

tuples and sets.

Week 5 | Lecture 2 (5.2.1)

While waiting for class to start:

Download and open the Jupyter Notebook (.ipynb) for Lecture 5.2.1

You may also use this lecture's JupyterHub link instead (although opening it locally is encouraged).

Upcoming:

- Reflection 5 released Friday @ 11 AM
- Lab 4 due this Friday @ 12 PM
- Lab 5 out already, due next Friday
- Behrang's Coffee Break / Office Hours Friday @ 1 PM
- PRA (Lab) on Friday @ 2PM this week

if nothing else, write `#cleancode`

Today's Content

- Lecture 5.2
 - Looping through lists
 - tuples and sets

Tuples

- Tuples are an **ordered sequence** of items similar to lists.
- Ordered Sequences:
 - Strings
 - Lists
 - range()**
 - Tuples

Common Sequence Operations

Operation	Result	Notes
<code>x in s</code>	True if an item of <code>s</code> is equal to <code>x</code> , else False	(1)
<code>x not in s</code>	False if an item of <code>s</code> is equal to <code>x</code> , else True	(1)
<code>s + t</code>	the concatenation of <code>s</code> and <code>t</code>	(6)(7)
<code>s * n</code> or <code>n * s</code>	equivalent to adding <code>s</code> to itself <code>n</code> times	(2)(7)
<code>s[i]</code>	<code>i</code> th item of <code>s</code> , origin 0	(3)
<code>s[i:j]</code>	slice of <code>s</code> from <code>i</code> to <code>j</code>	(3)(4)
<code>s[i:j:k]</code>	slice of <code>s</code> from <code>i</code> to <code>j</code> with step <code>k</code>	(3)(5)
<code>len(s)</code>	length of <code>s</code>	
<code>min(s)</code>	smallest item of <code>s</code>	
<code>max(s)</code>	largest item of <code>s</code>	
<code>s.index(x[, i[, j]])</code>	index of the first occurrence of <code>x</code> in <code>s</code> (at or after index <code>i</code> and before index <code>j</code>)	(8)
<code>s.count(x)</code>	total number of occurrences of <code>x</code> in <code>s</code>	

birthday = (20, 01, 1985)

Tuples

- The general syntax of a tuple is as follows:

`(expr1, expr2, ..., exprN)`

- Tuples are represented with parentheses `()` while lists are represented by `[]`.
- To avoid ambiguity, a tuple with a single element is written as `(expr,)`, to not be confused with arithmetic operations.
 - `(1 + 1) / 2`
 - `(1) / 2`

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notebook**

Click Link:

1. Creating Tuples

Immutable

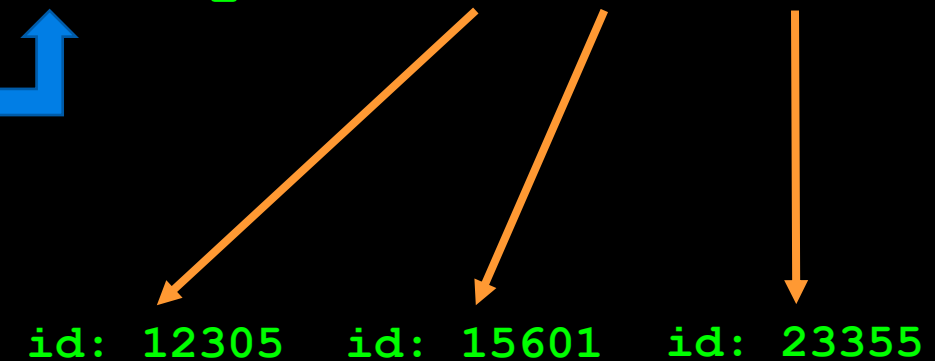
Once assigned,
the tuple cannot
be changed.

`birthday = (20, 01, 1985)`

- Tuples are basically **immutable** lists meaning everything works as with lists excepts methods that modify the tuple.

- `.append()`
- `.sort()`
- `.pop()`

- **Immutable** means that the item reference addresses contained in a tuple cannot be changed after the tuple has been created.
- You've seen this with strings (immutable sequence of characters).



Immutability Rules

1. Can only ever have 3 items.
2. Must always point to these references id's.
2. Must always be in this original order.

Immutable

Once assigned,
the tuple cannot
be changed.

