CS 1112: Introduction To Programming

Lists

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Friendly Reminders

- Your ***safety*** and ***comfort*** is important!
  - If you choose to wear a mask you are welcome to do so
  - *We will interpret wearing a mask as being **considerate and caring** of others in the classroom (not that you are sick), and realize that some may choose to mask to **remain distanced***

- Remember to always be **kind**, **respectful**, **supportive**, **compassionate** and **mindful of others**! ☺

- Be an ***active*** participant in your learning!
  You're welcome and ***encouraged*** to ask questions during class!

- If you feel ***unwell***, or think you are, please stay home
  - *Contact us!* *We will work with you!*
  - Get some rest ☺
  - View the recorded lectures – *please allow 24-48 hours to post*

Announcements

- **PA04** is due by 11:00pm on Wednesday (***March 19 ~ After Spring Break***)!
  - Submit on Gradescope: your **.py** file, and a **PDF** of your reflection
  - Please be mindful about submitting the right kind of files (.py file and .pdf file) as well as submitting the .py file that is named correctly (see assignment document for full details)
  - A note about submitting on Gradescope: you can submit an **UNLIMITED** number of times prior to the deadline. Look at the score you got, if you have some points taken off, that's ok, go back and fix your code and resubmit! Do this as often as you like BEFORE the assignment deadline. You cannot resubmit after the deadline.
  - ***REMEMBER ALSO***: You have a grace period of 24 hours to submit your PAs!
- **Quiz 5** will come out this week (probably 3/5) and due Monday (***March 17 ~ After Spring Break***)

Exam 1

- **Exam 1** is ***being graded***!
- Results will be on both Sherlock and Canvas grades
- Most students including our TAs have many midterms this week before the break
- **So, Exam 1 grades will be returned either Friday of this week or after the break**
  - This is to ensure grading is done accurately, carefully, and not rushed

Properties of some collections

Today

Type	**Stores**	**Syntax**
Range	ints	`range(3,7)`
String	characters	`"Hello", "abc 123"`
List	anything	`[1,2,3,6,"hello"]`
Tuple	anything	`(1,2,3,6,"hello")`

Future Class

Dictionary	key:value pairs	`{17:"hi", 29:"bye"}`
Set	anything	`{1,2,6,"hi"}`

Kinds of Collections (the word "collection" in python technically has a much more strict meaning)

Sequence types

```
str     # string
range
list
tuple
```

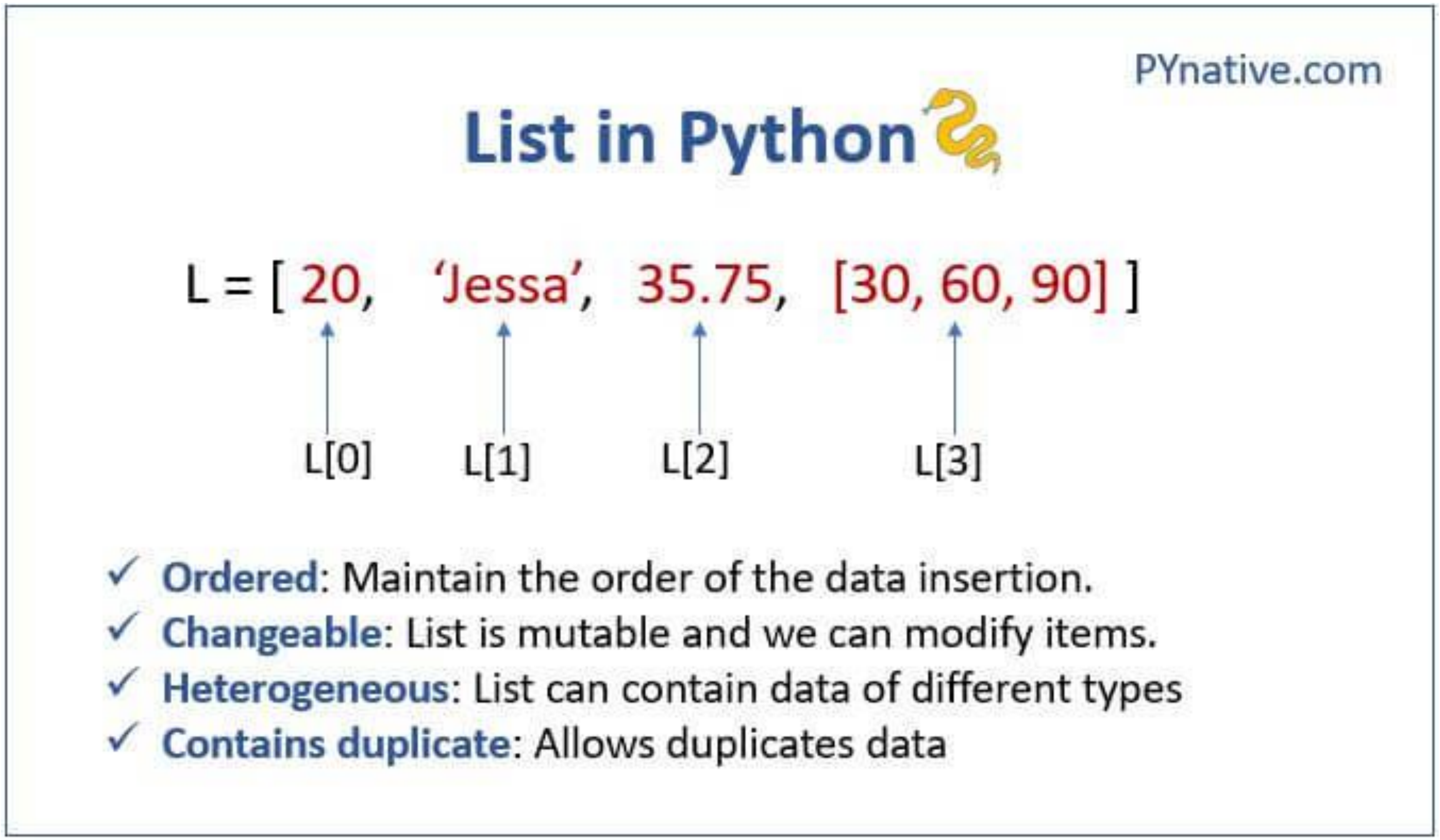
- Order Matters
- Repetition of Items OK
- Counting starts at 0
- Collection[index] gives a specific value from the collection

