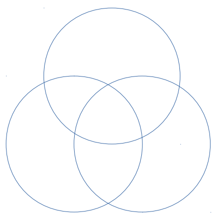
Sets in Python

- A type of collection (as are lists and tuples).
- Main differences from a list:
  - Unordered collection:
    - not indexed by number
    - printing / looping over set gives elements in no particular order
  - Collection of distinct items:
    - The same element can only appear once.
- Analogous to sets in mathematics.



Why use sets? An example.

- Suppose we have meteorological data at various measurement sites.

- We want to ask questions such as:
  - which sites have both wind **and** temperature data?
  - which sites have either wind **or** temperature data?

- We can store information in sets, e.g.:
  - the set of sites that have wind data
  - the set of sites that have temperature data

- Answer these questions intuitively and efficiently using Python set operations like **intersection** or **union**.

How to construct sets in python

- Using `{...}` from specified items, e.g.: `{2, 3, 4}`
- Using `set(...)` from anything you can loop over, e.g.
  - `set([0, 1, 2, 3])`
  - `set('fred')` ← *loop over characters*
  - but not: ~~`set(0, 1, 2, 3)`~~ ← *needs 1 thing to loop over*
- For an empty set, use: `set()`
  - because `{}` means something else
- In Python 2.6 and earlier, `{...}` doesn't exist.
  Use the `set(...)` way instead

Sets are mutable

```
>>> a = {10, 11, 12}

>>> a.add(13)

>>> a.remove(11)

>>> print a
set([10, 12, 13])    ← NB not ordered

>>> a.clear()  ← remove all items
```

Find unique items in a collection

```
letters = set()
for char in 'ichthyosaur':
    letters.add(char)
print letters
```

```
set(['a', 'c', 'i', 'h', 'o', 's', 'r',
'u', 't', 'y'])
```

note h only appears once, and no particular order

- *or simply:*

```
letters = set('ichthyosaur')
```

Set operations

- `len(a)` gives the number of elements

- Many operations on two sets exist
  - comparisons
  - combinations
  - many *operators* have equivalent *methods*
  - see following slides

Set comparisons

returning True or False

`a <= b`	`a.issubset(b)`
`a >= b`	`a.issuperset(b)`

`a < b`	*strict subset*
`a > b`	*strict superset*
`a == b`	*identical*

Set combinations

returning a new set

```
a = { 2, 3 }
b = { 3, 4 }
```

```
a | b    a.union(b)              {2, 3, 4}
a & b    a.intersection(b)             {3}
a - b    a.difference(b)               {2}
a ^ b    a.symmetric_difference(b)  {2, 4}
```

Set operators vs methods

- operators act on two sets
- the equivalent methods act on anything you can loop over

```
set1 = { 2, 3 }
set2 = { 3, 4 }
set1 - set2 gives {2}

tup = ( 3, 4 )
set1 - tup fails with a TypeError

set1.difference(tup) gives {2}
```