COLLECTIONS

DATA 601

PYTHON COLLECTIONS

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

- **List**
- **Tuple**
- **Set**
- **Dictionary**

	Symbol
Parentheses	( )
Brackets	[ ]
Braces	{ }

PYTHON COLLECTIONS: DEFINITIONS

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

- **List:** Ordered and changeable collection allowing duplicate members.
- **Tuple:** Ordered and unchangeable collection allowing duplicate members.
- **Set:** Unordered and unindexed collection **w/o** duplicate members.
- **Dictionary:** Unordered, changeable, and indexed collection **w/o** duplicate members.

		Ordered?	Changeable?	Indexed?	Duplicates?
List	[ ]	Yes	Yes	Yes	Yes
Tuple	( )	Yes	No	Yes	Yes
Set	{ }	No	Yes	No	No
Dictionary	{"_:_"}	No	Yes	Yes	No

LISTS

Ordered and changeable collections allowing duplicate members

HOW DO WE CREATE A LIST?

- Lists are written with square brackets.

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

Output:

```
['apple', 'banana', 'cherry']
```

LOOP THROUGH A LIST

```
for x in thislist:
  print(x)
```

Output:

```
apple
banana
orange
```

CHECK IF ITEM EXISTS

```
thislist = ["apple", "banana", "cherry"]
anitem = "apple"
if anitem in thislist:
  print("Yes,", anitem,"is in the fruits list")
else:
  print("No,", anitem,"is not in the fruits list")
```

Output:

```
Yes, apple is in the fruits list
```

```
anitem = "blackberry"
if anitem in thislist:
  print("Yes,", anitem,"is in the fruits list")
else:
  print("No,", anitem,"is not in the fruits list")
```

Output:

```
No, blackberry is not in the fruits list
```

LIST LENGTH

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

print(len(thislist))
```

Output:

```
3
```

ADD ITEMS

```
thislist.append("watermelon")
print(thislist)
```

Output:

```
['apple', 'banana', 'orange', 'watermelon']
```

ADD AN ITEM AT THE SPECIFIED INDEX

```
thislist = ['apple', 'banana', 'orange', 'watermelon']
```

```
thislist.insert(1, "pear")
print(thislist)
```

Output:

```
['apple', 'pear', 'banana', 'orange', 'watermelon']
```

EXTENDING

- The extend() method adds the specified list elements (or any iterable) to the end of the current list.

```
fruits = ['apple', 'banana', 'cherry']
morefruits = ['watermelon', 'pear', 'orange', 'grape']

fruits.extend(morefruits)
print(fruits)
```

Output:

```
['apple', 'banana', 'cherry', 'watermelon', 'pear',
'orange', 'grape']
```

REMOVE AN ITEM (METHOD #1)

```
thislist=['apple', 'pear', 'banana', 'orange', 'watermelon’]

thislist.remove("banana")
print(thislist)
```

Output:

```
['apple', 'pear', 'orange', 'watermelon']
```

REMOVE AN ITEM (METHOD #2)

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

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

thislist.pop()

print(thislist)
```

Output:

```
['apple', 'banana']
```

CLEARING VS. DELETING A LIST

```
# The clear() method empties the list:

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

thislist.clear()

print(thislist)
```

Output: []

```
del thislist
```

➔ This command deletes the list.
➔ If you try to print the list, you'll get an error message

COPYING A LIST (METHOD #1)

You cannot copy a list simply by typing list2 = list1, because: list2 will only be a reference to list1, and changes made in list1 will automatically also be made in list2.

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

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

mylist = thislist.copy()

print(mylist)
```

Output:

```
['apple', 'banana', 'cherry']
```

COPYING A LIST (METHOD #2)

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

mylist = list(thislist)

print(mylist)
```

Output:

```
['apple', 'banana', 'cherry']
```

SORTING

```
thislist = ["watermelon", "apple", "cherry", "banana"]

thislist.sort()

print(thislist)
```

Output:

```
['apple', 'banana', 'cherry', 'watermelon']
```

REVERSE ORDERING

```
thislist = ["watermelon","apple", "cherry", "banana"]

thislist.reverse()

print(thislist)
```

Output:

```
['banana', 'cherry', 'apple', 'watermelon']
```

COUNTING

```
names = ["Adam","Michael","Susan","Leo","Adam","Marry","Heather"]

names.count("Adam")
```

Output:

```
2
```

INDEXING

The index() method finds the first occurrence of the specified value.