Non-Sequence types

```
dict  # dictionary
set
```

- Ordering - not really?
  - first item is not at index 0
  - dict - insertion order only
  - set - no ordering
- No Repetition of Items Allowed

List in Python


PYnative.com

List in Python

```
L = [ 20,  'Jessa',  35.75,  [30, 60, 90] ]
```

- ✓ **Ordered**: Maintain the order of the data insertion.
- ✓ **Changeable**: List is mutable and we can modify items.
- ✓ **Heterogeneous**: List can contain data of different types
- ✓ **Contains duplicate**: Allows duplicates data

Lists

One of the most popular and versatile data structures!

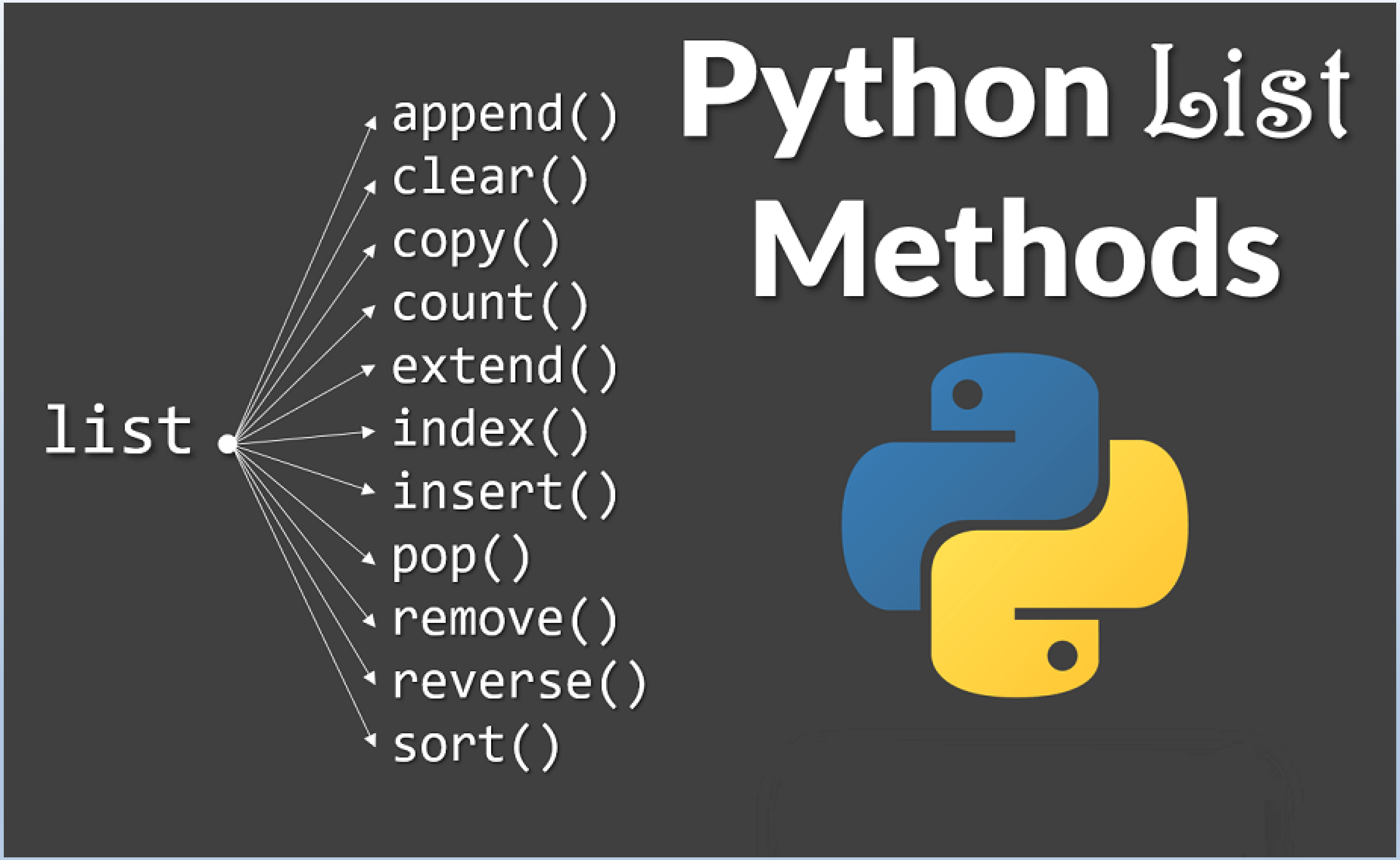
-- Yes, it is completely *mutable* (modifications are allowed: adding, removing, updating)

