

# Python Sets

A set is an unordered collection of items. Every set element is unique (no duplicates) and must be immutable (cannot be changed).

However, a set itself is mutable. We can add or remove items from it.

Sets can also be used to perform mathematical set operations like union, intersection, symmetric difference, etc.

## Creating Python Sets

A set is created by placing all the items (elements) inside curly braces { }, separated by comma, or by using the built-in set() function.

It can have any number of items and they may be of different types (integer, float, tuple, string etc.). But a set cannot have mutable elements like lists, sets or dictionaries as its elements.

```
# Different types of sets in Python
```

```
# set of integers
```

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

```
print(my_set)
```

```
# set of mixed datatypes
```

```
my_set = {1.0, "Hello", (1, 2, 3)}
```

```
print(my_set)
```

Creating an empty set is a bit tricky.

Empty curly braces { } will make an empty dictionary in Python. To make a set without any elements, we use the set ( ) function without any argument.

```
# Distinguish set and dictionary while creating empty set

# initialize a with {}

a = {}

# check data type of a

print(type(a))

# initialize a with set()

a = set()

# check data type of a

print(type(a))
```

## Modifying a set in Python

Sets are mutable. However, since they are unordered, indexing has no meaning.

We cannot access or change an element of a set using indexing or slicing. Set data type does not support it.

We can add a single element using the add ( ) method, and multiple elements using the update ( ) method. The update ( ) method can take tuples, lists, strings or other sets as its argument. In all cases, duplicates are avoided.

```
# initialize my_set

my_set = {1, 3}

print(my_set)

# my_set[0]

# if you uncomment the above line

# you will get an error

# TypeError: 'set' object does not support indexing

# add an element

# Output: {1, 2, 3}

my_set.add(2)

print(my_set)

# add multiple elements
```

```
# Output: {1, 2, 3, 4}
my_set.update([2, 3, 4])
print(my_set)

# add list and set
# Output: {1, 2, 3, 4, 5, 6, 8}
my_set.update([4, 5], {1, 6, 8})
print(my_set)
```

## Removing elements from a set

A particular item can be removed from a set using the methods `discard ( )` and `remove ( )`

The only difference between the two is that the `discard ( )` function leaves a set unchanged if the element is not present in the set. On the other hand, the `remove ( )` function will raise an error in such a condition (if element is not present in the set).

The following example will illustrate this.

```
# Difference between discard() and remove()
# initialize my_set
my_set = {1, 3, 4, 5, 6}
print(my_set)

# discard an element
# Output: {1, 3, 5, 6}
my_set.discard(4)
print(my_set)

# remove an element
# Output: {1, 3, 5}
my_set.remove(6)
print(my_set)

# discard an element
# not present in my_set
```

```
# Output: {1, 3, 5}
```

```
my_set.discard(2)
```

```
print(my_set)
```

```
# remove an element
```

```
# not present in my_set
```

```
# you will get an error.
```

```
# Output: KeyError
```

```
my_set.remove(2)
```

Similarly, we can remove and return an item using the pop ( ) method.

Since set is an unordered data type, there is no way of determining which item will be popped. It is completely arbitrary.

We can also remove all the items from a set using the clear ( ) method

```
# initialize my_set
```

```
# Output: set of unique elements
```

```
my_set = set("HelloWorld")
```

```
print(my_set)
```

```
# pop an element
```

```
# Output: random element
```

```
print(my_set.pop())
```

```
# pop another element
```

```
my_set.pop()
```

```
print(my_set)
```

```
# clear my_set
```

```
# Output: set()
```

```
my_set.clear()
```

```
print(my_set)
```

