ITP 115

Lists

Recall: Sequences Have Indices!

- Each individual item in a sequence is automatically given a position number
- This number is called an **index** and tells what position the item is in
- The **first index** is **zero (`0`)**
- The **last index** is the **number of items – 1**

Recall: Two Categories of Sequences

- Mutable – changeable
  - Can modify A SINGLE item in the sequence
- Immutable – unchangeable
  - Can **NOT** modify A SINGLE item in the sequence

Strings are Immutable

```
word = "game"
print (word)
word[0] = "l"
```

```
TypeError: 'str' object does not
           support item assignment
```

Strings are Immutable

- Well that's frustrating…
- What kind of sequence is mutable then?

Consider…

Ask the user for three test scores. Display the average along with the original scores.

Create a ***count*** (*set to 0*) and create a ***sum*** (*set to 0*)

Ask user for 1st number (store in ***testScore1***)
    Add number to sum and increment counter
Ask user for 2nd number (store in **testScore2**)
    Add number to sum and increment counter
Ask user for 3rd number (store in ***testScore3***)
    Add number to sum and increment counter

Display ***testScore1***, ***testScore2***, ***testScore3***, and average (***sum/count***)

Consider…

Now you have 6 test scores…

Create a ***count*** (*set to 0*) and create a ***sum*** (*set to 0*)

Ask user for 1st number (store in ***testScore1***)
    Add number to sum and increment counter
Ask user for 2nd number (store in **testScore2**)
    Add number to sum and increment counter
Ask user for 3rd number (store in ***testScore3***)
    Add number to sum and increment counter
Ask user for 4th number (store in ***testScore4***)
    Add number to sum and increment counter
Ask user for 5th number (store in **testScore5**)
    Add number to sum and increment counter
Ask user for 6th number (store in ***testScore6***)
    Add number to sum and increment counter

Display ***testScore1***, ***testScore2***, ***testScore3***, ***testScore4***, ***testScore5***, ***testScore6*** and average (***sum/count***)

Consider…

- Using a separate variable for each score…
  - Is impractical for more than a few scores
  - Makes it difficult to use a for loop for efficiency
  - Prone to errors

- All the scores are *related* so….
  - Instead we use a sequence (or group) of variables called a **list**

Lists

- New type of variable!
- Are sequences like strings, but lists are **mutable**
- Contain all the same type of elements*
  - i.e. all strings or all ints

**Technically, Python allows lists to hold different types of elements. For our class, though, we will only store "like items"*

Lists

- Syntax

```
listVariable = [item1, item2, ...]
```

- `item1` could be any type of variable
  - string: `"hello"`
  - int: `7`
  - float: `8.5`
  - another list: `["this is", "another list"]`
  - Any other variable type we will cover

Lists are Sequences

- Since lists are sequences, you can manipulate them just like strings!

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]

#concatenate
things += stuff
#alternatively
things = things + stuff
```

things

0	1	2	3	4
emu	pig	dog	cat	boa

stuff

0	1	2
dog	cat	boa

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]

#index operator
animal = stuff[0]
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

animal

dog

- What type of variable is **stuff**?
- What type of variable is stored at **stuff[0]**?
- What type of variable is stored in **animal**?

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]

#slices
grabBag = stuff[0:2]
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

grabBag

0	1
dog	cat

What type of variable is **grabBag**?

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]

#len operator
length = len(stuff)
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

length

3

Lists are Sequences

```
things = ["emu", "pig"]
stuff = ["dog", "cat", "boa"]

#in operator
if "dog" in stuff:
    print("Found dog")
else:
    print("No dog found")
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

```
Found dog
```

Lists are Sequences

```
things = ["emu", pig]
stuff = ["dog", "cat", "boa"]

#for loop
for item in stuff:
    print(item)
```

things

0	1
emu	pig

stuff

0	1	2
dog	cat	boa

```
dog
cat
boa
```

Creating Empty Lists

- Often we will want to create an empty list before a loop, at the start of our program, etc.