-- Lists are *dynamic* (meaning their size can change during runtime)

Lists

- A way of collecting together a bunch of things, and giving them all one **name**
- Looks like this: [*the*, *things*, *separated*, *by*, *commas*] ☺

```
my_list0 = list((1, 2, 3))  # creating a list using the list constructor

my_list1 = [1, 2, 3, 4]     # creating a list using square brackets []

my_list2 = ['one', 'two', 'three', 'four’] # a list of strings (same type)

my_list3 = [1, 'two’, 3.0, False]         # a list of heterogeneous items

my_list4 = []  # creating an empty list using []

len(my_list3) # gives the number of things in the list (in this case 4)

my_list2[i] # gives the ith thing in the list (starts at 0) → indexing
```


Python List
Methods
list
append()
clear()
copy()
count()
extend()
index()
insert()
pop()
remove()
reverse()
sort()

Some Common List Operations

1. Adding Elements:

- `append()`: Adds an element to the end of the list.
- `insert()`: Inserts an element at a specific index.

2. Removing Elements:

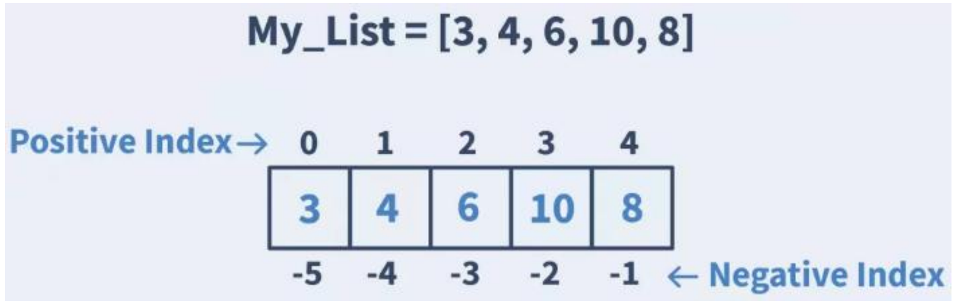
- `remove()`: Removes the first occurrence of a specific value.
- `pop()`: Removes and returns an element at a given index.

3. List Concatenation:

- Lists can be ***concatenated*** using the **+** operator.
- `combined_list = list1 + list2`

4. Sorting and Reversing:

- `sort()`: Sorts the elements of a list in ascending order.
- `reverse()`: Reverses the order of elements in a list.


My_List = [3, 4, 6, 10, 8]
Positive Index→ 0 1 2 3 4
3 4 6 10 8
-5 -4 -3 -2 -1 ← Negative Index

scaler.com What is List in Python?

medium.com Python Lists

Iterating Over List Elements :: for loop!

- Lists are **iterable**, allowing for convenient iteration through their elements using loops.

- For example: *iterating over every element in the list and printing each element out*

```
my_list: [‘cat’, ‘dog’, ‘rabbit’]
for item in my_list:
      print(item)
```

In every iteration, the variable “`item`” will hold a new element in the list. For example in the first iteration it will hold the value “cat” then “dog” and finally “rabbit”. The loop will stop iterating once the end of the list is reached *(it does this automatically!)*

Examples of Some common **list** methods

```
my_list = ['apple', 'banana']

my_list.append('watermelon’)

# Where does append put the new item?
```

Examples of Some common **list** methods

```
my_list = ['apple', 'banana']

my_list.append('watermelon’)

# ['apple', 'banana', 'watermelon']
```

Examples of Some common **list** methods

```
# ['apple', 'banana', 'watermelon']

my_list.insert(1, 'orange')
```

