Python Collections (Arrays)

There are four collection data types in the Python programming language:

* **List** is a collection which is ordered and changeable. Allows duplicate members.
* **Tuple** is a collection which is ordered and unchangeable. Allows duplicate members.
* **Set** is a collection which is unordered and unindexed. No duplicate members.
* **Dictionary** is a collection which is unordered, changeable and indexed. No duplicate members.

When choosing a collection type, it is useful to understand the properties of that type. Choosing the right type for a particular data set could mean retention of meaning, and, it could mean an increase in efficiency or security.

List

A list is a collection which is ordered and changeable. In Python lists are written with square brackets.

### Example

Create a List:

thislist = ["apple", "banana", "cherry"]  
print(thislist)

## Access Items

You access the list items by referring to the index number:

### Example

Print the second item of the list:

thislist = ["apple", "banana", "cherry"]  
print(thislist[1])

### Negative Indexing

Negative indexing means beginning from the end, -1 refers to the last item, -2 refers to the second last item etc.

### Example

Print the last item of the list:

thislist = ["apple", "banana", "cherry"]  
print(thislist[-1])

### Range of Indexes

You can specify a range of indexes by specifying where to start and where to end the range.

When specifying a range, the return value will be a new list with the specified items.

### Example

Return the third, fourth, and fifth item:

thislist = ["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]  
print(thislist[2:5])

**Note:** The search will start at index 2 (included) and end at index 5 (not included).

### Example

This example returns the items from the beginning to "orange":

thislist = ["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]  
print(thislist[:4])

By leaving out the end value, the range will go on to the end of the list:

### Example

This example returns the items from "cherry" and to the end:

thislist = ["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]  
print(thislist[2:])

### Range of Negative Indexes

Specify negative indexes if you want to start the search from the end of the list:

### Example

This example returns the items from index -4 (included) to index -1 (excluded)

thislist = ["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]  
print(thislist[-4:-1])

## Change Item Value

To change the value of a specific item, refer to the index number:

### Example

Change the second item:

thislist = ["apple", "banana", "cherry"]  
thislist[1] = "blackcurrant"  
print(thislist)

## Check if Item Exists

To determine if a specified item is present in a list use the in keyword:

### Example

Check if "apple" is present in the list:

thislist = ["apple", "banana", "cherry"]  
if "apple" in thislist:  
  print("Yes, 'apple' is in the fruits list")

## List Length

To determine how many items a list has, use the len() function:

### Example

Print the number of items in the list:

thislist = ["apple", "banana", "cherry"]  
print(len(thislist))

## Add Items

To add an item to the end of the list, use the append() method:

### Example

Using the append() method to append an item:

thislist = ["apple", "banana", "cherry"]  
thislist.append("orange")  
print(thislist)

To add an item at the specified index, use the insert() method:

### Example

Insert an item as the second position:

thislist = ["apple", "banana", "cherry"]  
thislist.insert(1, "orange")  
print(thislist)

## Remove Item

There are several methods to remove items from a list:

### Example

The remove() method removes the specified item:

thislist = ["apple", "banana", "cherry"]  
thislist.remove("banana")  
print(thislist)

**Example**

The pop() method removes the specified index, (or the last item if index is not specified):

thislist = ["apple", "banana", "cherry"]  
thislist.pop()  
print(thislist)

### Example

The del keyword removes the specified index:

thislist = ["apple", "banana", "cherry"]  
del thislist[0]  
print(thislist)

### Example

The del keyword can also delete the list completely:

thislist = ["apple", "banana", "cherry"]  
del thislist

### Example

The clear() method empties the list:

thislist = ["apple", "banana", "cherry"]  
thislist.clear()  
print(thislist)

# Python Tuples

## Tuple

A tuple is a collection which is ordered and **unchangeable**. In Python tuples are written with round brackets.

### Example

Create a Tuple:

thistuple = ("apple", "banana", "cherry")  
print(thistuple)

## Check if Item Exists

To determine if a specified item is present in a tuple use the in keyword:

### Example

Check if "apple" is present in the tuple:

thistuple = ("apple", "banana", "cherry")  
if "apple" in thistuple:  
  print("Yes, 'apple' is in the fruits tuple")

## Change Tuple Values

Once a tuple is created, you cannot change its values. Tuples are **unchangeable**, or **immutable** as it also is called.

But there is a workaround. You can convert the tuple into a list, change the list, and convert the list back into a tuple.

