

Copying the Whole Sequence

To make a *copy* of an entire sequence, you can use `[:]`.

```
>>> t[:]  
(23, 'abc', 4.56, (2,3), 'def')
```

Note the difference between these two lines for mutable sequences:

```
>>> list2 = list1      # 2 names refer to 1 ref  
                        # Changing one affects both
```

```
>>> list2 = list1[:]   # Two independent copies, two refs
```

The 'in' Operator

- **Boolean test whether a value is inside a container:**

```
>>> t = [1, 2, 4, 5]
>>> 3 in t
False
>>> 4 in t
True
>>> 4 not in t
False
```

- **For strings, tests for substrings**

```
>>> a = 'abcde'
>>> 'c' in a
True
>>> 'cd' in a
True
>>> 'ac' in a
False
```

- **Be careful: the *in* keyword is also used in the syntax of *for loops* and *list comprehensions*.**

The + Operator

- The + operator produces a *new* tuple, list, or string whose value is the concatenation of its arguments.

```
>>> (1, 2, 3) + (4, 5, 6)
(1, 2, 3, 4, 5, 6)
```

```
>>> [1, 2, 3] + [4, 5, 6]
[1, 2, 3, 4, 5, 6]
```

```
>>> "Hello" + " " + "World"
'Hello World'
```

The * Operator

- The * operator produces a *new* tuple, list, or string that “repeats” the original content.

```
>>> (1, 2, 3) * 3  
(1, 2, 3, 1, 2, 3, 1, 2, 3)
```

```
>>> [1, 2, 3] * 3  
[1, 2, 3, 1, 2, 3, 1, 2, 3]
```

```
>>> "Hello" * 3  
'HelloHelloHello'
```

Mutability: Tuples vs. Lists

Tuples: Immutable

```
>>> t = (23, 'abc', 4.56, (2,3), 'def')
>>> t[2] = 3.14
```

```
Traceback (most recent call last):
  File "<pyshell#75>", line 1, in -toplevel-
    tu[2] = 3.14
TypeError: object doesn't support item assignment
```

You can't change a tuple.

You can make a fresh tuple and assign its reference to a previously used name.

```
>>> t = (23, 'abc', 3.14, (2,3), 'def')
```

Lists: Mutable

```
>>> li = ['abc', 23, 4.34, 23]
>>> li[1] = 45
>>> li
['abc', 45, 4.34, 23]
```

- We can change lists *in place*.
- Name *li* still points to the same memory reference when we're done.
- The mutability of lists means that they aren't as fast as tuples.

Operations on Lists Only 1

```
>>> li = [1, 11, 3, 4, 5]
```

```
>>> li.append('a')    # Our first exposure to method syntax
```

```
>>> li
```

```
[1, 11, 3, 4, 5, 'a']
```

```
>>> li.insert(2, 'i')
```

```
>>> li
```

```
[1, 11, 'i', 3, 4, 5, 'a']
```


The *extend* method vs the **+** operator.

- **+** creates a fresh list (with a new memory reference)
- *extend* operates on list `li` in place.

```
>>> li.extend([9, 8, 7])
>>> li
[1, 2, 'i', 3, 4, 5, 'a', 9, 8, 7]
```

Confusing:

- **Extend** takes a list as an argument.
- **Append** takes a singleton as an argument.

```
>>> li.append([10, 11, 12])
>>> li
[1, 2, 'i', 3, 4, 5, 'a', 9, 8, 7, [10, 11, 12]]
```

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```
>>> li = ['a', 'b', 'c', 'b']
```

```
>>> li.index('b')      # index of first occurrence  
1
```

```
>>> li.count('b')      # number of occurrences  
2
```

```
>>> li.remove('b')     # remove first occurrence  
>>> li  
['a', 'c', 'b']
```

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```
>>> li = [5, 2, 6, 8]
```

```
>>> li.reverse()      # reverse the list *in place*
```

```
>>> li  
[8, 6, 2, 5]
```

```
>>> li.sort()         # sort the list *in place*
```

```
>>> li  
[2, 5, 6, 8]
```

```
>>> li.sort(some_function)  
# sort in place using user-defined comparison
```

Tuples vs. Lists

- **Lists slower but more powerful than tuples.**
 - Lists can be modified, and they have lots of handy operations we can perform on them.
 - Tuples are immutable and have fewer features.
- **To convert between tuples and lists use the `list()` and `tuple()` functions:**

```
li = list(tu)
tu = tuple(li)
```

Dictionaries

Dictionaries: A Mapping type

- **Dictionaries store a mapping between a set of keys and a set of values.**
 - Keys can be any immutable type.
 - Values can be any type
 - A single dictionary can store values of different types
- **You can define, modify, view, lookup, and delete the key-value pairs in the dictionary.**

Using dictionaries

```
>>> d = {'user': 'bozo', 'pswd': 1234}
>>> d['user']
'bozo'
>>> d['pswd']
1234
>>> d['bozo']
```

```
Traceback (innermost last):
  File "<interactive input>" line 1, in ?
KeyError: bozo
```

```
>>> d = {'user': 'bozo', 'pswd': 1234}
>>> d['user'] = 'clown'
>>> d
{'user': 'clown', 'pswd': 1234}

>>> d['id'] = 45
>>> d
{'user': 'clown', 'id': 45, 'pswd': 1234}
```

```
>>> d = {'user': 'bozo', 'p': 1234, 'i': 34}
>>> del d['user']          # Remove one.
>>> d
{'p': 1234, 'i': 34}
>>> d.clear()             # Remove all.
>>> d
{}
```

```
>>> d = {'user': 'bozo', 'p': 1234, 'i': 34}
>>> d.keys()              # List of keys.
['user', 'p', 'i']
>>> d.values()            # List of values.
['bozo', 1234, 34]
>>> d.items()             # List of item tuples.
[('user', 'bozo'), ('p', 1234), ('i', 34)]
```