# Python Set Operations

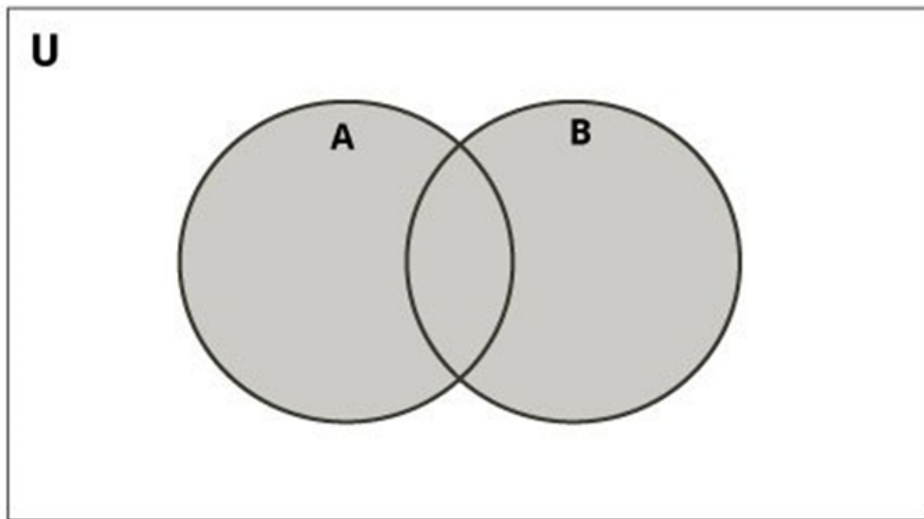
Sets can be used to carry out mathematical set operations like union, intersection, difference and symmetric difference. We can do this with operators or methods.

Let us consider the following two sets for the following operations.

$A = \{1, 2, 3, 4, 5\}$

$B = \{4, 5, 6, 7, 8\}$

Set Union



Set Union in Python

Union of A and B is a set of all elements from both sets.

Union is performed using `|` operator. Same can be accomplished using the union method.

```
# Set union method
```

```
# initialize A and B
```

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

```
B = {4, 5, 6, 7, 8}
```

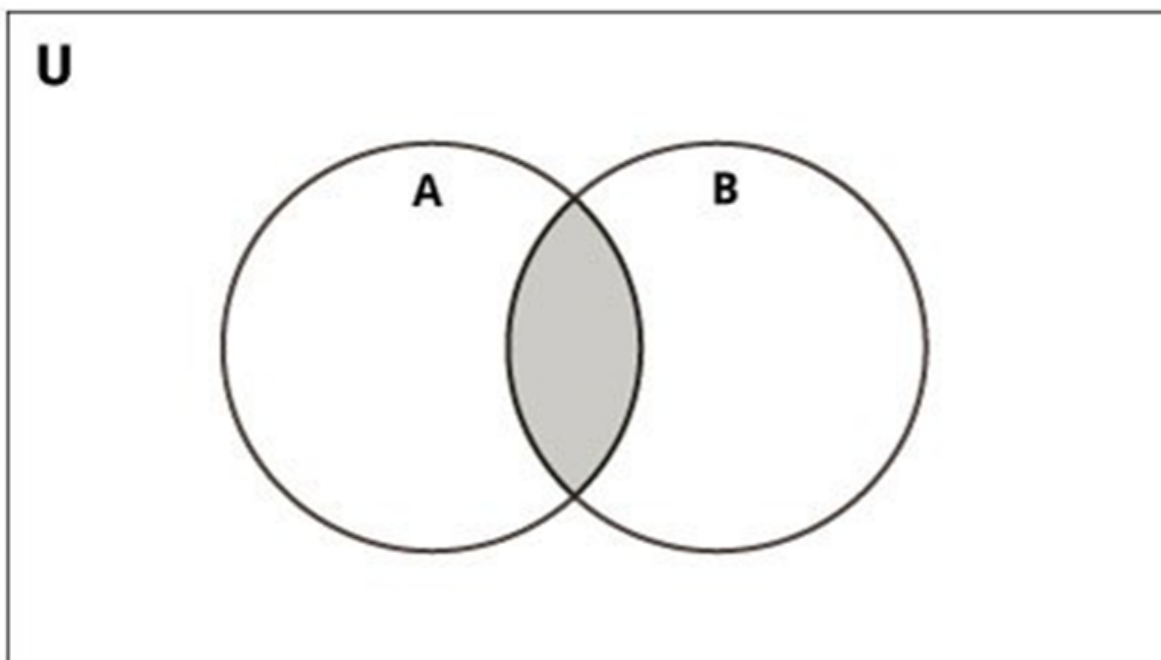
```
# use | operator
```

```
# Output: {1, 2, 3, 4, 5, 6, 7, 8}
```

```
print(A | B)
```