The index() method raises an exception if the value is not found.

```
names =["Adam","Michael","Susan","Leo","Adam","Marry","Heather"]

names.index("Adam")
```

Output:
```
0
```

```
names.index("Susan")
```

Output:
```
2
```

SUMMARY

A list is a collection which is ordered and changeable.
Lists are written with square brackets.

`append()`	Adds an element at the end of the list
`clear()`	Removes all the elements from the list
`copy()`	Returns a copy of the list
`count()`	Returns the number of elements with the specified value
`extend()`	Add the elements of a list (or any iterable), to the end of the current list
`index()`	Returns the index of the first element with the specified value
`insert()`	Adds an element at the specified position
`pop()`	Removes the element at the specified position
`remove()`	Removes the item with the specified value
`reverse()`	Reverses the order of the list
`sort()`	Sorts the list

TUPLES

Ordered & unchangeable collections allowing duplicate members

HOW DO WE CREATE A TUPLE?

- Tuples are written with round brackets.

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

print(thistuple)
```

Output:

```
('apple', 'banana', 'cherry')
```

LOOP THROUGH A TUPLE

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

for x in thistuple:
  print(x)
```

Output:

```
apple
banana
orange
```

CHECK IF ITEM EXISTS

```
thistuple = ("apple", "banana", "cherry")
anitem = "apple"
if anitem in thistuple:
  print("Yes,", anitem,"is in this tuple")
else:
  print("No,", anitem,"is not in this tuple")
```

Output:

```
Yes, apple is in this tuple
```

```
thistuple = ("apple", "banana", "cherry")
anitem = "grape"
if anitem in thistuple:
  print("Yes,", anitem,"is in this tuple")
else:
  print("No,", anitem,"is not in this tuple")
```

Output:

```
No, grape is not in this tuple
```

TUPLE LENGTH

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

print(len(thistuple))
```

Output: 3

ADD/REMOVE ITEMS, EXTEND TUPLE SORTING AND REVERSE ORDERING

YOU CANNOT DO ANY OF THESE

TUPLES ARE UNCHANGEABLE

DELETING A TUPLE

```
del thistuple
```

➔ This command deletes the tuple.

➔ If you try to print the tuple after deleting, then you'll get an error message

COPYING A TUPLE

You cannot copy a list with the = sign because lists are mutables.
The = sign creates a reference not a copy.
Tuples are immutable therefore a = sign does not create a reference but a copy as expected.

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

newtuple = thistuple

print(newtuple)
```

Output:

```
('apple', 'banana', 'cherry')
```

Since tuples cannot be changed, why would someone copy a tuple?

COUNTING

```
names = ("Adam","Michael","Susan","Leo","Adam","Marry","Heather")

names.count("Adam")
```

Output:
```
2
```

INDEXING

The index() method finds the first occurrence of the specified value.

The index() method raises an exception if the value is not found.

```
names =("Adam","Michael","Susan","Leo","Adam","Marry","Heather")

names.index("Adam")
```