Examples of Some common **list** methods

```
# ['apple', 'banana', 'watermelon']

my_list.insert(1, 'orange')

# ['apple', 'orange', 'banana', 'watermelon']
```

Examples of Some common **list** methods

```python
# ['apple', 'orange', 'banana', 'watermelon']

my_list.remove('apple')
```

Examples of Some common **list** methods

```
# ['apple', 'orange', 'banana', 'watermelon']

my_list.remove('apple')
```

# [~~'apple', ~~'orange', 'banana', 'watermelon’]

```
# ['orange', 'banana', 'watermelon']
```

Examples of Some common **list** methods

```
my_list.index('banana')

# ['orange', 'banana', 'watermelon']
```

Examples of Some common **list** methods

```
my_list.index('banana')

# ['orange', 'banana', 'watermelon’]

# Answer:  1
```

Examples of Some common **list** methods

```
# ['orange', 'banana', 'watermelon’]

my_list.sort()
```

Examples of Some common **list** methods

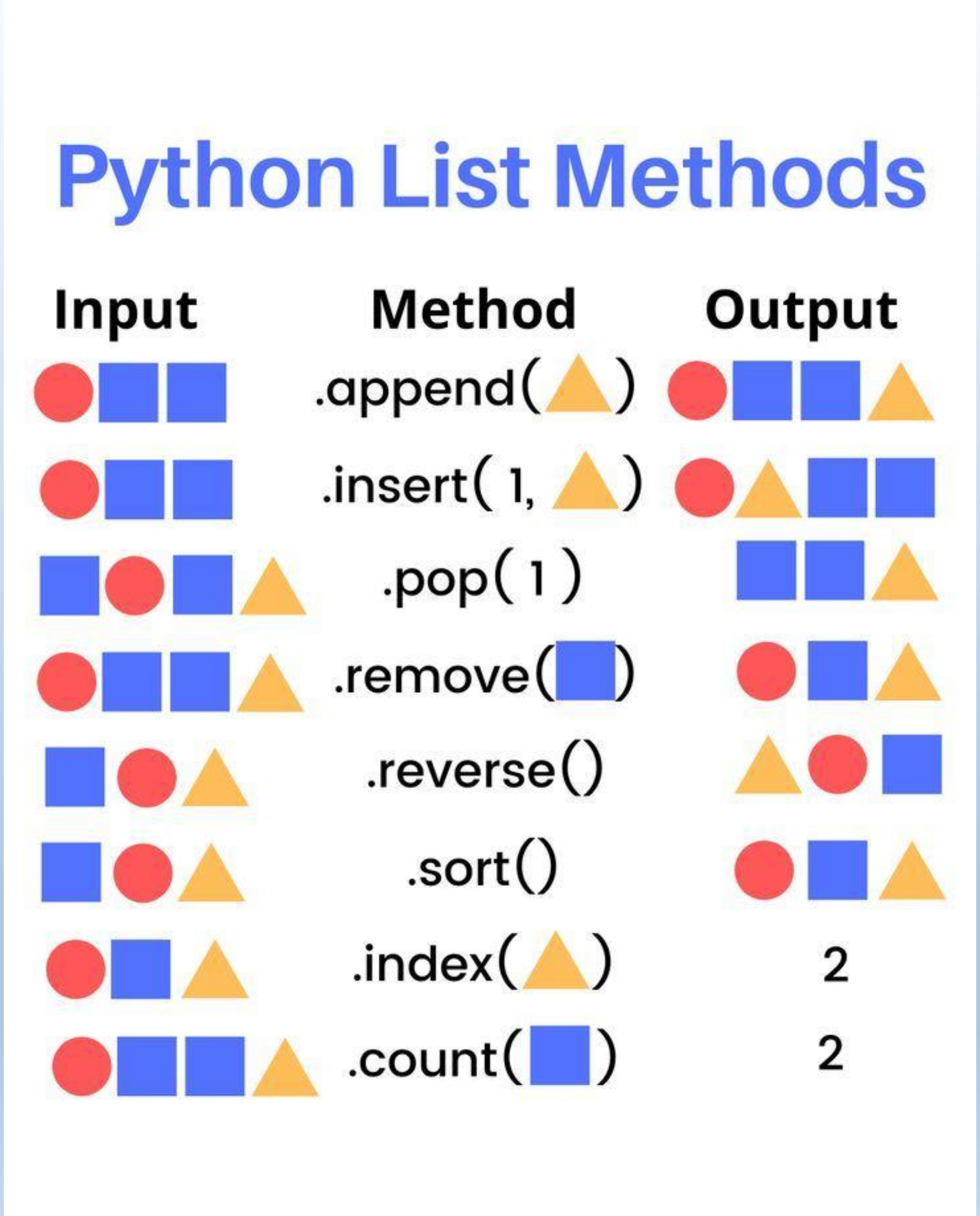
```
# ['orange', 'banana', 'watermelon’]

my_list.sort()

# ['banana', 'orange', 'watermelon’]
# Since strings: sorts in alphabetical order
```