### Example

Convert the tuple into a list to be able to change it:

x = ("apple", "banana", "cherry")  
y = list(x)  
y[1] = "kiwi"  
x = tuple(y)  
  
print(x)

## Add Items

Once a tuple is created, you cannot add items to it. Tuples are **unchangeable**.

### Example

You cannot add items to a tuple:

thistuple = ("apple", "banana", "cherry")  
thistuple[3] = "orange" # This will raise an error  
print(thistuple)

## Create Tuple With One Item

To create a tuple with only one item, you have add a comma after the item, unless Python will not recognize the variable as a tuple.

### Example

One item tuple, remember the commma:

thistuple = ("apple",)  
print(type(thistuple))  
  
#NOT a tuple  
thistuple = ("apple")  
print(type(thistuple))

## Remove Items

**Note:** You cannot remove items in a tuple.

 Tuples are **unchangeable**, so you cannot remove items from it, but you can delete the tuple completely:

### Example

The del keyword can delete the tuple completely:

thistuple = ("apple", "banana", "cherry")  
del thistuple  
print(thistuple) #this will raise an error because the tuple no longer exists

## Join Two Tuples

To join two or more tuples you can use the + operator:

### Example

Join two tuples:

tuple1 = ("a", "b" , "c")  
tuple2 = (1, 2, 3)  
  
tuple3 = tuple1 + tuple2  
print(tuple3)

# Python Sets

## Set

A set is a collection which is unordered and unindexed. In Python sets are written with curly brackets.

### Example

Create a Set:

thisset = {"apple", "banana", "cherry"}  
print(thisset)

**Note:** Sets are unordered, so you cannot be sure in which order the items will appear.

## Access Items

You cannot access items in a set by referring to an index, since sets are unordered the items has no index.

But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

### Example

Loop through the set, and print the values:

thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
  print(x)

### Example

Check if "banana" is present in the set:

thisset = {"apple", "banana", "cherry"}  
  
print("banana" in thisset)

## Change Items

Once a set is created, you cannot change its items, but you can add new items.

## Add Items

To add one item to a set use the add() method.

To add more than one item to a set use the update() method.

### Example

Add an item to a set, using the add() method:

thisset = {"apple", "banana", "cherry"}  
  
thisset.add("orange")  
  
print(thisset)

### Example

Add multiple items to a set, using the update() method:

thisset = {"apple", "banana", "cherry"}  
  
thisset.update(["orange", "mango", "grapes"])  
  
print(thisset)

## Get the Length of a Set

To determine how many items a set has, use the len() method.

### Example

Get the number of items in a set:

thisset = {"apple", "banana", "cherry"}  
  
print(len(thisset))

## Remove Item

To remove an item in a set, use the remove(), or the discard() method.

### Example

Remove "banana" by using the remove() method:

thisset = {"apple", "banana", "cherry"}  
  
thisset.remove("banana")  
  
print(thisset)

**Note:** If the item to remove does not exist, remove() will raise an error.

### Example

Remove "banana" by using the discard() method:

thisset = {"apple", "banana", "cherry"}  
  
thisset.discard("banana")  
  
print(thisset)

**Note:** If the item to remove does not exist, discard() will **NOT** raise an error.

You can also use the pop(), method to remove an item, but this method will remove the last item. Remember that sets are unordered, so you will not know what item that gets removed.

The return value of the pop() method is the removed item.

### Example

Remove the last item by using the pop() method:

thisset = {"apple", "banana", "cherry"}  
  
x = thisset.pop()  
  
print(x)  
  
print(thisset)

**Note:** Sets are unordered, so when using the pop() method, you will not know which item that gets removed.

### Example

The clear() method empties the set:

thisset = {"apple", "banana", "cherry"}  
  
thisset.clear()  
  
print(thisset)

### Example

The del keyword will delete the set completely:

thisset = {"apple", "banana", "cherry"}  
  
del thisset  
  
print(thisset)

## Join Two Sets

There are several ways to join two or more sets in Python.

You can use the union() method that returns a new set containing all items from both sets, or the update() method that inserts all the items from one set into another:

### Example

The union() method returns a new set with all items from both sets:

set1 = {"a", "b" , "c"}  
set2 = {1, 2, 3}  
  
set3 = set1.union(set2)  
print(set3)

### Example

The update() method inserts the items in set2 into set1:

set1 = {"a", "b" , "c"}  
set2 = {1, 2, 3}  
  
set1.update(set2)  
print(set1)

# Python Dictionaries

## Dictionary

A dictionary is a collection which is unordered, changeable and indexed. In Python dictionaries are written with curly brackets, and they have keys and values.