Output:
```
0
```

```
names.index("Susan")
```

Output:
```
2
```

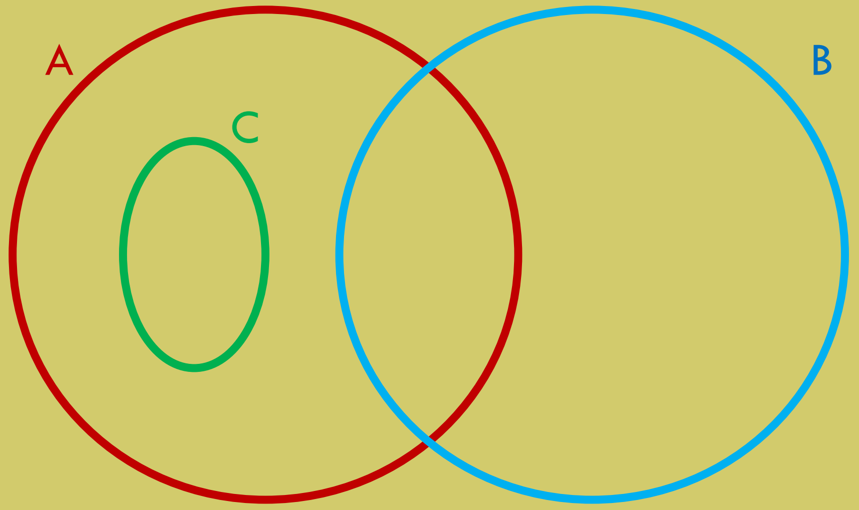
SUMMARY

Tuple is a collection which is ordered and unchangeable.

Allows duplicate members.

Tuples are written with round brackets.

`count()`	Returns the number of elements with the specified value
`index()`	Returns the index of the first element with the specified value



SETS

Unordered and unindexed collections without duplicate members

HOW DO WE CREATE A SET?

- Sets can be created with curly brackets.

```
thisset = {"apple", "banana", "cherry"}

print(thisset)
```

Output:

```
{'apple', 'cherry', 'banana'}
```

ANOTHER WAY OF CREATING SETS

Use the set() constructor to make a set.

note the double round-brackets

```
thisset = set(("apple", "banana", "cherry"))

print(thisset)
```

Output:

```
{'apple', 'cherry', 'banana'}
```

ACCESSING ITEMS

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

<u>What we can do?</u>

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

LOOP THROUGH A SET

```
thisset = {"apple", "banana", "cherry"}

for x in thisset:

  print(x)
```

Output:

```
apple
cherry
banana
```

CHECK IF ITEM EXISTS

```
thisset = {"apple", "banana", "cherry"}

print("banana" in thisset)
```

Output:

```
True
```

```
thisset = {"apple", "banana", "cherry"}

print("grape" in thisset)
```

Output:

```
False
```

GET LENGTH

```
thisset = {"apple", "banana", "cherry"}

print(len(thisset))
```

Output: 3

ADD ITEMS

```
thisset = {"apple", "banana", "cherry"}

thisset.add("orange")

print(thisset)
```

Output:

```
{'apple', 'cherry', 'orange', 'banana'}
```

UPDATING

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

```
thisset = {"apple", "banana", "cherry"}

thisset.update(["orange", "mango", "grapes"])

print(thisset)
```

Output:

```
{'cherry', 'mango', 'apple', 'orange', 'banana', 'grapes'}
```

REMOVE AN ITEM (METHOD #1)

```
thisset = {"apple", "banana", "cherry"}

thisset.remove("banana")

print(thisset)
```

Output:

```
{'apple', 'cherry'}
```

REMOVE AN ITEM (METHOD #2)

```
thisset = {"apple", "banana", "cherry"}

thisset.discard("banana")

print(thisset)
```

Output:

```
{'apple', 'cherry'}
```

What is the difference between remove and discard
If the item to remove does not exist,
- remove() will raise an error but
- discard() will NOT raise an error.

REMOVE AN ITEM (METHOD #3)

```
# Remove an item by using the pop() method:
thisset = {"apple", "banana", "cherry"}
x = thisset.pop()
print(x)
print(thisset)
```

Output:

```
apple
{'cherry', 'banana'}
```

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

CLEARING VS. DELETING A SET

```
thisset = {"apple", "banana", "cherry"}

thisset.clear()

print(thisset)
```

Output:

```
set()
```

```
del thisset
```

➔ This command deletes the set

COPYING A SET

```
fruits = {"apple", "banana", "cherry"}
x = fruits.copy()
print(x)
```

Output:

```
{'apple', 'cherry', 'banana'}
```

FINDING THE DIFFERENCES BETWEEN TWO SETS

x.difference(y) method return a set that contains the items that only exist in set x, and not in set y:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}
z = x.difference(y)
print(z)
```

Output:

```
{'cherry', 'banana'}
```

REMOVING THE ITEMS THAT EXIST IN BOTH SETS

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}
x.difference_update(y)
print(x)
```

Output:

```
{'cherry', 'banana'}
```

Note that
difference() method returns a new set, without the unwanted items,
difference_update() method removes the unwanted items from the original set.