`birthday = (20, 01, 1985)`



- Tuples are basically **immutable** lists meaning everything works as with lists excepts methods that modify the tuple.
 - `.append()`
 - `.sort()`
 - `.pop()`
- **Immutable** means that the item reference addresses contained in a tuple cannot be changed after the tuple has been created.
- You've seen this with strings (immutable sequence of characters).

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**2. Tuples Are
Immutable**

Breakout Session 1

- Complete the exercises in the notebook.

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3. Breakout Session 1

Why Tuples?

■ Reason 1

- Tuples makes your code safer and less prone to **bugs** by providing write protection.
- Consider that you're reading data from a database and saving it into memory.
- **Example:** Imagine if you're telling the doctor what the symptoms are for a certain disease. If these symptoms were stored in a list, they could be changed, which could lead to negative outcomes for patients.

Database



In Python Memory

(20, 01, 1985)

Why Tuples?

■ Reason 2

- Performance increase. Processing a tuple is faster than processing a list. Great for large data sets.
- Since a tuple's size is fixed, it can be stored more compactly than lists which need to over-allocate to make `append()` operations efficient.

```
>>> sys.getsizeof((1, 2, 3, 4, 5))  
88 bytes
```

```
>>> sys.getsizeof([1, 2, 3, 4, 5])  
104 bytes
```

Why Tuples?

■ Reason 3

- You can always unpack tuples successfully because you always know how many items are in them (Immutability).

This will always work

```
data = (20,01,1985)  
day, month, year = data
```

This will not always work

```
data = [20,01,1985]  
day, month, year = data
```

Unpacking Tuples

- **Tuple Packing**
- The values on the right are 'packed' together in the tuple.
- `>>> record = ("Joe", 19, "CIV")`
- **Tuple Unpacking**
- The values in a tuple on the right are 'unpacked' into the variables on the left.
- `>>> name, age, studies = record`
- `>>> name`
- `'Joe'`

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4. Unpacking Tuples

Tuples as **return** Values

- Functions can only return a single value, but by making that value a **tuple**, we can effectively group together as many values as we like (**tuple** packing), and **return** them together.

```
def func_name(parameters):  
    return (expr1, expr2, ...)
```

- When we call the function we can unpack the **tuple** into multiple variables.

```
var1, var2, ... = func_name(args)
```

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Click Link:

**5. Tuples as return
Values**

Breakout Session 2

- In this Breakout Session, you'll loop through a collection of some famous albums and print the content.

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6. Breakout Session 2

Sets

- A set `{exp1, exp2, ...}` is an unordered (and **mutable**) collection of distinct items that does not record element position or order of insertion.
- Accordingly, sets do not support indexing, slicing, or other sequence-like behavior.
- Their primary purpose is to hold distinct items: there are no duplicates in sets.

List

```
['ford', 'tesla', 'dodge', 'tesla']
```

```
>>> cars[0:2]  
'ford', 'tesla'
```