Examples of Some common **list** methods

```
my_list = ['apple', 'banana']
my_list.append('watermelon') # ['apple', 'banana', 'watermelon']
my_list.insert(1, 'orange’)
     # ['apple', 'orange', 'banana', 'watermelon']
my_list.remove('apple') # ['orange', 'banana', 'watermelon']
my_list.index('banana') # 1
my_list.sort() # ['banana', 'orange', 'watermelon']
```

A Few Examples of Changing A List (using =)

```
my_list = [3, 4, 6, 10, 8, 5]

print(my_list)    Output: [3, 4, 6, 10, 8, 5]

# Changing value of index 3:

my_list[3] = 7

print(my_list)    Output: [3, 4, 6, 7, 8, 5]

# Changing value of index -1, i.e., the last value.

my_list[-1] = 11

print(my_list)    Output: [3, 4, 6, 10, 8, 11]
```



Python List Methods

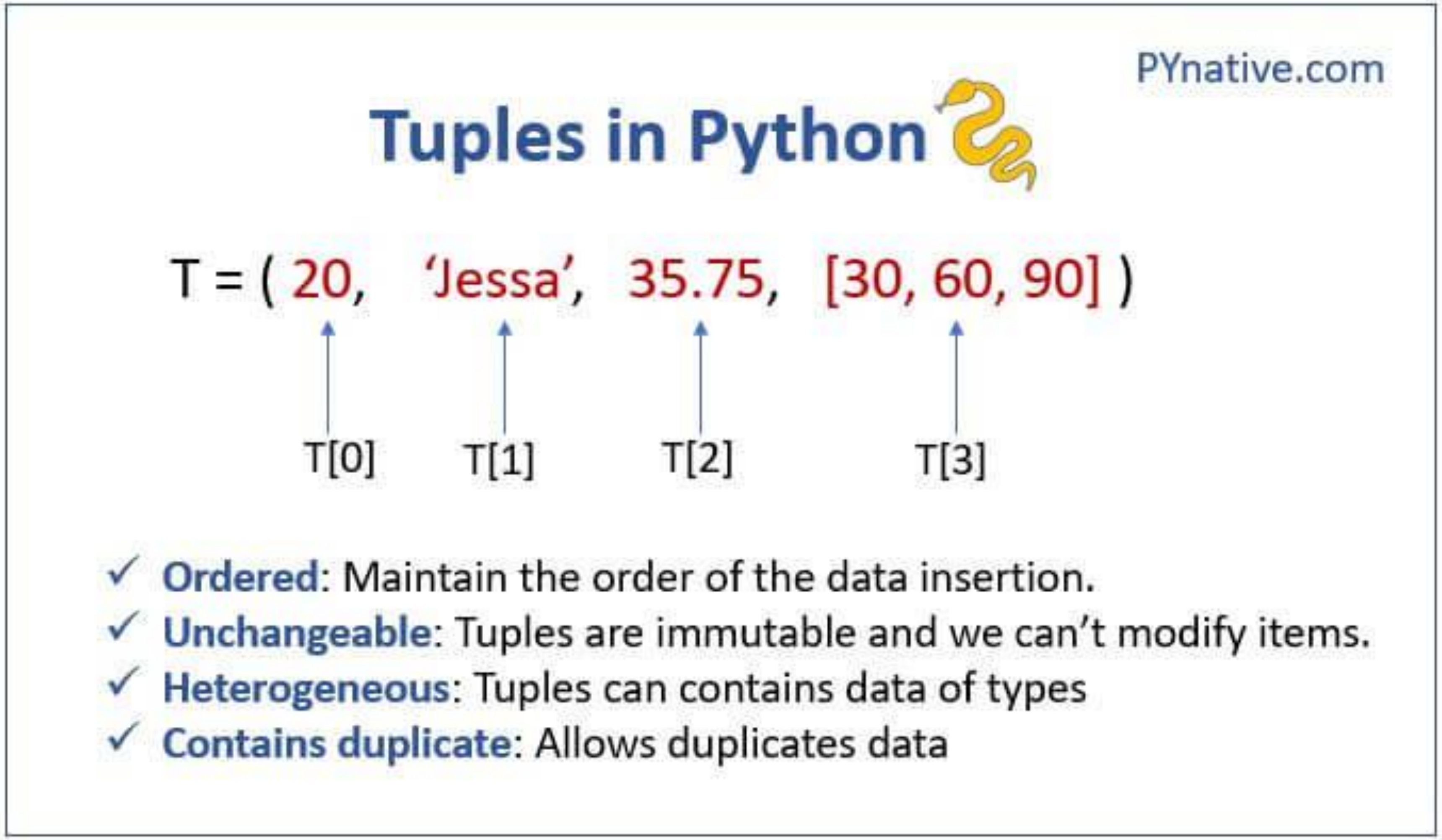
Input	Method	Output
●■■	.append(▲)	●■■▲
●■■	.insert(1, ▲)	●▲■■
■●■▲	.pop(1)	■■▲
●■■▲	.remove(■)	●■▲
■●▲	.reverse()	▲●■
■●▲	.sort()	●■▲
●■▲	.index(▲)	2
●■■▲	.count(■)	2

Quick & Fun Survey Questions

Get to know your peers! ☺ **WOULD YOU RATHER…**

Have the ability to see 10 minutes into the future <u>or</u> 150 years into the future??

