CSE231 - Lab 09

Nested Dictionaries, Sets

Nesting Dictionaries

Like lists and tuples, dictionaries can be nested. You can have a dictionary whose values are *other* dictionaries. Remember that keys in a dictionary have to be immutable, thus keys *cannot* be dictionaries.

Having a nested dictionary can be a bit confusing, so hopefully an example might help. We're not going to spend much time on this since it should all be review. It might come in handy for the lab today.

Sets

The last Python data structure, we've finally made it. Sets are an idea taken from mathematics, most of you should know them, but if not, we'll briefly go over the essentials.

Sets are a collection of *unique*, *unordered* objects. Meaning that two sets like the following are *equivalent*:

$A = \{1, 2, 3, 3, 4, 5\} = \{ x \mid 1 \leq x \leq 5, x \in \mathbb{Z} \}$

$B = \{5, 4, 4, 4, 3, 2, 1, 1\} = \{ x \mid 1 \leq x \leq 5, x \in \mathbb{Z} \}$

"$\{ x \mid 1 \leq x \leq 5, x \in \mathbb{Z} \}$" can be read as: "x such that x is inclusively bounded between 1 and 5, and is within the set of all integers."

Sets (cont.)

How do we translate this to Python? In much the same way, actually.

```
A = {1, 2, 3, 3, 4, 5}

B = {5, 4, 4, 4, 3, 2, 1, 1}

print(A == B)    # True

print(A)    # {1, 2, 3, 4, 5}

print(B)    # {1, 2, 3, 4, 5}

print(len(A))    # 5
```

Set Initialization

```
D = {}    # curly braces with nothing = empty dictionary

S = set()    # correct empty set initialization

S = {20, 5, 10}    # initialization of a set with values

S = set(“abcabbcd”)    # can convert from iterables

print(S)    # {‘b’, ‘d’, ‘a’, ‘c’}

S = {x for x in “abracadabra” if x not in “abc”}

print(S)    # {‘r’, ‘d’}, set comprehension!
```

Adding/Discarding

```
S = set()

S.add(100)    # S = {100, }, adds a given element

S.discard(100)    # S = set(), discards a given element

S.remove(100)    # KeyError

# .remove() removes the object from the set, but raises

# KeyError if the object doesn’t exist
```

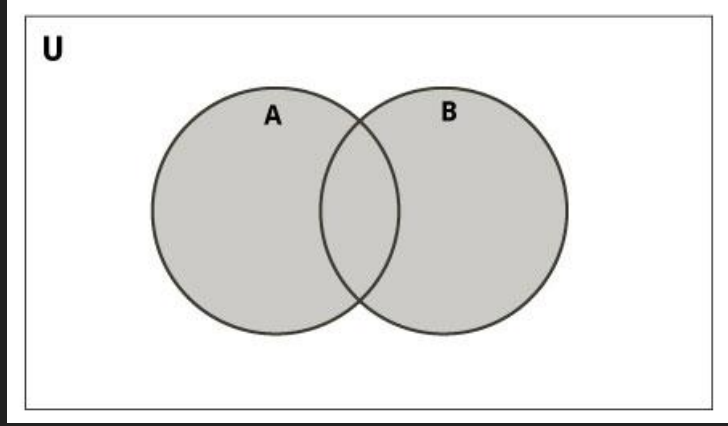
Set Operations

Like in mathematics, sets have a lot of unique operations. If you already know about mathematical sets, you may recognize these guys: ⊆, ⊂, ∪, ∩, etc.. All of these operations have a Python equivalent.

In addition to this, you can of course use `len()` to determine the number of elements within the set (| | in mathematics, also known as the “cardinality” when talking about sets), and use the `` `in` `` keyword to determine if an element exists within your set (∈ in mathematics).

For each of the operators in Python, there is also a corresponding method function as you’ll see.