Set

```
{'ford', 'tesla', 'dodge'}
```

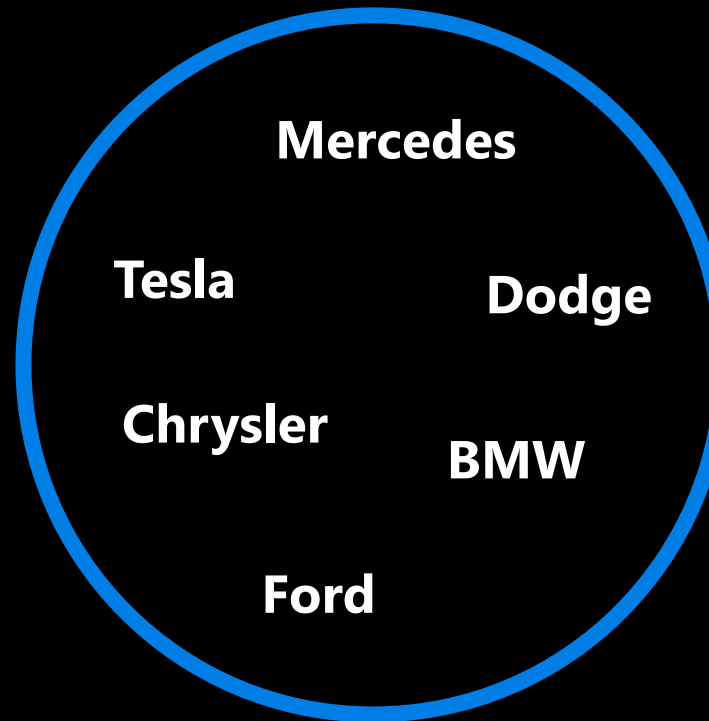
```
>>> cars[0:2]
```

Error

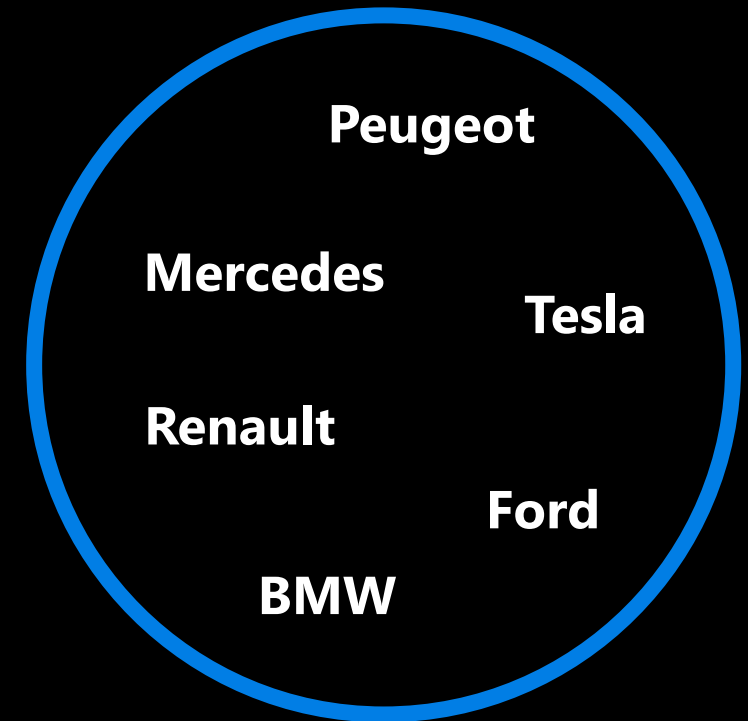
Sets

- Here we have two Sets.
- Cars sold in North America and cars sold in Europe.
- From this graphic, its easy to see that Sets are unordered.