FINDING THE ITEMS THAT EXIST IN TWO SETS

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}
z = x.intersection(y)
print(z)
```

Output:

```
{'apple'}
```

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}
x.intersection_update(y)
print(x)
```

Output:

```
{'apple'}
```

Note that
intersection() method returns a new set, without the unwanted items
intersection_update() method removes the unwanted items from the original set.

MERGING SETS

union() return a set that contains all items from both sets, duplicates are excluded:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}
z = x.union(y)
print(z)
```

Output:

```
{'cherry', 'google', 'banana', 'apple', 'microsoft'}
```

DETERMINING WHETHER X IS A SUBSET OF Y

issubset() teturns True if all items set x are present in set y:

```
x = {"a", "b", "c"}
y = {"f", "e", "d", "c", "b", "a"}

z = x.issubset(y)

print(z)
```

Output:

```
True
```

DETERMINING WHETHER Y IS A SUPERSET OF X

issuperset() returns True if all items set y are present in set x:

```
x = {"f", "e", "d", "c", "b", "a"}
y = {"a", "b", "c"}

z = x.issuperset(y)

print(z)
```

Output:

```
True
```

SUMMARY

A set is an unindex and unorders collections without duplicates

Sets are written with {, , , }

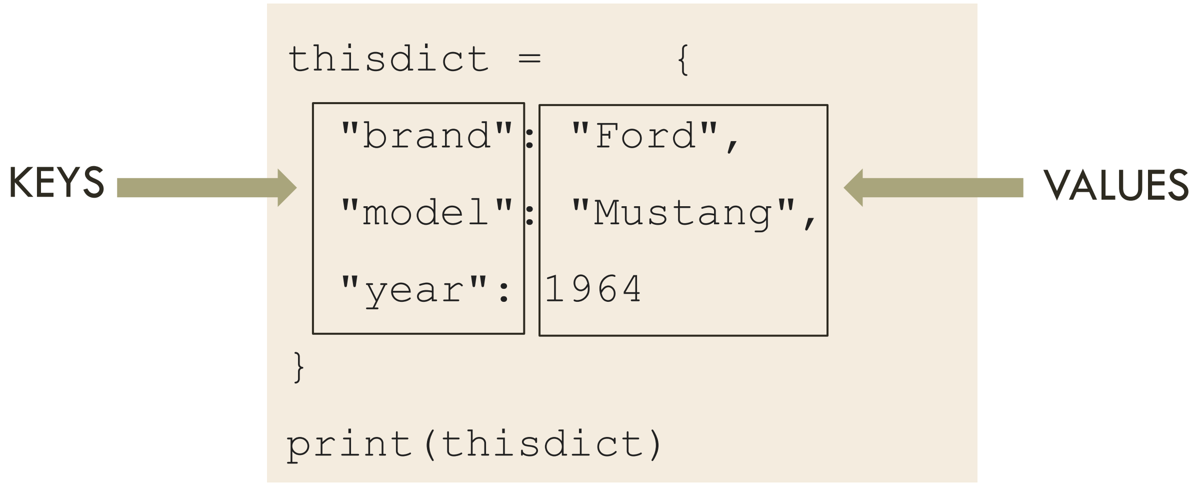
`add()`	Adds an element to the set
`clear()`	Removes all the elements from the set
`copy()`	Returns a copy of the set
`update()`	Adds the multiple to a set
`discard()`	Removes the element from the set
`remove()`	Removes the element from the set
`union()`	Merges sets
`issubset()`	Returns 1 if subset
`issuperset()`	Returns 1 if superset

DICTIONARIES

Unordered, changeable, and indexed collections without duplicate members

HOW TO CREATE A DICTIONARY

- Dictionaries are written with curly brackets
- Dictionaries have <u>keys</u> and <u>values</u>.



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

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
```

