Admin

- Homework 9 and Quiz 9 are due **tomorrow (Thursday)**
- Final project is due May 3 (Wednesday)
- Remaining graded labs: Lab 10 (today/tomorrow), Lab 11
- Labs on last two days of classes: practice final
- **Office hours tomorrow 10am-12pm** (Ford 015)
- Please read Piazza, lots of hints and important info!
Outline: 4/19

- Biology example: Gene class
- Continue classes: variable usage
- Introduce Lab 10 and Final Project
- New today: assert, list of lists, __str__
Continue Classes

variable usage
Global vs. Local

def function1(, , ):

def function2(, ):

def main():

Global vs. Local

```python
def function1:green, blue, orange:
    purple
    green
    blue
    orange

def function2:yellow, cyan:

def main:
```
Global vs. Local

```python
def function1(, , ):  
  
def function2(, ):  
  
def main():
```
Global vs. Local

Global

Everything else: local to their functions

```python
def function1(var1, var2, var3):
    # Global variables

def function2(var4, var5):
    # Global variables

def main():
    # Global variables
```
Global vs. Local

Global

Everything else: local to their functions

Same name? still different!

def function1(, x, ):

def function2(x, ):

def main():
How the picture changes for classes
How the picture changes for classes

```python
class MyClass:
    def __init__(self, var1, var2, var3):
        self.
        self.

    def method1(self, var):
        self.

    def method2(self, var1, var2, var3):
        self.

    def function1(self, var1, var2, var3):

    def function2(self, var1, var2, var3):

    def main():
        
```
How the picture changes for classes

class MyClass:
    def __init__(self):
        self.
        self.

    def method1(self):
        self.

    def method2(self):
        self.

    def function1():

    def function2():

    def main():
How the picture changes for classes
How the picture changes for classes

```python
class MyClass:
    def __init__(self):
        self.
        self.

    def method1(self):
        self.
        

    def method2(self):
        self.
        

    def function1(self):

    def function2(self):

    def main():
        
```
Biology Example:
Gene class
Biology example: Gene class

- **Goal:** test whether a query position is inside a gene or not

- **Motivation:** some genomic locations show up on scans for natural selection or disease association

- If these positions are inside genes, we might understand how they affect physical traits and diseases

```python
BASES = ["A","C","G","T"]

def main():
    # TODO Gene class here

    def main():
        # start and end positions for a single gene
        start = 2934
        end = 5247

        # list of positions - we want to know if they are inside the gene
        query_list = [2384, 4928, 8374, 238, 3872, 1278, 4374, 12898, 5019]

        # TODO: construct a gene, then check each query position

    main()
```
New Today
Assert (keyword: **assert**)

- Important debugging strategy
- Also very useful for checking user input
- The expression used with assert must evaluate to a boolean
  - **True**, assert holds, nothing happens
  - If this boolean is **False**, assert fails and throws an error
Assert (keyword: **assert**)

+ Important debugging strategy
+ Also very useful for checking user input
+ The expression used with assert must evaluate to a boolean
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  - If this boolean is **False**, assert fails and throws an error

```python
>>> user_input = "hello"
>>> assert isinstance(user_input, int)
Traceback (most recent call last):
  File "<pyshell#22>", line 1, in <module>
    assert isinstance(user_input, int)
AssertionError

>>> assert isinstance(user_input, str)
```

```python
>>> lst = [4, 6, 3, 2, 5, 3]
>>> assert 3 in lst
>>> assert 10 in lst
Traceback (most recent call last):
  File "<pyshell#11>", line 1, in <module>
    assert 10 in lst
AssertionError
```
List of Lists (matrix)

+ List of lists, also called a matrix or 2D array
+ Row is always first, then column
+ Example: what is the entry in row 3, column 4?

```
[[4, 8, 9, 0, 7],
 [4, 9, 0, 2, 8],
 [7, 6, 7, 2, 0],
 [5, 7, 5, 5, 6],
 [3, 8, 2, 0, 0]]
```
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```
[[4, 8, 9, 0, 7],
 [4, 9, 0, 2, 8],
 [7, 6, 7, 2, 0],
 [5, 7, 5, 5, 6],
 [3, 8, 2, 0, 0]]
```