

파이썬으로 배우는 데이터 구조



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학습 목표

list자료형의 다양한 메소드를 익히고
shallow copy와 deep copy의 차이점을 알 수 있다

Data Structures in Python

Chapter 1 - 1

- Introduction - Review Python
- Objects and References
- **List Operations**
- GitHub & Jupyter-Lab
- Markdown Tutorial

너는 청년의 때에 너의 창조주를 기억하라 곧 곤고한 날이 이르기 전에, 나는 아무 낙이 없다고 할 해들이
가깝기 전에 (전12:1)

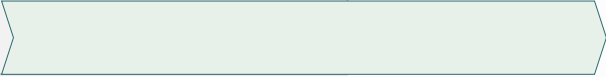
Agenda

- Topics:
 - Objects and References
 - Objects in memory
 - References
 - Equality
 - Mutability vs. Immutability
 - **List Operations**
 - List operations (methods)
 - **Shallow copy vs. Deep copy**
- References:
 - DSpy: Chapter 1: Python Review
 - Problem Solving with Algorithms and Data Structures using Python
 - Chapter 1

Operations on Lists - append vs. extend

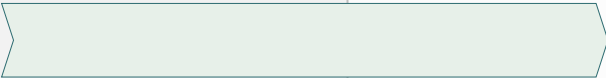
- `extend()` - extends the list by appending all the items in the given list (i.e. the argument is a list)

```
x = [1, 2, 3]
x.extend([4, 5, 6])
print(x)
```



- `append()` - adds an item to the end of the list.

```
x = [1, 2, 3]
x.append([4, 5, 6])
print(x)
```



Operations on Lists - Reversing a list

- reverse() - reverses the list **in place** or **alters** the content of the list.

```
x = [1, 2, 3]
y = x
x.reverse()
print(x)
```

[3, 2, 1]



- sort() - sorts the list **in place** or **alters** the content of the list.

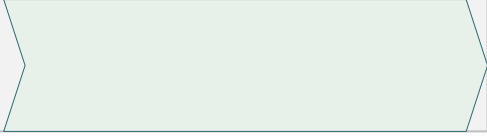
```
x = [1, 2, 3, -1]
x.sort()
print(x)
```

[-1, 1, 2, 3]

Exercise 1

- What is the output of the following code fragment? Why?

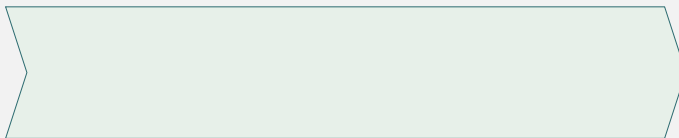
```
p = [1, 2, 3]
print (p[::-1])
print (p)
```



Aliases

- Two references to the same object are known as **aliases**.

```
x = [1, 2, 3, 4]
y = x
x.append(5)
print(x)
print(y)
```



- When an assignment is performed, **the reference** to the object on the right of the assignment is assigned to the variable on the left.
- When a method of an object is called, it sometimes **returns a value** and sometimes it **alters the object**.

Example

- What happens in the following cases? What is the output?

```
x = [1, 2, 3]
```

```
y = x
```

```
x += [4]      alters the object
```

```
print(x)
```

```
print(y)
```



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



```
x = [1, 2, 3]
```

```
y = x
```

```
x = x + [4]      returns a new object;  
                 x is replaced
```

```
print(x)
```

```
print(y)
```



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

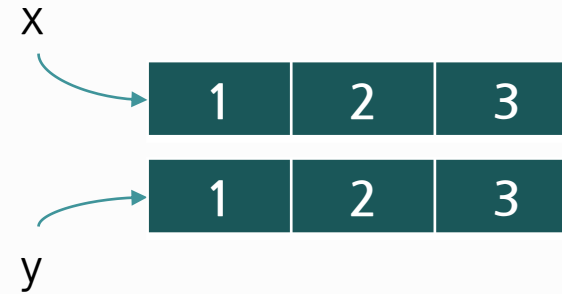
Shallow copy

- Lists and dictionaries have a **copy()** method

```
x = [1, 2, 3]
y = x.copy()
```

```
print( x == y )
print( x is y )
```

```
True
False
```



```
a = [ [11], [22], [33] ]
b = a.copy()
```

```
print( a == b )
print( a is b )
print( a[0] is b[0] )
```

```
True
False
True
```

What does it mean?

a and b are different objects, but
a[0] and b[0] are referencing the same object.

Shallow copy

- New object created
 - Contents of the original object are copied
 - If the contents are references, then the *references* are copied

```
a = [ [11], [22], [33] ]  
b = a.copy()
```

```
print( a == b )
```

True

```
print( a is b )
```

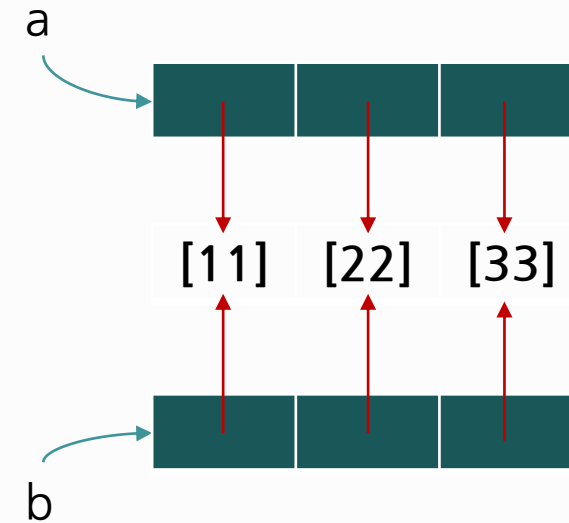
False

```
print( a[0] is b[0] )
```

True

What does it mean?

a and b are different objects, but
a[0] and b[0] are referencing the same object.



Deep copy

- New object created
 - Contents of the original object are copied
 - If the contents are references, then **the copy the objects referred to** are copied



```
import copy
```

```
a = [ [11], [22], [33] ]
```

```
b = copy.deepcopy(a)
```

```
print( a == b )
```

```
print( a is b )
```

```
print( a[0] is b[0] )
```

True

False

False

← b[0] has its own copy of the object.

Summary

- Variables store references to the objects, not the actual objects.
 - When you assign a variable, **a reference is copied**, not the object. Even it creates a new object and assigns its new reference to it in case of an immutable object.
- There are two kinds of equality.
 - Equality of content (value equality) can be tested with **==**
 - Equality of identity (reference equality) can be tested with **is**
- When a copy is created, it can be a shallow or deep copy.
 - A shallow copy copies the references.
 - A deep copy recursively copies the objects referred to.
- Lists slower but more powerful than tuples.
 - Lists can be modified and have lots of handy operations and methods.
 - Tuples are immutable and have fewer features.
- To convert between tuples and lists use the **list()** and **tuple()** function.

학습 정리

- 1) 내장 함수로는 `len()`, `max()`, `sum()`, `sorted()` 등이 있고, 각 객체는 다양한 메소드(method)들을 제공한다
- 2) 깊은 복사(`deepcopy()`)는 원본 객체의 모든 내부 객체들까지 모두 복제한 새 참조(reference)를 반환한다
- 3) 얇은 복사(`copy()`)는 원본 객체를 복제한 새 참조(reference)를 반환하지만, 내부 개체들은 원본의 것을 함께 참조한다

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수고했습니다
곧 다음 시간에
다시 뵙겠습니다