North America



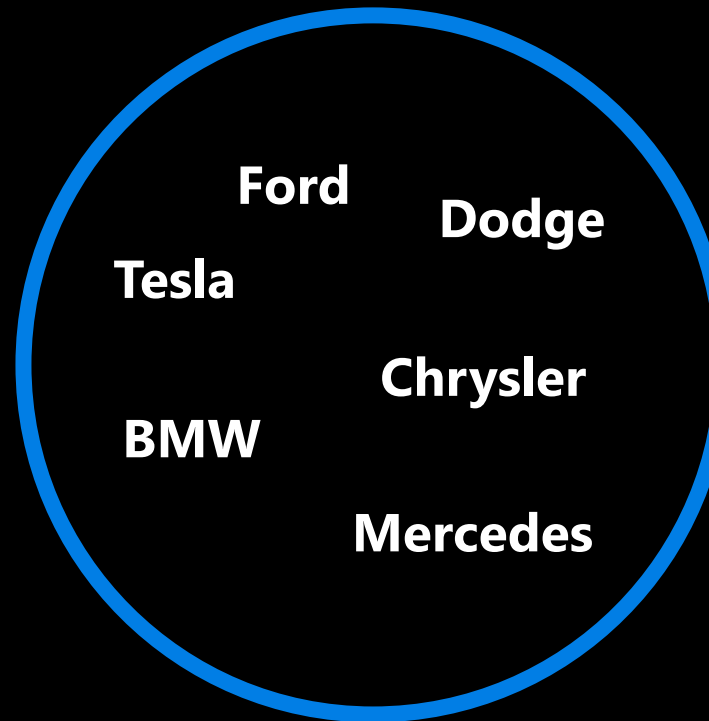
Europe



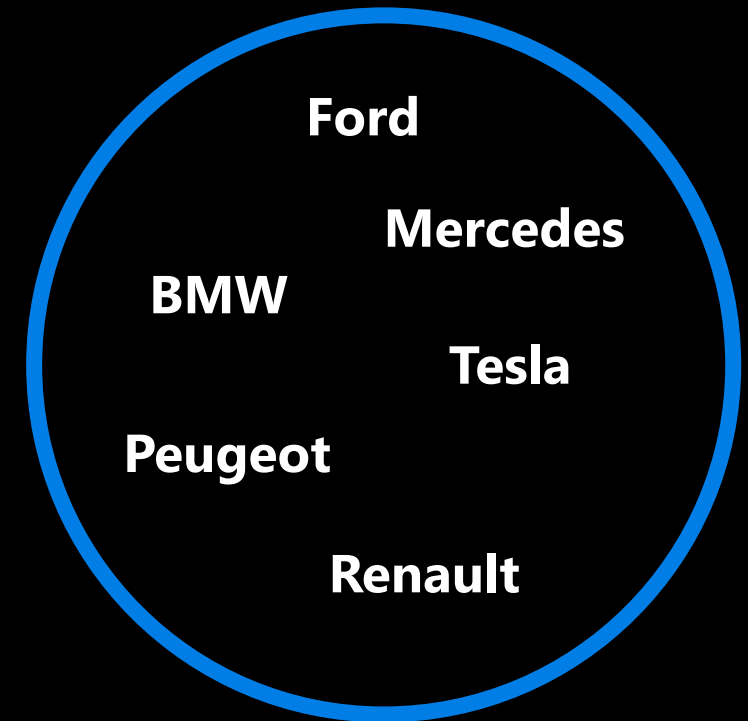
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North America



