Comprehension

```
# Formula
l = []
for {var} in {collection of items}:
    l.append({expression})

# Equivalent list comprehension

l = [{expression}  for {var}  in {collection of items}]


# Example
l = []
for x in range(10):
    l.append(x*x)

# Equivalent list comprehension

l = [ x*x  for  x  in  range(10) ]
```

Conditional comprehension

```
# Formula
l = []
for {var} in {collection of items}:
    if {condition}:
        l.append({expression})

# Equivalent list comprehension

l = [{expression}  for {var}  in {collection of items} if {condition}]


# Example
l = []
for x in [5,6,7,8,9,10,11]:
    if x%2 == 0:
        l.append(x*x)

# Equivalent list comprehension

l = [ x*x  for  x  in [5,6,7,8,9,10,11] if x%2 == 0]
```

List comprehension

```
l = [ x*x  for  x  in range(10) if x%2 == 0 ]
l = list( x*x  for  x  in range(10) if x%2 == 0 )
```

Dictionary comprehension

```
d = { x:x*x  for  x  in range(10) if x%2 == 0 }
d = dict( { x:x*x  for  x  in range(10) if x%2 == 0}  )
```

The lecture video was missing two braces. You need this for the second method.

Set comprehension

```
s = { x*x  for  x  in range(10) if x%2 == 0 }
s = set( x*x  for  x  in range(10) if x%2 == 0 )
```

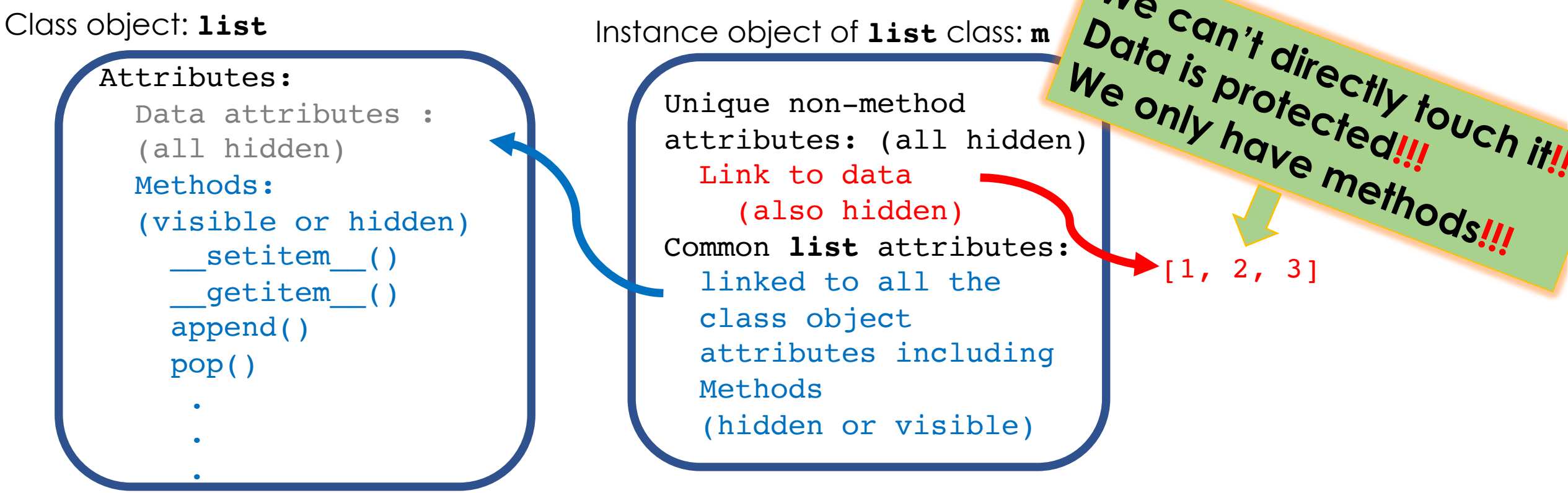
Tuple comprehension (Tuple comprehension requires “tuple()”)

```
t = tuple( x*x  for  x  in range(10) if x%2 == 0 )
```

How to study Python, knowing that everything in python is an object?