**Output**

```
{1, 2, 3, 4, 5, 6, 7, 8}
```

**Set Intersection**

Set Intersection in Python

Intersection of A and B is a set of elements that are common in both the sets

Intersection is performed using & operator. Same can be accomplished using the Intersection ( ) method

```
# Intersection of sets
```

```
# initialize A and B
```

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

```
B = {4, 5, 6, 7, 8}
```

```
# use & operator
```

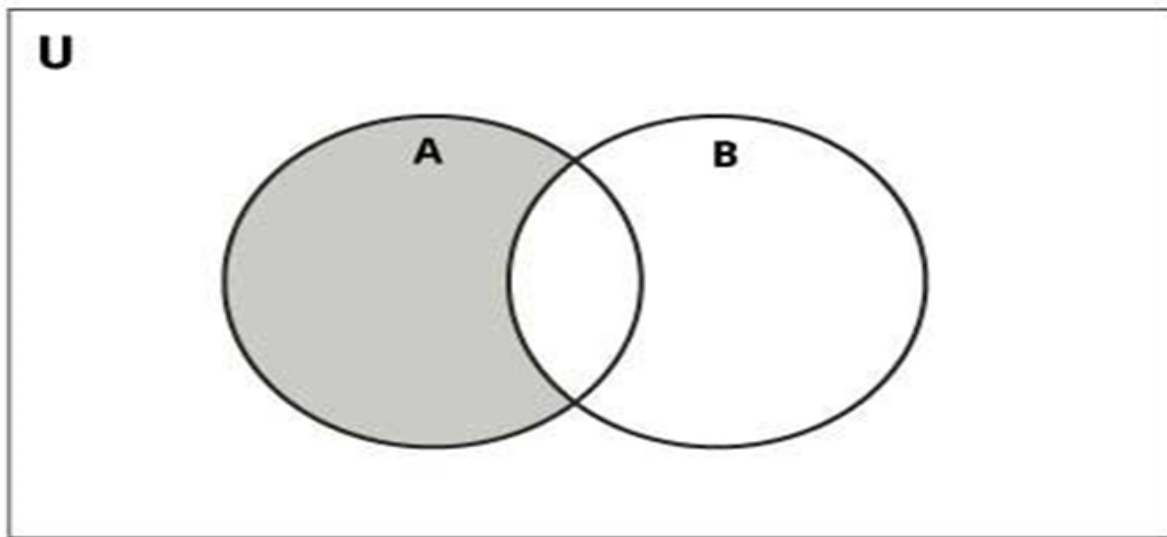
```
# Output: {4, 5}
```

```
print(A & B)
```

## Output

```
{ 4, 5 }
```

## Set Difference



## Set Difference in Python

Difference of the set B from set A ( $A-B$ ) is a set of elements that are only in A but not in B.

Similarly,  $B-A$  is a set of elements in B but not in A.

Difference is performed using  $-$  operator. Same can be accomplished using the difference ( ) method.

```
# Difference of two sets
```

```
# initialize A and B
```

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

```
B = {4, 5, 6, 7, 8}
```

```
# use - operator on A
```