- Syntax

```
numbers = list()
```

or

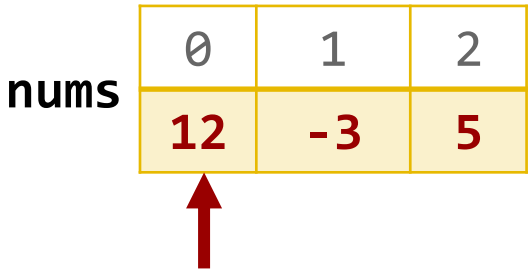
```
numbers = []
```

Lists are Mutable!

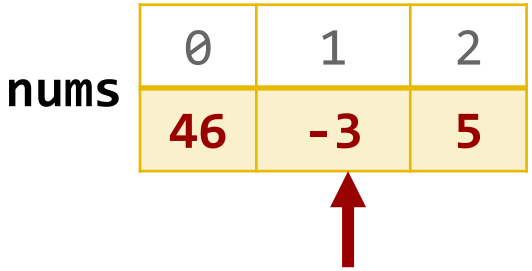
- Assign a new list element by index
- Assign a new list slice
  - Replace multiple items with one item
- Delete a list element
  - Doesn't create a gap in a sequence
  - All the elements "slide down" one position
- Delete a list slice
  - Delete multiple elements

Lists are Mutable!

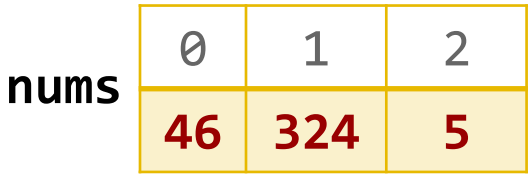
```
nums    = [12, -3, 5]
```




```
nums[0] = 46
```




```
nums[1] = 324
```



Note **[1]** *refers to index position, not the value*

List Methods

Method	Description
`someList.append(value)`	Adds value to end of a list.
`someList.remove(value)`	Removes the first occurrence of value from the list.
The following will be covered next week	
`someList.sort()`	Sorts the elements, smallest value first.
`someList.reverse()`	Reverses the order of a list.
`someList.count(value)`	Returns the number of occurrences of value.
`someList.index(value)`	Returns the first position number of where value occurs.
`someList.insert(i, value)`	Inserts value at position i.
`someList.pop([i])`	Returns value at position i and removes value from the list. Position number i is optional; omitting will remove last element and return it.
`del someList[i]`	Removes the element at the specified index

someList.append(someValue)

- Adds value to end of a list

- Example

```
numbers = [3, 5, -12]
```

0	1	2
3	5	-12

someList.append(someValue)

- Adds value to end of a list

- Example

```
numbers = [3, 5, -12]
numbers.append(40)
```

0	1	2	3
3	5	-12	40

someList.remove(someValue)

- Removes the first occurrence of a *value* from list
- Example

```
numbers = [3, 5, -12, 40, 5]
```

0	1	2	3	4
3	5	-12	40	5

someList.remove(someValue)

- Removes the first occurrence of a *value* from list
- Example

```
numbers = [3, 5, -12, 40, 5]
numbers.remove(5)
```

0	1	2	3
3	-12	40	5

someList.remove(someValue)

- Removes the first occurrence of a *value* from list
- Example

```
numbers = [3, 5, -12, 40, 5]
numbers.remove(5)
numbers.remove(5)
```

0	1	2
3	-12	40

someList.remove(someValue)

- Removes the first occurrence of a *value* from list
- Example

```
numbers = [3, 5, -12, 40, 5]
numbers.remove(5)
numbers.remove(5)
numbers.remove(5)
```

```
ValueError: list.remove(x): x not in list
```

0	1	2
3	-12	40

Important: Always check **if** value is in list before removing it