### Example

Create and print a dictionary:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
print(thisdict)

## Accessing Items

You can access the items of a dictionary by referring to its key name, inside square brackets:

### Example

Get the value of the "model" key:

x = thisdict["model"]

There is also a method called get() that will give you the same result:

### Example

Get the value of the "model" key:

x = thisdict.get("model")

## Change Values

You can change the value of a specific item by referring to its key name:

### Example

Change the "year" to 2018:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
thisdict["year"] = 2018

## Loop Through a Dictionary

You can loop through a dictionary by using a for loop.

When looping through a dictionary, the return value are the keys of the dictionary, but there are methods to return the values as well.

### Example

Print all key names in the dictionary, one by one:

for x in thisdict:  
  print(x)

### Example

Print all values in the dictionary, one by one:

for x in thisdict:  
  print(thisdict[x])

### Example

You can also use the values() function to return values of a dictionary:

for x in thisdict.values():  
  print(x)

### Example

Loop through both keys and values, by using the items() function:

for x, y in thisdict.items():  
  print(x, y)

## Check if Key Exists

To determine if a specified key is present in a dictionary use the in keyword:

### Example

Check if "model" is present in the dictionary:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
if "model" in thisdict:  
  print("Yes, 'model' is one of the keys in the thisdict dictionary")

## Dictionary Length

To determine how many items (key-value pairs) a dictionary has, use the len() method.

### Example

Print the number of items in the dictionary:

print(len(thisdict))

## Adding Items

Adding an item to the dictionary is done by using a new index key and assigning a value to it:

### Example

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
thisdict["color"] = "red"  
print(thisdict)

## Removing Items

There are several methods to remove items from a dictionary:

### Example

The pop() method removes the item with the specified key name:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
thisdict.pop("model")  
print(thisdict)

### Example

The popitem() method removes the last inserted item (in versions before 3.7, a random item is removed instead):

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
thisdict.popitem()  
print(thisdict)

### Example

The del keyword removes the item with the specified key name:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
del thisdict["model"]  
print(thisdict)

### Example

The del keyword can also delete the dictionary completely:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
del thisdict  
print(thisdict) #this will cause an error because "thisdict" no longer exists.

### Example

The clear() keyword empties the dictionary:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
thisdict.clear()  
print(thisdict)

## Copy a Dictionary

You cannot copy a dictionary simply by typing dict2 = dict1, because: dict2 will only be a reference to dict1, and changes made in dict1 will automatically also be made in dict2.

There are ways to make a copy, one way is to use the built-in Dictionary method copy().

### Example

Make a copy of a dictionary with the copy() method:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
mydict = thisdict.copy()  
print(mydict)

Another way to make a copy is to use the built-in method dict().

### Example

Make a copy of a dictionary with the dict() method:

thisdict = {  
  "brand": "Ford",  
  "model": "Mustang",  
  "year": 1964  
}  
mydict = dict(thisdict)  
print(mydict)

## Nested Dictionaries

A dictionary can also contain many dictionaries, this is called nested dictionaries.

### Example

Create a dictionary that contain three dictionaries:

myfamily = {  
  "child1" : {  
    "name" : "Emil",  
    "year" : 2004  
  },  
  "child2" : {  
    "name" : "Tobias",  
    "year" : 2007  
  },  
  "child3" : {  
    "name" : "Linus",  
    "year" : 2011  
  }  
}

Or, if you want to nest three dictionaries that already exists as dictionaries:

### Example

Create three dictionaries, than create one dictionary that will contain the other three dictionaries:

child1 = {  
  "name" : "Emil",  
  "year" : 2004  
}  
child2 = {  
  "name" : "Tobias",  
  "year" : 2007  
}  
child3 = {  
  "name" : "Linus",  
  "year" : 2011  
}  
  
myfamily = {  
  "child1" : child1,  
  "child2" : child2,  
  "child3" : child3  
}

## Loop Through a List

You can loop through the list items by using a for loop:

### Example

Print all items in the list, one by one:

thislist = ["apple", "banana", "cherry"]  
for x in thislist:  
  print(x)

## Loop Through a Tuple

You can loop through the tuple items by using a for loop.

### Example

Iterate through the items and print the values:

thistuple = ("apple", "banana", "cherry")  
for x in thistuple:  
  print(x)

## Access Items

You cannot access items in a set by referring to an index, since sets are unordered the items has no index.

But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

### Example

Loop through the set, and print the values:

thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
  print(x)