BUILDING DICTIONARIES

Dictionary: Days

- There are multiple ways of creating dictionaries.
- Let's build a dictionary of days in English (keys) and Italian(values)
- Method-1:

```
Days_Eng_Ita = {'Monday':'Lunedi',
                'Tuesday':'Martedi',
                'Wednesday':'Mercoledi',
                'Thursday':'Geovedi',
                'Friday':'Venerdi',
                'Saturday':'Saboto',
                'Sunday':'Domenica'
               }
```

BUILDING DICTIONARIES (CONT…)

Dictionary: Days

- There are multiple ways of creating dictionaries.
- Let's build a dictionary of days in English (keys) and Italian(values)
- Method-2:

```
Days_Eng_Ita = dict([
     ('Monday','Lunedi'),
     ('Tuesday','Martedi'),
     ('Wednesday','Mercoledi'),
     ('Thursday','Geovedi'),
     ('Friday','Venerdi'),
     ('Saturday','Saboto'),
     ('Sunday','Domenica')
      ])
```

BUILDING DICTIONARIES (CONT…)

Dictionary: Days

- There are multiple ways of creating dictionaries.
- Let's build a dictionary of days in English (keys) and Italian(values)
- Method-3:

```
Days_Eng_Ita = dict(
    Monday='Lunedi',
    Tuesday='Martedi',
    Wednesday='Mercoledi',
    Thursday='Geovedi',
    Friday='Venerdi',
    Saturday='Saboto',
    Sunday='Domenica'
    )
```

BUILDING DICTIONARIES (CONT…)

Dictionary: Days

```
type(Days_Eng_Ita)
```

```
dict
```

```
Days_Eng_Ita
```

Output:

```
{'Friday': 'Venerdi',
 'Monday': 'Lunedi',
 'Saturday': 'Saboto',
 'Sunday': 'Domenica',
 'Thursday': 'Geovedi',
 'Tuesday': 'Martedi',
 'Wednesday': 'Mercoledi'}
```

BUILDING DICTIONARIES (CONT…)

Dictionary: Person

- We can even build dictionaries incrementally.
- Let’s work on a new example

```
person = {}
person['fname'] = 'Jon'
person['lname'] = 'Snow'
person['age'] = 27
person['spouse'] = 'Ygritte'
person['relatives'] = ['Ned', 'Robb', 'Sansa','Arya']
person['pets'] = {'dog': 'Ghost', 'dragon': 'Drogon'}
```

BUILDING DICTIONARIES (CONT…)

Dictionary: Person

```
person
```

Output:

```
{'age': 27,
 'fname': 'Jon',
 'lname': 'Snow',
 'pets': {'dog': 'Ghost', 'dragon': 'Drogon'},
 'relatives': ['Ned', 'Robb', 'Sansa', 'Arya'],
 'spouse': 'Ygritte'}
```

`person['fname']` Output: `'Jon'`

`person['relatives']` Output: `['Ned', 'Robb', 'Sansa', 'Arya']`

`person['relatives’][0]` Output: `'Ned'`

`person['relatives’][-1]` Output: `'Arya'`

`person['pets']['dog']` Output: `'Ghost'`

LOOP THROUGH A DICTIONARY

Dictionary: Person

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

```
for x in person:
  print(x)
```

Output:

```
fname
lname
age
spouse
relatives
pets
```

- Print all values in the dictionary, one by one:

```
for x in person:
  print(person[x])
```

Output:

```
Jon
Snow
27
Ygritte
['Ned', 'Robb', 'Sansa', 'Arya']
{'dog': 'Ghost', 'dragon': 'Drogon'}
```

LOOP THROUGH A DICTIONARY (CONT…)

Dictionary: Person

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

```
for x in person.values():
  print(x)
```

Output:

```
Jon
Snow
27
Ygritte
['Ned', 'Robb', 'Sansa', 'Arya']
{'dog': 'Ghost', 'dragon': 'Drogon'}
```

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

```
for x, y in person.items():
  print(x, y)
```

Output:

```
fname Jon
lname Snow
age 27
spouse Ygritte
relatives ['Ned', 'Robb', 'Sansa', 'Arya']
pets {'dog': 'Ghost', 'dragon': 'Drogon'}
```