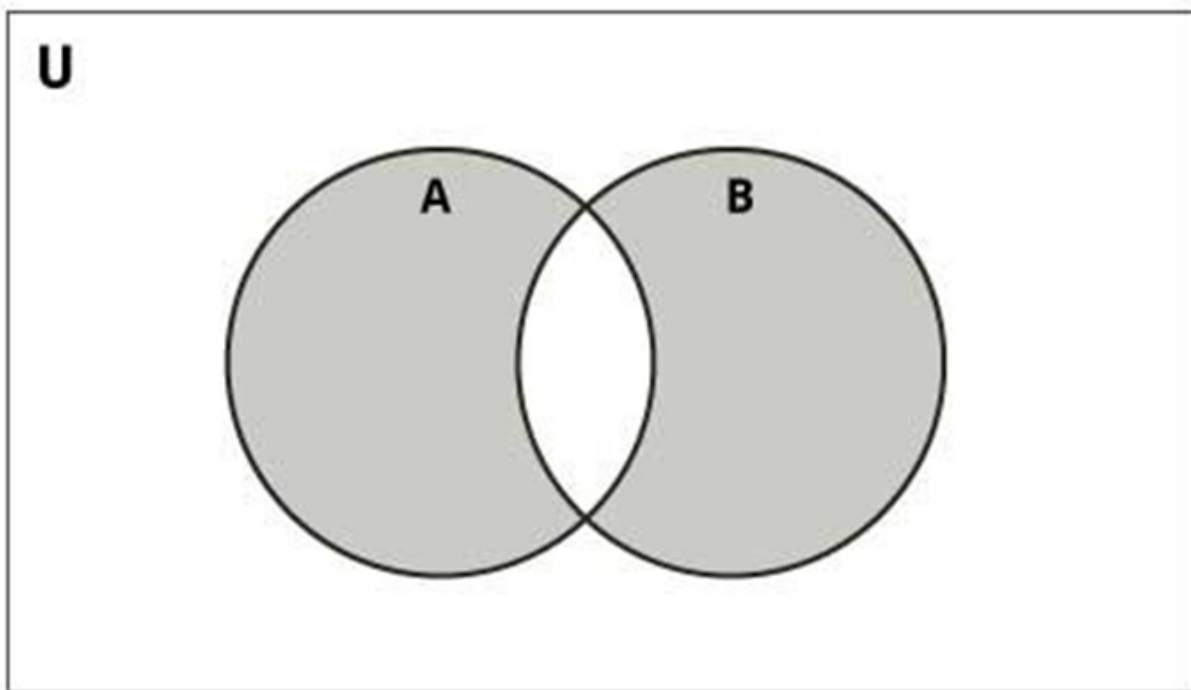
```
# Output: {1, 2, 3}
```

```
print(A - B)
```

**Output**

```
{1, 2, 3}
```

## Set Symmetric Difference



Set Symmetric Difference in python

Symmetric Difference of A and B is a set of elements in A and B but not in both (excluding the intersection).

Symmetric difference is performed using ^ operator. Same can be accomplished using the method `symmetric_difference()`

```
# Symmetric difference of two sets
```

```
# initialize A and B
```



```
A = {1, 2, 3, 4, 5}
B = {4, 5, 6, 7, 8}
# use ^ operator
# Output: {1, 2, 3, 6, 7, 8}
print(A ^ B)
```

### Output

```
{1, 2, 3, 6, 7, 8}
```

## Other Python Set Methods

There are many set methods, some of which we have already used above. Here is a list of all the methods that are available with the set objects:

## Other Set Operations

### Set Membership Test

We can test if an item exists in a set or not, using the `in` keyword

```
# in keyword in a set
# initialize my_set
my_set = set("apple")
# check if 'a' is present
# Output: True
print('a' in my_set)
# check if 'p' is present
# Output: False
print('p' not in my_set)
```

## Iterating Through a Set

We can iterate through each item in a set using a for loop

for letter in set ("apple"):

```
    print(letter)
```

Output

a

p

l

e

## Python Frozenset

Frozenset is a new class that has the characteristics of a set, but its elements cannot be changed once assigned. While tuples are immutable lists, frozensets are immutable sets.

Sets being mutable are unhashable, so they can't be used as dictionary keys. On the other hand, frozensets are hashable and can be used as keys to a dictionary.

Frozensets can be created using the `frozenset()` function.

This data type supports methods like: `copy()`, `difference()`, `intersection()`, `isdisjoint()`, `issubset()`, `issuperset()`, `symmetric_difference()`, and `union()`. Being immutable, it does not have methods that add or remove elements.

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