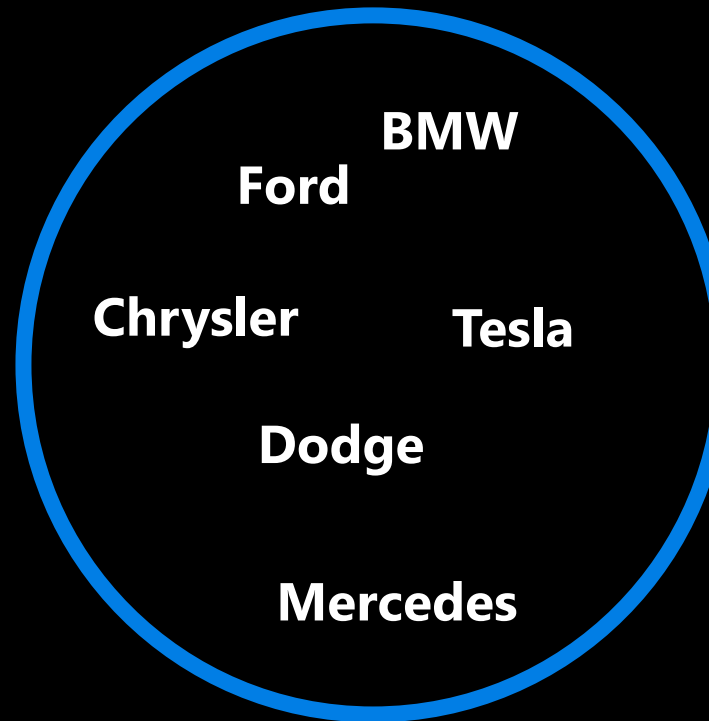
Europe



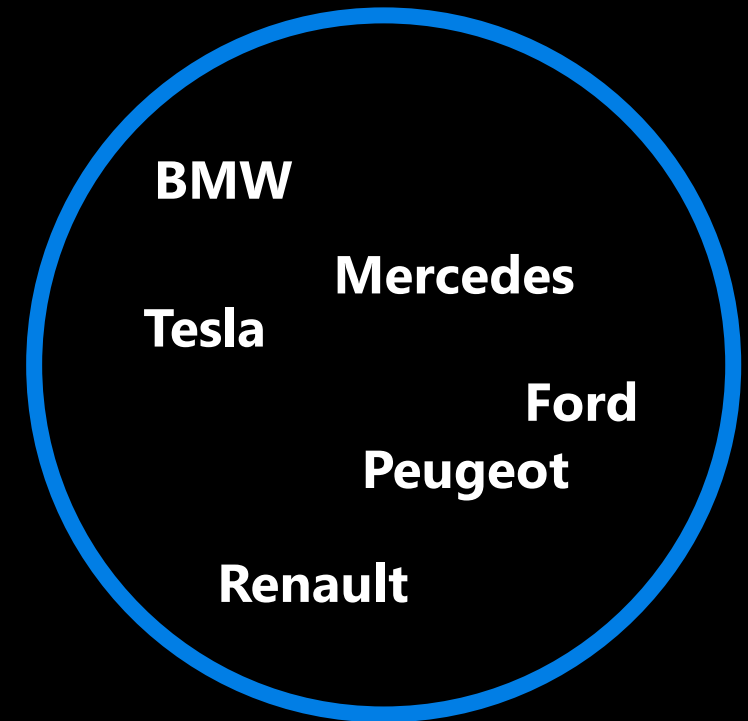
Sets

- Here we have two Sets.
- Cars sold in North America and cars sold in Europe.
- From this graphic, its easy to see that Sets are unordered.

North America



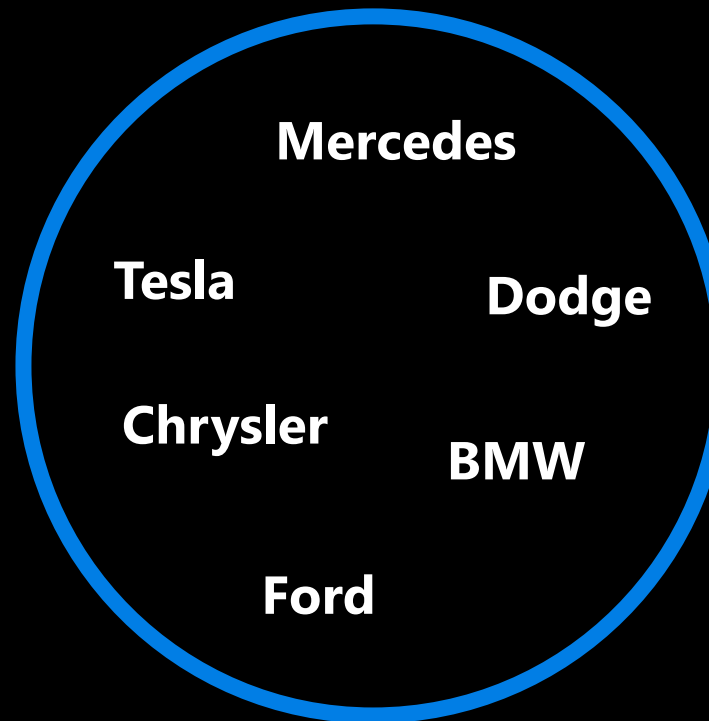
Europe



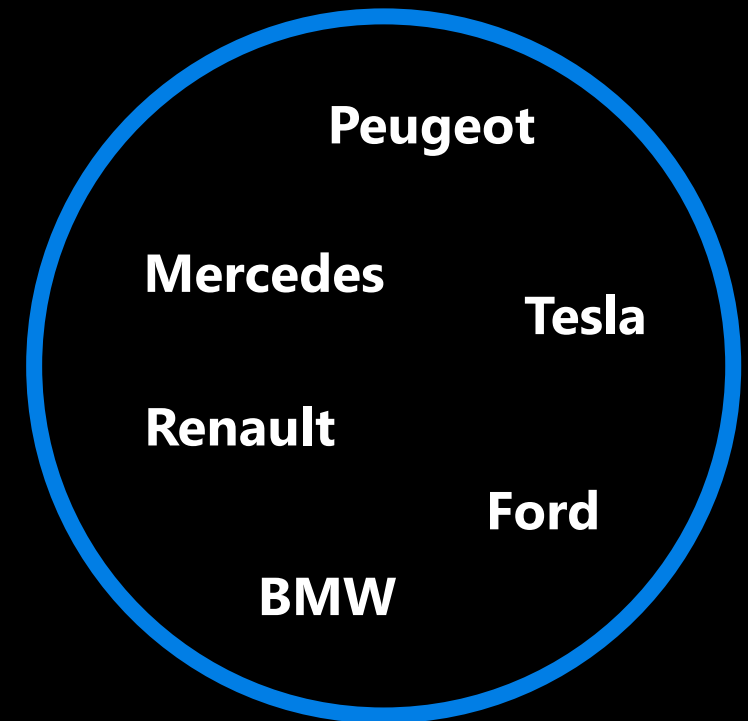
Membership

- Testing for membership is a common operation to perform on a **Set**.
- Mercedes, Tesla, Dodge, Chrysler, BMW, and Ford are **members** of the North America Set.
- Similar to lists and tuples, you can test for membership using the **in** operator.

