Lists, Tuples, Dictionaries

...and, uh, turtles

Container #1: Lists!

A list is a type in Python. The list type is a container that holds some number of elements in a particular order. Usually these are the same type of element, but this isn't necessary. Lists are denoted by square brackets: [and]

For example:

```
[1, 2, 3]
[]
['x', True, 0]
```

What can I do with a list?

Assigning a list: `x = [1, 2, 3]`

Finding the size: `len(x)`

Adding to a list: `x.append(4)`

Accessing a list element: `x[0]`

Changing a list element: `x[0] = 5`

Deleting from a list: `del x[1]`

Iterating over a list in a for loop:

```
for var in x:
    print x
```

Container #2: Tuples!

A tuple is a type in Python. Like lists, it holds an ordered set of values. These can be of any type. Like lists, you can have any number of values. Unlike lists, they are denoted with parentheses instead of square brackets.

For example:

```
(1, 2, 3)
()
('x', True, 0)
```

What can I do with a ~~list~~ tuple?

Assigning a tuple: `x = (1, 2, 3)`

Finding the size: `len(x)`

Adding to a tuple: `x.append(4)`

Accessing a tuple element: `x[0]`

Changing a tuple element: `x[0] = 5`

Deleting from a tuple: `del x[1]`

Iterating over a tuple in a for loop:

```
for var in x:
    print x
```

What can I do with a ~~list~~ tuple?

Assigning a tuple: `x = (1, 2, 3)`

Finding the size: `len(x)`

~~Adding to a tuple: `x.append(4)`~~

Accessing a tuple element: `x[0]`

~~Changing a tuple element: `x[0] = 5`~~

~~Deleting from a tuple: `del x[1]`~~

Iterating over a tuple in a for loop:

```
for var in x:
    print x
```

Tuple vs List (Why???)

Tuple: Usually a collection of heterogeneous data that will not change in size.

Filling out a form: (first_name, last_name)

Geographic data: (latitude, longitude)

List: Usually a collection of homogenous data that has a variable size.

Grades: [100, 80, 85, 92, 75, 82, 99]

Students: [('Enne', 'Walker'), ('Naomi', 'Seyfer')]

Quick aside on more differences

Lists:

```
[]
[4]
[4, 5]
z = ['x', 'y']
z = ['x', 'y']
z = ['x']
z = ['x']
```

Tuples:

```
()
(4,)
(4, 5)
z = ('x', 'y')
z = 'x', 'y'
z = ('x',)
z = 'x',
```

Refresher on assignment

```
x = 3
y = x
x += 5 # x += 5 is shorthand for x = x + 5
```

...you can do this with strings too.

```
x = "some string"
y = x
x += " with some other stuff appended"
```

Lists and tuples

Tuples:

```
x = ('a', 'tuple')
y = x
x = ('other', 'tuple')
```

Lists:

```
x = ['1', '2', '3']
y = x
x.append('4')
```

Mutable vs. Immutable

Immutable types in Python can never be modified. Assignment changes which immutable value a variable references, but does not affect other variables. Examples: bool, int, float, tuple

Mutable types in Python can be modified. If two variables are assigned to the same mutable value, modifying one will modify the other. Examples: list, map

Container #3: Dictionaries

Also known as: map, lookup table, hash map, hash table, key-value store

Python dictionary

For each "key" in the dictionary, there is an associated "value". A "value" can have any type. A "key" can only be an immutable type.

Python is flexible about dictionaries

```
# Dictionary as a one-liner if short
d = { 'a': 3, 'b': 4 }

# Or...split across multiple lines!
d = {
    'a': 3,
    'b': 4,
    'c': 5,
}
```

What can I do with this type?

Assigning: x = { 'key': 'value', 'key2': 'value2'}

Accessing a value: x['key2']

Adding more key/values: x["key3"] = "value3"

Deleting a key/value: del x['key']

Number of keys: len(x)

The Python turtle module

...and now for something completely different.

A Python module is a collection of functions and variables. The turtle module happens to be an interactive drawing program.

Two ways to use a module

```
import turtle
turtle.forward(10)
turtle.right(90)
print turtle.heading()

from turtle import *
forward(10)
right(90)
print heading()
```

Open up IDLE, try some commands

```
from turtle import *
forward(10)
left(20)
stamp()
color('red')
right(130)
pensize(20)
circle(50)
dot(20)
clearscreen()
```

Simple geometry!

Creating simple shapes (squares, triangles, & circles)

Draw something fun

Create a file with a program that uses turtle to draw something interesting. (Don't call this file turtle.py.) Use for loops!

Need some thoughts?

- A five-pointed star
- The sun
- A grid
- A spiral