Tuples in Python



PYnative.com

Tuples in Python

T = (20, 'Jessa', 35.75, [30, 60, 90])

T[0] T[1] T[2] T[3]

- ✓ **Ordered**: Maintain the order of the data insertion.
- ✓ **Unchangeable**: Tuples are immutable and we can't modify items.
- ✓ **Heterogeneous**: Tuples can contains data of types
- ✓ **Contains duplicate**: Allows duplicates data

Tuples

Tuples are very similar to the List data structure – but have one main difference!

-- Tuples are *immutable* (Tuples are unchangeable, which means we cannot add/delete/etc)

Tuples

- Similar to lists, but can't be **modified** (more on this in future classes)
  - Python can access them *faster* than lists
    (but this only matters for really, really, big lists/tuples)

- Some functions that we will use return tuples instead of returning lists

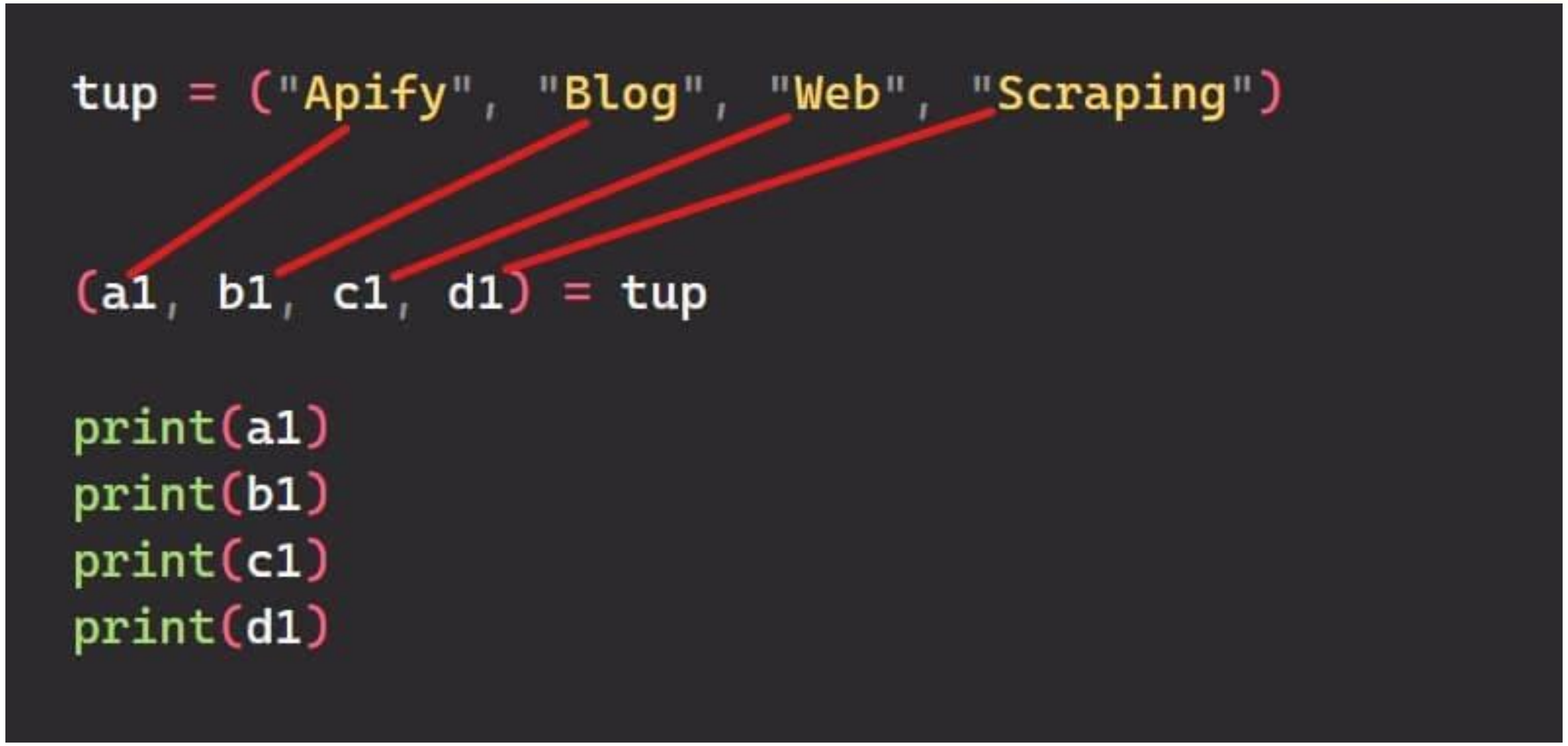
- We can **create a list** from a tuple with type-casting
  - `new_list = list(old_tuple)`

