



程式設計概論 Programming 101

—list(串列) operation

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outline

- list(串列): like string
 - sequence type
- Functions in the list class

lists

- A *list* is an object that contains multiple data items.
- Each item that is stored in a list is called an *element*.
- Lists are dynamic data structures, meaning that items may be added to them or removed from them.
- Use indexing, slicing, and various methods to work with lists.
- Example: `even_numbers=[2,4,6,8,10]`

list (串列)

- How to create lists?
 - `list1=list()` #create an empty list
 - (or) `list1_new=[]` # create an empty list, too
 - `list2=list([1,2,3])` #create a list with three values (建立包含 1,2,3的串列)
 - `list3=list(range(5))` #建立包含 0,1,2,3,4的串列
 - `list4=list(range(10, -10,-2))` #建立包含 10, 8, 6, 4, 2, 0, -2, -4, -6, -8的串列
 - `list5=list("ABCDE")` #建立包含'A','B','C','D','E'的串列

list operation

- To access the individual elements in a list is with an *index*.
- Each element in a list has an index that specifies its position in the list.
- **Indexing starts at 0**, so the index of the first element is 0, the index of the second element is 1, and so forth.
- The index of the last element in a list is 1 less than the number of elements in the list.
 - `a1=["John",20, "male",179,60,"大二"]`
 - `print(a1[0])`
 - `print(a1[1])`
 - `print(a1[-1])`
 - `a1[1]=21`
 - `del a1[-1]`
 - `print(a1)`

List operation (cont.)

```
a1 = [12,43,9,13,45,79,21,12,44]
print(132 in a1)
print('13' not in a1)
print(a1[4:7]) # a1[4] 開始取到 a1[7-1]，或者說 a1[4] 開始取 (7-4) 個元素
print(a1[3:8:2]) # a1[3] 開始取到 a1[8-1]，每 2 個取 1 個
print(len(a1)) # list 長度
# Each element is a number
print(min(a1))
print(max(a1))
print(sum(a1))
```

practice

- $A=[1,3,6,-13,5,67,-8]$
 - 求list A 最大值和最小值
 - 取出list A 中第五個數值
 - 在list A 刪除第三個數值
 - 在list A 第四個數值變成 100

List operation

- + symbol: `[1,2,3]+["Taipei","Tokyo","Vienna"]`
- * symbol: `3*[1,2,3] = [1,2,3]*3`
- comparion: `>, <, >=, <=, ==, !=`
 - `[1,2,3] != [1,2,3,4] # True`
 - `[1,"Hello", "Python"] == ["Hello","Python",1] #False`
 - `['a','A'] < ['a','B'] #True`
- slicing: `[start:end:step]`
 - 記得不包含end的數值(i.e., 也就是只包含end的前一個數值)

Functions in list class

```
x1=[0,1,2,3,4,5,3,-3,3.2,3]
```

```
x1.append(100) #新增一筆資料於list中最後一筆
```

```
x1.sort()
```

```
x1.count(3)
```

```
x1.reverse()
```

```
x1.index(1)
```

```
x1.insert(0,100)
```

Practice

- Q1: `x2=list(range(1,11))`
 - x2新增一筆資料在該串列第二個位置中該筆資料為**11111**
 - x2中刪除第一筆資料
 - 請告訴我**11111**該數值的位置是第幾筆資料

two-dimension list(二維串列)

- 二維表格或矩陣，可用二維串列來存放
- Ex:儲存五個學生國英數成績

Grades=[[96,65,73],[88,76,82],[92,84,89],[82,73,64],[70,83,68]]

	國文	英文	數學
學生1	96	65	73
學生2	88	76	82
學生3	92	84	89
學生4	82	73	64
學生5	70	83	68

對應的
索引值

	國文	英文	數學
學生1	[0][0]	[0][1]	[0][2]
學生2	[1][0]	[1][1]	[1][2]
學生3	[2][0]	[2][1]	[2][2]
學生4	[3][0]	[3][1]	[3][2]
學生5	[4][0]	[4][1]	[4][2]

如何運用?

- Ex: 儲存五個學生國英數成績

```
Grades=[[96,65,73],[88,76,82],[92,84,89],[82,73,64],[70,83,68]]
```

#取出某個學生的全部成績或某一科成績:

```
Grades[0]
```

```
Grades[1]
```

```
Grades[0][0]
```

```
Grades[1][2]
```

實例說明

- 印出每位學生的總分

```
Grades = [[96,65,73],[88,76,82],[92,84,89],[82,73,64],[70,83,68]]
for i in range(5):
    subtotal=0
    for j in range(3):
        subtotal = subtotal+Grades[i][j]
    Grades[i].append(subtotal)

for i in range(5):
    print("學生", i+1, "的總分為", Grades[i][3])
```

二維串列

- 二維串列可以用來存數學的矩陣(matrix)，下面有個4*3的矩陣，請撰寫一行敘述定義一個名為mar1是4*3的二維串列來存放該

$$\text{矩陣} \begin{bmatrix} 1 & 2 & 4 \\ 5 & 7 & 8 \\ 12 & 3 & 14 \\ 14 & 6 & 9 \end{bmatrix}$$

```
mar1=[[1,2,4],[5,7,8],[12,3,14],[14,6,9]]
```

Built-in function: sort()

- 排序的方式使用自己定義的大小來排序

```
a1 = ['Matlab', 'C', 'Ruby', 'Java', 'Python', 'R', 'JavaScript']
```

```
b1=sorted(a1)
```

```
print(b1)
```

```
c1=sorted(a1, key=len)
```

```
print(c1)
```



Student exercise_5

Question 1

```
listA=[1,2,3,4,5,6,7,8,9,10,11]
```

- print [1,3,5,7,9,11] in listA
- The last three values from listA

Question 2

- Find the negative numbers and print them from $x = [1, 3, -7, 4, 9, -5, 4]$
- Print the result
 - 第3個數值是負數：-7
 - 第6個數值是負數：-5

Question 3

- Let users input some messages and save these messages in a list until users enter n/N
 - Prompt: "Enter some messages:"
 - Then, prompt: "do you want to continue entering?(Y/y or N/n)"
- Finally, print this list

Advanced question 4

- Standard weight for boys: $(\text{height} - 80) * 0.7$
- Standard weight for girls: $(\text{height} - 70) * 0.6$
- Please calculate the mean of weight minus standard weight (w-sw)
- `data = [['Amy', 'female', 160, 65], ['Bob', 'male', 180, 83], ['Cathy', 'female', 172, 66], ['David', 'male', 177, 92], ['Alex', 'male', 185, 84]]`
- Hint: `print(sum(???) / len(data))`

Hint: `[1,3,5]+[2,4] → [1,3,5,2,4]`

Reviews

- Textbook chapter 8: 8-1~ 8.8