Case study: Lists

```
m = [1, 2, 3]
      or
m = list([1,2,3])
```



Programming is all about

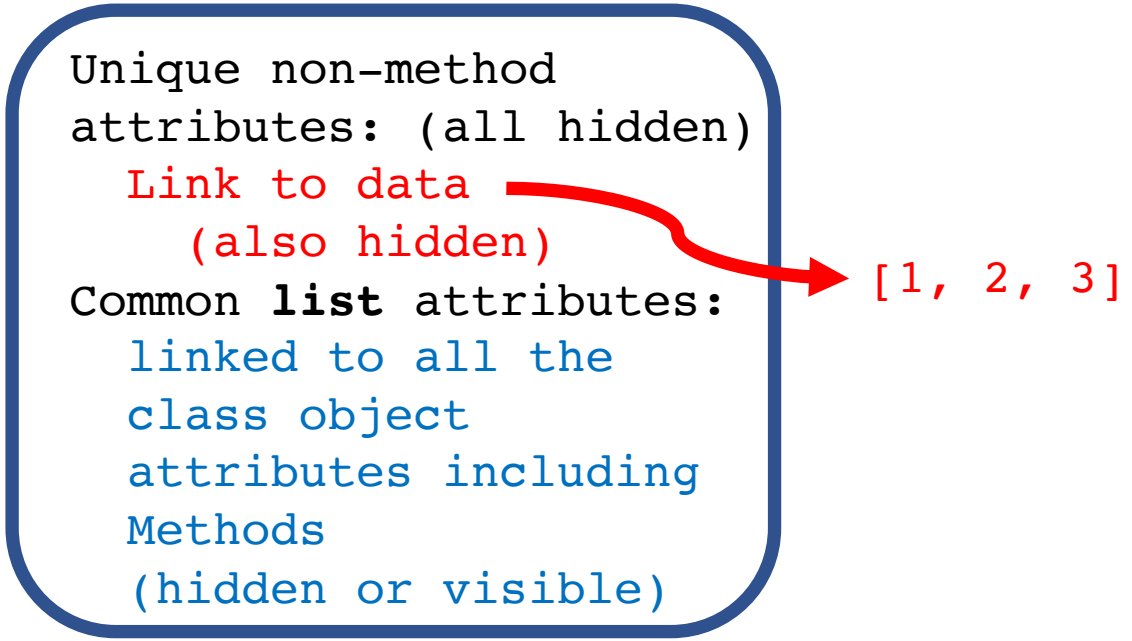
- ***Data***
- ***Data manipulation***

In python, making data is easy. Manipulating the data is **NOT** easy. We must use class methods that are specifically designed to manipulate the data.

```
m.__setitem__(idx, value)
m.__getitem__(idx)
m.append(value)
m.pop(idx)
m.insert(idx, value)
   .
```

```
list.__setitem__(m, idx, value)
list.__getitem__(m, idx)
list.append(m, value)
list.pop(m, idx)
list.insert(m, idx, value)
   .
```

Instance object of the **`list`** class: **`m`**



There are some syntactic sugars for built-in data types (or classes) in Python.

```
int,  float,  complex,  str

list,  tuple,  dict,  set
```

Operators: `[], +, -, *, /, %, **, in, not, is, and, or, >, >=, <, <=, ==, !=,` etc…
Not all operators are available for all types. It depends on whether it makes sense and if it is convenient for that data type.

Comprehension: `list, dictionary, set, tuple`

Note: Syntactic sugars are as important as the key syntaxes. And, often, it is more than sugar. It is not critical to *understand* the language. But, without them, Python won't be as powerful. Ex: a new walrus operator, '**:=**'. If you're curious, see https://realpython.com/lessons/assignment-expressions/

How should we study each class (or, object/data type)?

1. Check out how to *initialize* the object. There may be multiple ways.
2. Read examples to understand *methods* to manipulate the data
3. Check if there are any syntactic Kool-Aid, such as useful *operators*.

Ex: **`Dictoinary`**

1. Initialization of object:

```
d = { 'k':34, 'm':'abc', 'NYC':'cold'}  # there are more ways.
```

2. Methods for data manipulation: (getting a list of methods: `dir(d)`)

```
d.update({'SB':'69F'})
m_val = d.pop('m')
keys = d.keys()          # etc…
```

3. Syntactic sugar:

```
NYC_temp = d['NYC']    # same as d.__getitem__('NYC')
new_d = {  x*x for x in range(10) }  # comprehension
```

How about non-native data types?

(Python allows programmers to use operators to behave whatever way they want them to behave. We will see how operators behave differently in other non-native data types such as **`array`** and **`dataframe`**.)

The approach to study 3rd-party classes (or other classes in the standard library) is the same.

Ex: **`Seq`** class of Biopython

1. Initialization of an object (i.e., initializing the data):

```
seq = Seq('atgcatgc')  # There are more ways.
```

2. Methods for data manipulation: This is an immutable object. Thus, we can't manipulate it!! Instead, we get a modified version of the data as a return 'object'. (See **`MutableSeq`** class) Use `dir(seq)` to get a list of methods.

```
ex_seq = seq.upper()            # A new Seq object is returned.
mRNA_seq = seq.transcribe()     # Again, a new Seq object
rev_seq = seq.reverse_complement()   # etc…
```

3. Syntactic sugar:

```
sub_seq = seq[2:5]    # Returns a new seq object with partial seq
```

Worth memorizing (to be efficient and effective):

Control flow syntaxes (**`if-elif-else, for-loop, while-loop`**)

Syntaxes for **`functions`** and **`classes`**

Most methods and operators of **`str, list, tuple,`** and **`dictionary`**

A few selected methods (e.g., **`reverse_complement, translate`**, etc) of **`Seq`** and **`SeqRecord`**,

Useful tool functions, such as, **`dir(), type(), help(), callable(), %time, %debug,`** etc

(**`git pull, add, commit, push`**, though not Python.)