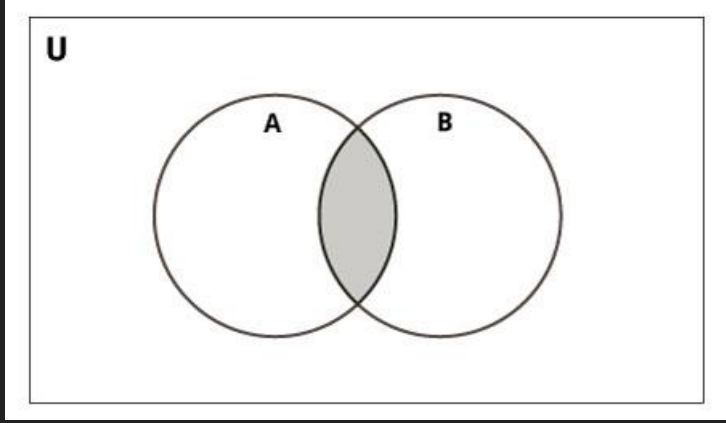
Union




```
A = {1, 2}

B = {3, 4}

print(A | B)     # {1, 2, 3, 4}

print(A.union(B))     # {1, 2, 3, 4}
```

All elements, within both sets. Equivalent to `U` in mathematics.

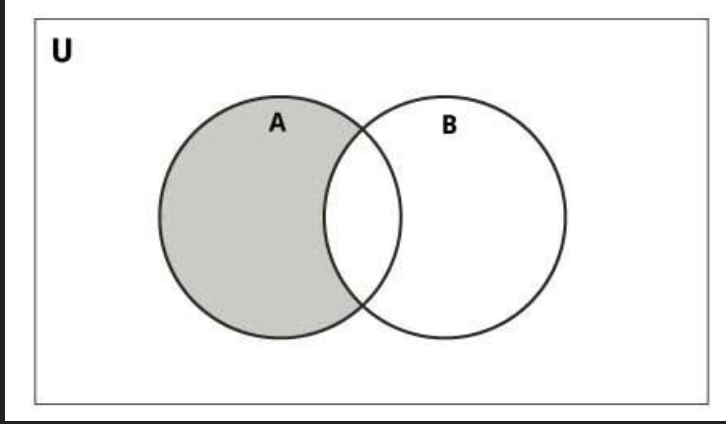
Intersection




```
A = {1, 2, 3}

B = {2, 3, 4}

print(A & B)    # {2, 3}

print(A.intersection(B))    # {2, 3}
```

All elements ***shared*** between both sets. Equivalent to ∩ in mathematics.

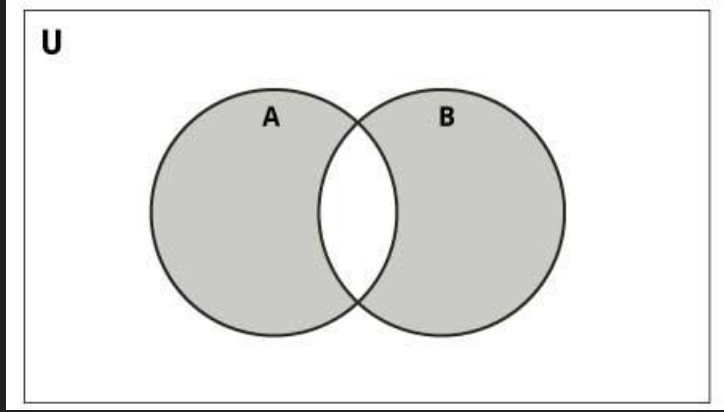
Difference




```
A = {1, 2, 3}

B = {2, 3, 4}

print(A - B)     # {1}

print(A.difference(B))     # {1}
```

Elements ***in A but not in B***. Equivalent to − in mathematics.

Symmetric Difference




```
A = {1, 2, 3}

B = {2, 3, 4}

print(A ^ B)    # {1, 4}

print(A.symmetric_difference(B))    # {1, 4}
```

All elements ***unique*** to both sets. Equivalent to ⊖ in mathematics.