**Compsci 101**

**Lists, Mutation, Objects**

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**F is for …**

- **Function**
  - Key to all programming

- **Floating Point**
  - Decimal numbers aka Python float

- **File**
  - Sequence of stored bits

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**Annie Easley**

- American computer scientist, mathematician, and rocket scientist
- Worked at NACA and NASA
- BS in Math, Cleveland State
- Leader in developing the software for the Centaur rocket stage

*On microaggressions: "If I can't work with you, I will work around you"*
Python Reference Sheet for CompSci 101, Exam 1, Spring 2023

On this page we will keep track of the Python types, functions, and operators that we’ve covered in class. You can also review the online Python Reference for more complete coverage, BUT NOTE there is way more python in the there then we will cover! The reference page below all you should need to complete the exam.

<table>
<thead>
<tr>
<th>Mathematical Operators</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>+</td>
<td>addition</td>
<td></td>
<td>4 + 5 = 9</td>
</tr>
<tr>
<td>-</td>
<td>subtraction</td>
<td>9 - 5 = 4</td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>multiplication</td>
<td>1*5 = 15</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>division</td>
<td>6/3 = 2.0</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>mod/remainder</td>
<td>5 % 2 = 2</td>
<td></td>
</tr>
<tr>
<td>**</td>
<td>exponentiation</td>
<td>2<strong>2 = 4, 2</strong>3 = 8</td>
<td></td>
</tr>
</tbody>
</table>

| String Operators | | |
|------------------| | |
| +                | concatenation | x + "y" = "xy" |
| *                | repeat | x*5 = "x"*5 |

| Comparison Operators | | |
|----------------------| | |
| ==                   | is equal to | 5 == 3 is True |
| !=                   | is not equal to | 5 != 3 is False |
| <                    | is less than | 3 < 5 is True |
| <=                   | is less than or equal to | 3 <= 5 is True |
| >                    | is greater than | 5 > 3 is True |
| >=                   | is greater than or equal to | 5 >= 3 is True |

| Boolean Operators | | |
|--------------------| | |
| not                 | negates the value of a bool | not x = x is False |

- Functions as Parameters
- Debugging
- List concatenation and nesting
- Mutability

Learning Goals: Faces

- Understand differences and similarities:
  - Function definitions vs function calls
  - Functions with return statements vs those without
  - Functions with parameters vs those without
  - Functions can be arguments

- Be creative and learn lesson(s) about software design and engineering
  - Create a small, working program, make incremental improvements.
  - Read the directions and understand specifications!

Name vs Value vs Type

Represent:
- Names: "hello"
- Values: [0, 1, 2.0] "three"
- Type: function addTen(x)

Global frame
addTen
num
numF
dot
list
3
5.0
"hello"
list
0
1
2.0
"three"
What are the arrows?

- **Name:** Enzo’s Pizza Co.
- **Address:** 2608 Erwin Rd # 140, Durham, NC 27705
- **Value:** Physical Store

Functions can be arguments

```python
def enzospizzaco():
    print("Pizza!")
    return "2608 Erwin Rd # 140, Durham, NC 27705"
def eatfood(where):
    print("Let's go eat!")
    address = where()
    print("The address is", address)
if __name__ == '__main__':
    eatfood(enzospizzaco)

def face_with_mouthAndEyes(mouthfunc, eyefunc):
    print(part_hair_squiggly())
    print(eyefunc())
    print(part_nose_up())
    print(mouthfunc())
    print(part_chin_simple())
```
**In Assignment 1 Faces**

```python
def face_random():
    eyefunc = part_eyes_sideways
    x = random.randint(1,3)
    if x == 1:
        eyefunc = part_eyes_ahead
    # now call the function
    face_with_mouthAndEyes(mouthfunc, eyefunc)
```

**WOTO-1: Functions as Parameters?**


**Debugging**

- **Finding what is wrong + fixing it**
  - Finding is its own skill set, and many find difficult
  - Fixing: revisit Step 1—5
Debugging Steps

1. Write down exactly what is happening
   1. input, output, what should be output
   2. ____ happened, but ____ should happen
2. Brainstorm possible reasons this is happening
   1. Write down list of ideas
3. Go through list
4. Found it?
   1. Yes, fix it using the 7-steps
   2. No, go back to step 2

Relate W’s to Debugging

- Who was involved?
- What happened?
- Where did it take place?
- When did it take place?
- Why/How did it happen?

Step 7 -> Steps 1-4 or 5

Translate these questions to debugging
Which year is a leap year?

- A Leap Year must be divisible by four.
- But Leap Years don't happen every four years ... there is an exception.
  - If the year is also divisible by 100, it is not a Leap Year unless it is also divisible by 400.

List Concatenation

- String concatenation:
  - "hi" + " there" == "hi there"

- List concatenation:
  - [1, 2] + [3, 4] == [1, 2, 3, 4]
Nested Lists

- Lists are heterogenous, therefore!
  - `lst = [1, 'a', [2, 'b']]` is valid
  - `len(lst) ==` 

- How to index?
  - `...` all the way down

Mutating Lists

- `lt = ['Hello', 'world']`
  - How to change `lt` to: `['Hello', 'Ashley']`

  Two ways: 1. Build new list or 2. modify list
    1. Concatenation: `lt = [lt[0]] + ['Ashley']`
    2. Index: `lt[1] = 'Ashley'

- How to change `b` in `lt = [1, 'a', [2, 'b']]`?
  - `lt[2][1] = 'c'`
WOTO-3 List Mutation