---	---	---

1	5	8	6	7	4	3	2	9
---	---	---	---	---	---	---	---	---

1	5	6	8	7	4	3	2	9
---	---	---	---	---	---	---	---	---

1	5	6	7	8	4	3	2	9
---	---	---	---	---	---	---	---	---

1	5	6	7	4	8	3	2	9
---	---	---	---	---	---	---	---	---

1	5	6	7	4	3	8	2	9
---	---	---	---	---	---	---	---	---

1	5	6	7	4	3	2	8	9
---	---	---	---	---	---	---	---	---

□ 第三趟

1	5	6	7	4	3	2	8	9
---	---	---	---	---	---	---	---	---

1	5	6	4	7	3	2	8	9
---	---	---	---	---	---	---	---	---

1	5	6	4	3	7	2	8	9
---	---	---	---	---	---	---	---	---

1	5	6	4	3	2	7	8	9
---	---	---	---	---	---	---	---	---

□ 第四趟

1	5	6	4	3	2	7	8	9
---	---	---	---	---	---	---	---	---

1	5	4	6	3	2	7	8	9
---	---	---	---	---	---	---	---	---

1	5	4	3	6	2	7	8	9
---	---	---	---	---	---	---	---	---

1	5	4	3	2	6	7	8	9
---	---	---	---	---	---	---	---	---

冒泡法

□ 第五趟

1	5	4	3	2	6	7	8	9
---	---	---	---	---	---	---	---	---

1	4	5	3	2	6	7	8	9
---	---	---	---	---	---	---	---	---

1	4	3	5	2	6	7	8	9
---	---	---	---	---	---	---	---	---

1	4	3	2	5	6	7	8	9
---	---	---	---	---	---	---	---	---

□ 第六趟

1	4	3	2	5	6	7	8	9
---	---	---	---	---	---	---	---	---

1	3	4	2	5	6	7	8	9
---	---	---	---	---	---	---	---	---

1	3	2	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

□ 第七趟

1	3	2	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

□ 第八趟

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

冒泡法代码实现（一）

□ 简单冒泡实现

```
num_list = [  
    [1, 9, 8, 5, 6, 7, 4, 3, 2],  
    [1, 2, 3, 4, 5, 6, 7, 8, 9]  
]  
nums = num_list[1]  
print(nums)  
length = len(nums)  
count_swap = 0  
count = 0  
# bubble_sort  
for i in range(length):  
    for j in range(length-i-1):  
        count += 1  
        if nums[j] > nums[j+1]:  
            tmp = nums[j]  
            nums[j] = nums[j+1]  
            nums[j+1] = tmp  
            count_swap += 1  
print(nums, count_swap, count)
```

冒泡法代码实现（二）

□ 优化实现

左边有问题

右边正确

```
num_list = [
    [1, 9, 8, 5, 6, 7, 4, 3, 2],
    [1, 2, 3, 4, 5, 6, 7, 8, 9]
]
nums = num_list[0]
print(nums)
length = len(nums)
flag = False
count_swap = 0
count = 0
# bubble_sort
for i in range(length):
    for j in range(length-i-1):
        count += 1
        if nums[j] > nums[j+1]:
            tmp = nums[j]
            nums[j] = nums[j+1]
            nums[j+1] = tmp
            flag = True # swapped
            count_swap += 1
    if not flag:
        break
print(nums, count_swap, count)
```

```
num_list = [
    [1, 9, 8, 5, 6, 7, 4, 3, 2],
    [1, 2, 3, 4, 5, 6, 7, 8, 9],
    [1, 2, 3, 4, 5, 6, 7, 9, 8]
]
nums = num_list[2]
print(nums)
length = len(nums)
count_swap = 0
count = 0
# bubble_sort
for i in range(length):
    flag = False
    for j in range(length-i-1):
        count += 1
        if nums[j] > nums[j+1]:
            tmp = nums[j]
            nums[j] = nums[j+1]
            nums[j+1] = tmp
            flag = True # swapped
            count_swap += 1
    if not flag:
        break
print(nums, count_swap, count)
```

冒泡法总结

- 冒泡法需要数据一轮轮比较
- 可以设定一个标记判断此轮是否有数据交换发生，如果没有发生交换，可以结束排序，如果发生交换，继续下一轮排序
- 最差的排序情况是，初始顺序与目标顺序完全相反，遍历次数 $1, \dots, n-1$ 之和 $n(n-1)/2$
- 最好的排序情况是，初始顺序与目标顺序完全相同，遍历次数 $n-1$
- 时间复杂度 $O(n^2)$

谢谢

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