- When given the option between creating a list and creating a tuple, we will almost always choose a **list**

Tuples

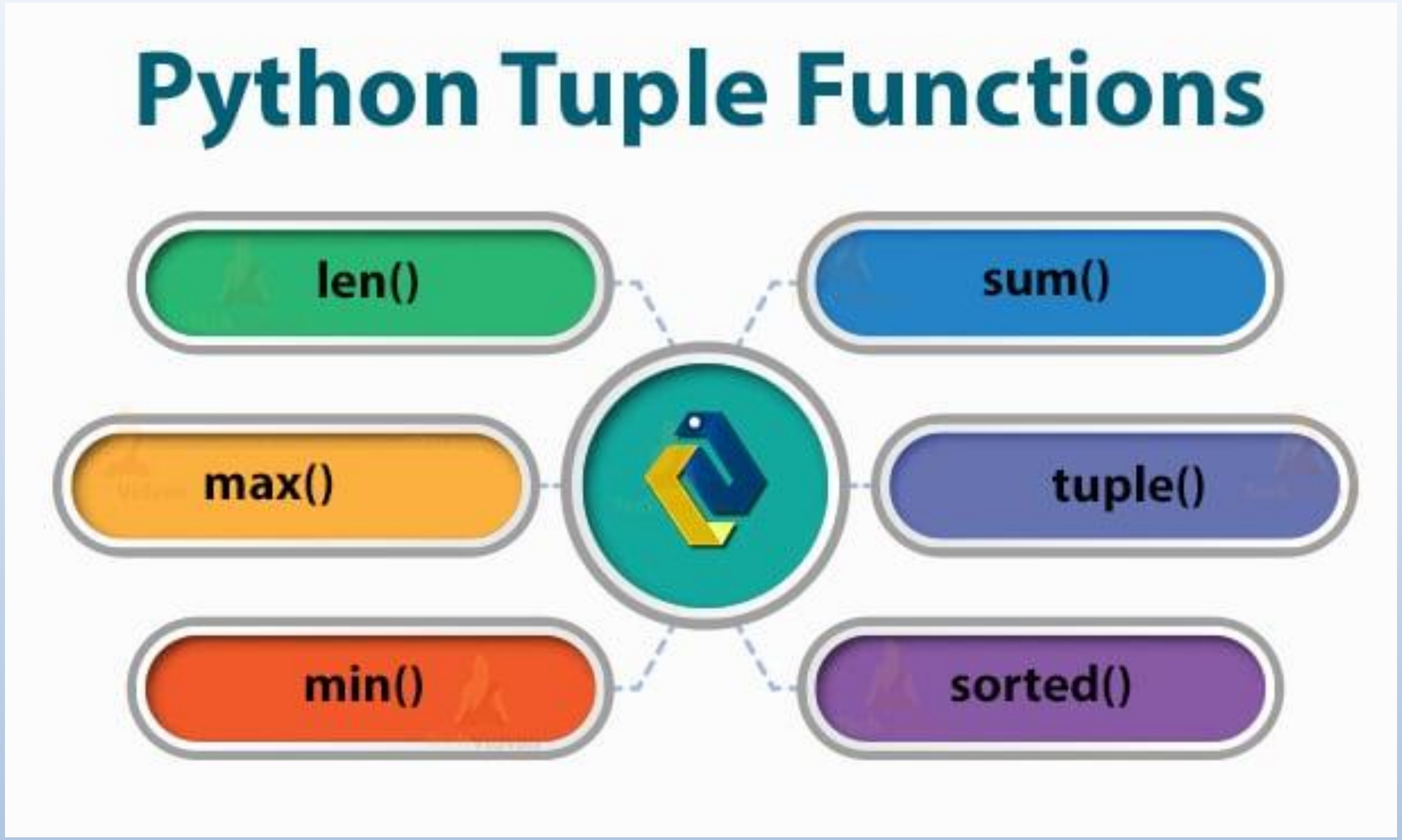
```
my_tuple0 = tuple((‘Nina’,30, 5.75, [7, 11]))
      # creating a tuple using the tuple constructor

my_tuple1 = (1,2,3,4)  # creating a tuple using parenthesis ()

my_tuple2 = ('one', 'two', 'three', 'four’)  # a tuple of strings (same type)

my_tuple3 = (1, 'two', 3, 'four’)  # a tuple of heterogenous items (types)

### Given tuples are immutable, there’s no point in creating an empty tuple! ☺

len(my_tuple3) # gives the number of things in the tuple (in this case 4)

my_tuple2[i] # gives the ith thing in the tuple (starts at 0) → indexing
```