North America



Europe

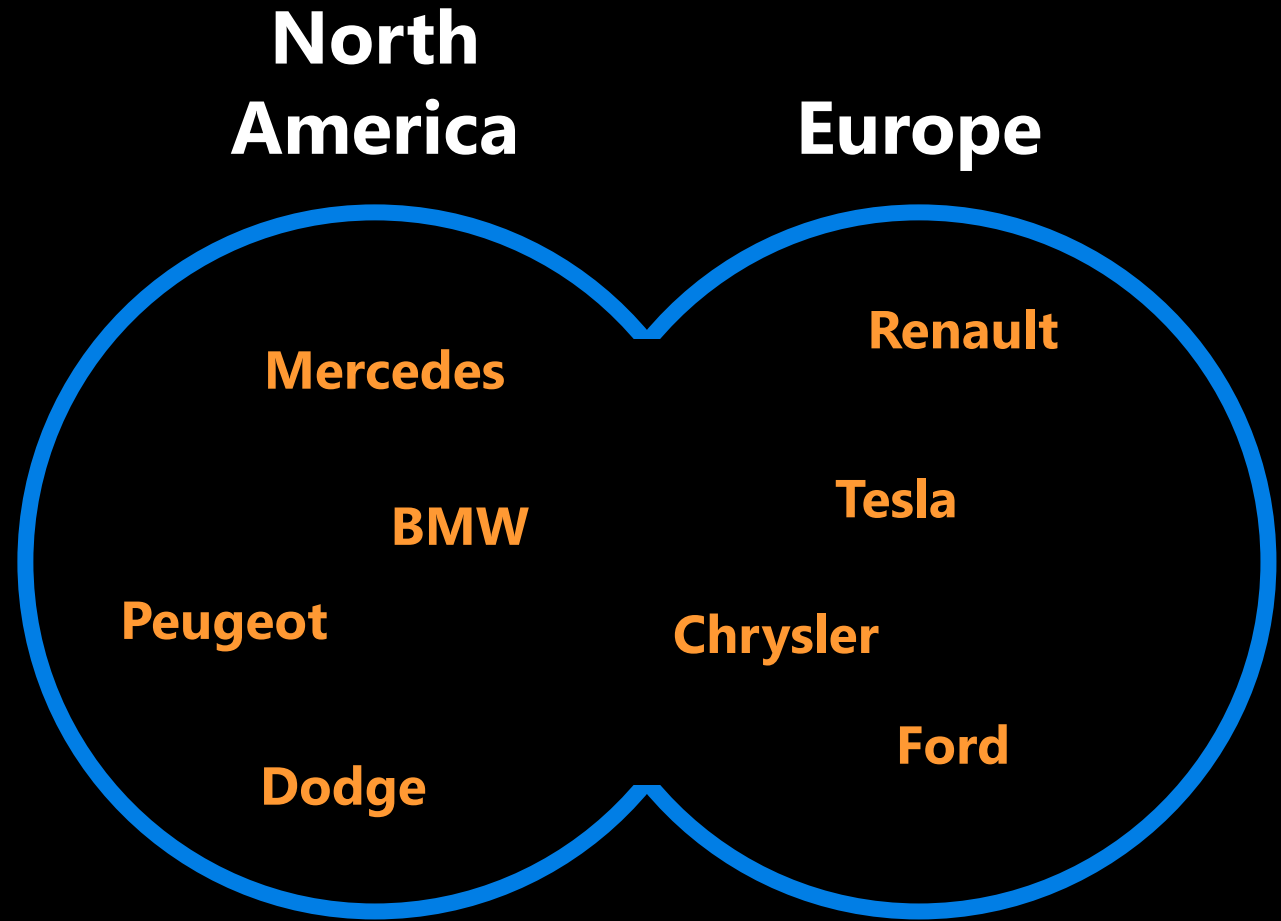


```
>>> 'ford' in north_america
True
```

Union

- The **Union** of two or more **Sets** is the **Set** of all items that appear across all **Sets**.
- Items appear once.
- `north_america.union(europe)`
- `europe.union(north_america)`
- `north_america | europe`
- `europe | north_america`

