Admin

- No Lab 4 due to Rally Day
- Homework 3 due Tuesday (tomorrow)
- Office hours today 3-5pm (Ford 355 or across the hall)
WEEK 4: all about FUNCTIONS

- Recap last time
- Formalize our discussion of functions
- Parameters
- Functions calling functions
- Return statements
Recap
Informal quiz (discuss with a partner)

1) Slicing can be done with:
   A) strings   B) lists   C) both

2) The product of slicing is called a ________, but its type is ________.

3) Which have more built-in methods, strings or lists?

4) Describe the difference between the elements of strings and lists.

5) Give the phrase below, how could you produce just “Rally” or just “Day” using string slicing?
   phrase = "Rally Day"
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1) Slicing can be done with:
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2) The product of slicing is called a substring, but its type is str (string).

3) Which have more built-in methods, strings or lists?

Strings have more built-in methods (strings are more “special”, lists are more “flexible”).

4) Describe the difference between the elements of strings and lists.

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   phrase = "Rally Day"
Informal quiz (discuss with a partner)

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3) Which have more built-in methods, strings or lists?

Strings have more built-in methods (strings are more “special”, lists are more “flexible”).

4) Describe the difference between the elements of strings and lists.

The elements of strings are characters, the elements of lists can be (almost) anything.

5) Give the phrase below, how could you produce just “Rally” or just “Day” using string slicing?

```
phrase = "Rally Day"
```
Why use functions?
Several advantages to functions

- Organizes code into logically connected sections
  - Easier for a reader or user to understand
  - Easier for the programmer to debug and maintain

Credit: Joe O’Rourke
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  - Need-to-know basis

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- Isolates one task from another by passing to the function exactly the data needed
  - Need-to-know basis

- To document separately with doc-strings (more later)

Credit: Joe O’Rourke
Recipe Idea: Example

Here we have 4 “helper” functions and 1 “main” function that call (invokes) the helper functions.

```python
# Making cookies in Python (pseudo-code)
# Yield: 4 dozen cookies

def mix(item1, item2):
    # combine item1 and item2 in a bowl
    return mixture

def spoon(batter):
    # place a spoonful of batter on cookie sheet
    return cookie

def bake(cookie):
    # bake in oven at 375 deg

def ice(cookie):
    # spread icing on cookie with knife
    # decorate with sprinkles

def main():

    flour = "my_flour"
    sugar = "domino_sugar"
    butter = "land_o_lakes_butter"
    eggs = "free_range_eggs"

    dry_ingredients = mix(flour, sugar)
    wet_ingredients = mix(butter, eggs)

    batter = mix(dry_ingredients, wet_ingredients)

    for i in range(12*4):
        cookie = spoon(batter)
        bake(cookie)
        ice(cookie)

    print("finished making cookies")

main()
```
Recipe Idea: Example

Functions are defined with "formal" parameters. Think of these as variables without values yet, or "placeholders".

These formal parameters are only valid inside the function where they are used. They are therefore "local" variables and theirs "scope" is inside the function.

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Before calling our helper functions, we need to assign the necessary variables some concrete, specific values.

Then we can call/invoke the helper functions with the “actual” parameters.

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Zelle: Section 6.4
Recipe Idea: Example

Idea: function -> minion (Dominique)

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Verb/Noun idea

+ Function names are often action oriented (i.e. verbs)
  + compute, count, mix, bake

+ Variable names are often object oriented (i.e. nouns)
  + cookie, name, level, x
Back to count example (Lab 3)
Count: function with two parameters

Function definition with two formal parameters (placeholders for *any* string and *any* character)

```python
def count(string, character):
    char_count = 0
    for c in string:
        if c == character:
            char_count = char_count + 1
    print(char_count)
```

We can call this function inside our .py file or in the shell.

```python
count("hello","l")
count("Mississippi","i")
```
Back to sea level (HW 2)
Separate this assignment into functions

**Goal Before**

Enter rate (mm/yr) = 3  
Enter acceleration (mm/yr^2) = 0.1  
Enter # of years = 8

year=0 rate=3.0 level=0.0  
year=1 rate=3.1 level=3.0  
year=2 rate=3.2 level=6.1  
year=3 rate=3.3 level=9.3  
year=4 rate=3.4 level=12.6  
year=5 rate=3.5 level=16.0  
year=6 rate=3.6 level=19.5  
year=7 rate=3.7 level=23.1  
year=8 rate=3.8 level=26.8  

**Goal After**

```python
>>> compute_level(3,0.1,8)
26.8
>>> compute_level(3,0.1,0)
0
>>> compute_level(3,0.1,1)
3.0
>>> compute_level(3,0.1,5)
16.0
>>> compute_rate(3,0.1,5)
3.5
```