Unpacking a Tuple… (Can be very handy!)



```
tup = ("Apify", "Blog", "Web", "Scraping")


(a1, b1, c1, d1) = tup

print(a1)
print(b1)
print(c1)
print(d1)
```

(Main Tuple functions, but there are others…)



Because of its *immutability*, we cannot use some of the methods like:
1. `append()` and `insert()`, because we cannot add elements to the tuple
2. `remove()` and `pop()`, because we cannot delete elements of a tuple

Lists vs. Tuples

This code ...

```python
# list vs. tuple comparison
my_list = [1, 2.7, 'wahoo', True]
my_tuple = (1, 2.7, 'wahoo', True)

for thing in my_list:
   print(thing)

for thing in my_tuple:
   print(thing)

print(my_list[2])
print(my_tuple[2])

print(my_list)
my_list[0] = 100
print(my_list)

print(my_tuple)
my_tuple[0] = 100  # Error - tuples are
                              immutable
print(my_tuple)
```

Produces this output

```
1
2.7
wahoo
True

1
2.7
wahoo
True

wahoo
wahoo

[1, 2.7, 'wahoo', True]
[100, 2.7, 'wahoo', True]


(1, 2.7, 'wahoo', True)
my_tuple[0] = 100
TypeError: 'tuple' object does not support
item assignment
```

Operating on Collections

- Let’s practice adding to collections -
  - **Adding one item to the collection**
    - Strings: `my_string = “hello” + “w”`
    - Lists: `my_list.append(thing)`
    - Tuples: you should probably use a list
    - Ranges: can’t do this
  - **Adding several items to the collection**
    - Strings: `my_string = “hello” + “goodbye”`
    - Lists: `my_list = list1 + list2`
    - Tuples: `my_tuple = tuple1 + tuple2`
    - Ranges: can’t do this

Collection types we know: strings, lists, ranges, tuples

```python
# a program to look at collections
string1 = "1234"
tuple1 = (1,2,3,4)
list1 = [1,2,3,4]
range1 = range(1,5)

my_group = [string1, tuple1, list1, range1]

def collection_info(the_collection):
   print('-----------------')
   print(type(the_collection), the_collection)
   for each in the_collection:
      print(type(each), each)

print("my_group - ", my_group)
for item in my_group:
   collection_info(item)
```

```
my_group -  ['1234', (1, 2, 3, 4), [1, 2, 3, 4], range(1,
5)]
-----------------
<class 'str'> 1234
<class 'str'> 1
<class 'str'> 2
<class 'str'> 3
<class 'str'> 4
-----------------
<class 'tuple'> (1, 2, 3, 4)
<class 'int'> 1
<class 'int'> 2
<class 'int'> 3
<class 'int'> 4
-----------------
<class 'list'> [1, 2, 3, 4]
<class 'int'> 1
<class 'int'> 2
<class 'int'> 3
<class 'int'> 4
-----------------
<class 'range'> range(1, 5)
<class 'int'> 1
<class 'int'> 2
<class 'int'> 3
<class 'int'> 4
```

Python Demonstration

Let's jump on PyCharm!

`lists.py` - Lots of List examples!

```
elif _operation == "MIRROR_Y":
    mirror_mod.use_x = False
    mirror_mod.use_y = True
    mirror_mod.use_z = False
elif _operation == "MIRROR_Z":
    mirror_mod.use_x = False
    mirror_mod.use_y = False
    mirror_mod.use_z = True

    #selection at the end -add back the deselec
mirror_ob.select= 1
modifier_ob.select=1
bpy.context.scene.objects.active = modifier_ob
print("Selected" + str(modifier_ob)) # modifier
    #mirror_ob.select = 0
```

In-Class “lab” Activity!

Activity for Today!

- In pairs or groups up to three work on the following activity.
- **lists_ica.py**
- *Practice writing code that uses a list. Also practice with sorting and searching*

Remember to check-in with a TA before leaving class today!

Reminder: CS Laptop Loaner Program

- This course requires students to have a **laptop**
- I realize that not everybody might have one (nor necessarily need one for their desired major / path…)
- If you do not have a laptop for any reason… ***not to worry!***
- The CS department's Systems staff has a notebook / laptop loaner program and will be able to loan you a notebook / laptop computer for the duration of the semester if you don't have one or if you cannot afford one.
  - Also available if your laptop is broken and under repair, we can arrange for you to receive a loaner laptop for a week or two until your own laptop is fixed

Interested? Link: https://www.cs.virginia.edu/wiki/doku.php?id=cs_laptop_loaner

I am happy to be your sponsor. Please let me know.