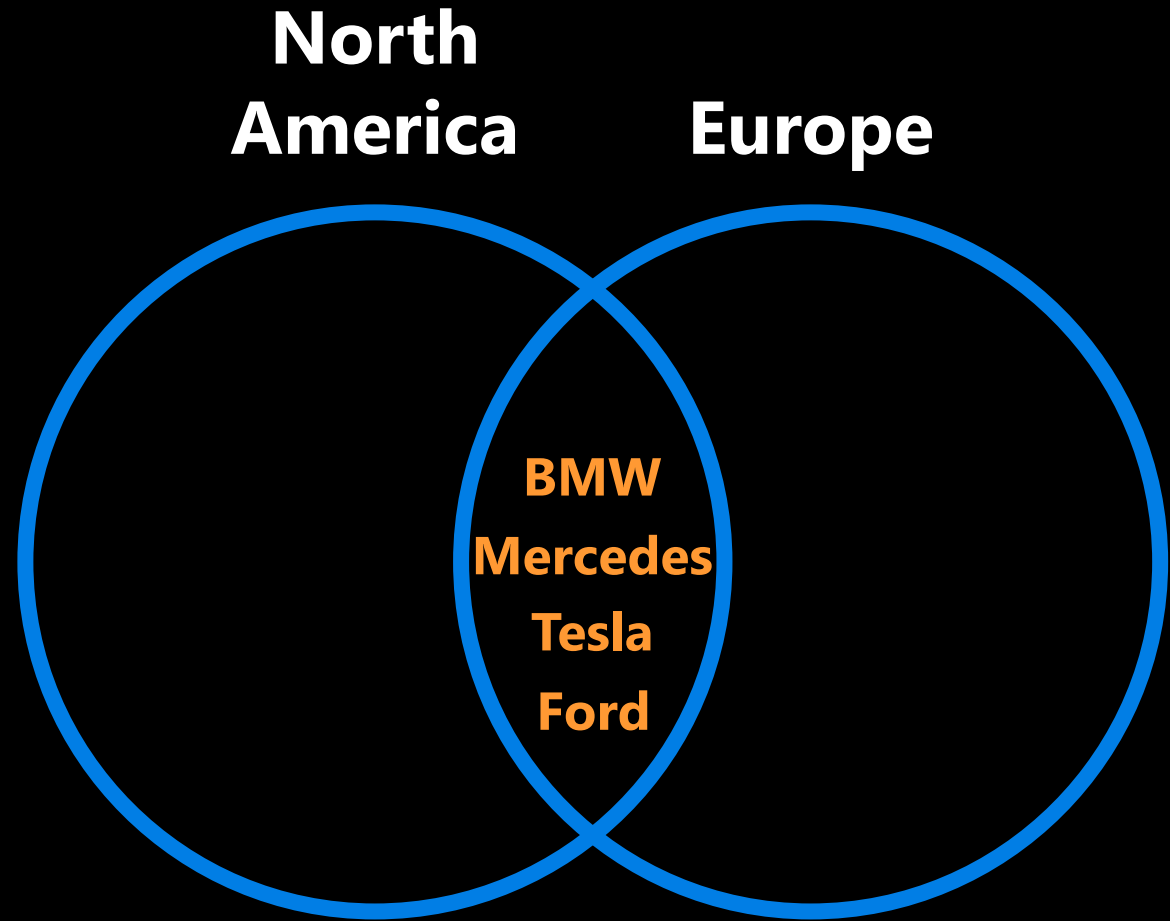
```
>>> north_america.union(europe)
{'Mercedes', 'BMW', 'Ford', 'Tesla', 'Peugeot', 'Chrysler', 'Renault', 'Dodge'}
```



Intersection

- The **Intersection** of two or more **Sets** is the **Set** of all items that are in each **Sets**.
- Items appear once.
 - `north_america.intersection(europe)`
 - `europe.intersection(north_america)`
 - `north_america & europe`
 - `europe & north_america`

```
>>> north_america.intersection(europe)
{'Mercedes', 'BMW', 'Ford', 'Tesla'}
```



Sets

- Let's work through some problems with **Sets**.

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7. Sets

Lecture Recap

- **Tuples** are immutable lists.
- **Tuples**: assignments (packing and unpacking).
- **Sets**: an unordered collection of distinct items.
- **Sets**: set have many methods and operations.
- See **Chapter 11** of the Gries textbook for more on **Tuples** and **Sets**.

tuples and sets.

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