ANOTHER DICTIONARY EXAMPLE

Dictionary: Mustang

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

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
```

CHECK IF KEY EXISTS

Dictionary: Mustang

```
key = "model"
thisdict =     {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}
if key in thisdict:
  print("Yes,", key, "is one of the keys in this dictionary")
else:
  print("No,", key, "is not one of the keys in this dictionary")
```

Output:

```
Yes, model is one of the keys in this dictionary
```

DICTIONARY LENGTH

Dictionary: Mustang

```
print(len(thisdict))
```

Output: 3

ADDING ITEMS

Dictionary: Mustang

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

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

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964,
'color': 'red'}
```

ADDING ITEMS (CONT...)

Dictionary: Mustang

We can also use update()

```
car = {
  "brand": "Ford",
  "model": "Mustang",
  "year": 2019
}
car.update({"color": "White"})
print(car)
```

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 2019,
'color': 'White'}
```

REMOVE AN ITEM (METHOD #1)

Dictionary: Mustang

Method-1: The pop() method removes the item with the specified key name

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

Output:

```
{'brand': 'Ford', 'year': 1964}
```

REMOVE AN ITEM (METHOD #2)

The popitem() method removes a random item!

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

Output:

```
{'brand': 'Ford', 'model': 'Mustang'}
```

REMOVE AN ITEM (METHOD #3)

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

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

Output:

```
{'brand': 'Ford', 'year': 1964}
```

Note that `del thisdict` deletes the entire dictionary

CLEARING A DICTIONARY

The clear() keyword empties the dictionary:

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

Output: {}

COPYING A DICTIONARY (METHOD #1)

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 various ways to make a copy.
One way is to use the built-in Dictionary method copy().

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

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
```

COPYING A LIST (METHOD #2)

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

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

Output:

```
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
```

CREATING A DICTIONARY WITH KEYS AND A VALUE

```
keys = {'a', 'e', 'i', 'o', 'u' }
value = 'vowel'
vowels = dict.fromkeys(keys, value)
print(vowels)
```

Output:

```
{'u': 'vowel', 'e': 'vowel', 'a': 'vowel', 'i': 'vowel', 'o': 'vowel'}
```

ALSO

```
thisdict =     {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}
```

```
thisdict.items()
```

Output:

```
dict_items([('brand', 'Ford'), ('model', 'Mustang'), ('year', 1964)])
```

```
thisdict.keys()
```

Output:

```
dict_keys(['brand', 'model', 'year'])
```

```
thisdict.values()
```

Output:

```
dict_values(['Ford', 'Mustang', 1964])
```

SUMMARY: DICT

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.

`clear()`	Removes all the elements from the dictionary
`copy()`	Returns a copy of the dictionary
`fromkeys()`	Returns a dictionary with the specified keys and values
`get()`	Returns the value of the specified key
`items()`	Returns a list containing the a tuple for each key value pair
`keys()`	Returns a list containing the dictionary's keys
`pop()`	Removes the element with the specified key
`popitem()`	Removes the last inserted key-value pair
`setdefault()`	Returns the value of the specified key. If the key does not exist: insert the key, with the specified value
`update()`	Updates the dictionary with the specified key-value pairs
`values()`	Returns a list of all the values in the dictionary

SUMMARY: PYTHON COLLECTIONS

		Ordered?	Changeable?	Indexed?	Duplicates?
List	[ ]	Yes	Yes	Yes	Yes
Tuple	( )	Yes	No	Yes	Yes
Set	{ }	No	Yes	No	No
Dictionary	{"_:_"}	No	Yes	Yes	No

LIST
```
append()
clear()
copy()
count()
extend()
index()
insert()
pop()
remove()
reverse()
sort()
```

TUPLE
```
count()
index()
```

SET
```
add()
clear()
copy()
difference_update()
discard()
issubset()
issuperset()
len()
remove()
union()
update()
```

DICT
```
clear()
copy()
fromkeys()
get()
items()
keys()
pop()
popitem()
setdefault()
update()
values()
```