Compsci 101
Introduction

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```python
st = f.read().decode('utf-8')
st = st.lower()
total = len(st)
```
B is for …

• Bug
  • What you will always have and need to fix

• Bits
  • Zeros and Ones that are our C,G,A,T

• Break
  • An easy way out of a loop

• Boolean
  • Type that's true or false
Barbara Liskov

• Among first women in US to earn Ph.D. in Computer Science: 1968
• Turing Award 2008, Software Engineering and Programming Languages
• Object-Oriented
  • CLU
• Liskov Substitution Principle

“Every time you exchange e-mail with a friend, check your bank statement online, or run a Google search, you are riding the momentum of her research” – MIT President Rafael Reif about Liskov
Announcements

• Survey coming out— complete this week
• Lab 1 is Friday
• Prelab 1 before lab— Install Python/Pycharm
  • Ways to get help:
    • Office hours, consulting hours
    • Post on Ed Discussion – what type of machine, etc
    • https://colab.duke.edu/resources

• Ed Discussion Back channel during lecture
• QZ03 and reading due Thursday at 10:15am
• Assignment 1 - Blockly due 1/18
Is this the right course for you?

- **CompSci 101**
  - beginner
  - little or no programming experience
- **CompSci 201**
  - 4/5 on AP CS A
  - OR Programming Experience in Python or Java or ?
    - Problem solving with arrays or lists
    - Looping structures (while/for)
    - Writing functions/methods
    - Problem solving with Sets, Dictionaries or maps?
Can’t take CompSci 101 if

• You already took CompSci 201, or CompSci 116, or ENG 103 ….

• You won’t get credit for this course

• This is a beginner course
Practice, Practice, Practice
Practice, Practice, Practice
Practice results in Success
Practice results in Success
Don’t get behind!!!

- Difficult to catch up…
Don’t get behind!!!

- Difficult to catch up…
Plan for the Day (PFTD)

- Look at a sample Python Program
  - OK if you don’t understand it all
- How to run Python Code
  - Run complete program in Pycharm
  - Short code segments with Python Console
    - Python Console is in Pycharm
- Names, types, and values in Python
- Functions in Python
Understanding Code

• We will look at an interesting Python program
  • Try to figure out what it does

• You Likely Will NOT understand all this code
• Maybe none of it

• That’s OK
How Breakout Groups Work with Google form links

• Given a bitly link
  • Type it in OR click on it on the calendar page
  • http://bit.ly/101s22-0111-1

• What you should do:
  • Introduce yourselves
  • Each person fills out the google form
  • Includes your email, name and netid
  • Discuss each question and fill out
  • Be mindful of time
import urllib.request

def processURL(url):
    f = urllib.request.urlopen(url)
    st = f.read().decode('utf-8')
    st = st.lower()
    total = len(st)
    print("total # chars = ", total)
    print("total # z's = ", st.count("z"))
    for ch in "abcdefghijklmnopqrstuvwxyz":
        print(ch, st.count(ch))

if __name__ == '__main__':
    processURL("https://www2.cs.duke.edu/csed/data/kjv10.txt")
WOTO-2 Understanding Code
```python
import urllib.request

def processURL(url):
    f = urllib.request.urlopen(url)
    st = f.read().decode('utf-8')
    st = st.lower()
    total = len(st)
    print("total # chars = ", total)
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    for ch in "abcdefghijklmnopqrstuvwxyz":
        print(ch, st.count(ch))

if __name__ == '__main__':
    processURL("https://www2.cs.duke.edu/csed/data/kjv10.txt")
```

Output:

```
total # chars = 4345018
total # z’s = 2977
a 275338
b 48761
c 54774
d 157899
e 411615
f 83377
g 55089
h 282472
i 193510
...```
Names, Types, and Values

• Relate to a file. Consider: homework.pdf
• What is its name?
  • homework.pdf
• What is its type?
  • .pdf (portable document format)
    • File format created by Adobe
• What is its value?
  • Content of the file, homework for a class?
Names, Types, and Values

• Relate to a file. Consider: homework.pdf
• What is its name?
  • homework.pdf
• What is its type?
  • .pdf (portable document format)
  • File format created by Adobe
• What is its value?
  • Content of the file, your homework for a class?
Names, Types, and Values

• Relate to a file. Consider: cats.jpg
• What is its name?

• What is its type?

• What is its value?
Names, Types, and Values

• Relate to a file. Consider: cats.jpg
• What is its name?
  • cats.jpg
• What is its type?
  • .jpg (type of image file)
• What is its value?
  • Content of the file, picture of cats?
Numeric Python Building Blocks

- Numbers are not everything! But good start
  - Values and arithmetic expressions
  - Integer aka int: 0, 3, -2, 5, ...
  - Float: 2.5, 3.6673, 1.938e+120
  - Operators: +, -, *, /, **
  - Operators: // and %

- Demo in Python Console
Interactive Console

• Short way to look at Python values and expressions
• Look in the bottom left corner of PyCharm
• Click on “Python Console”
Summary of Numbers

• Integers are arbitrarily large in Python 3
• Float values do not have infinite precision
  • Floats are for decimal values

• Be attentive to parentheses and precedence
• Understand / and // and %
  • Modulus or remainder
Python Strings

- A string is a sequence of characters
  - String literals use single or double quotes
  - "hello" and 'world' are both strings

- Operators we'll use: + and [:]
  - Concatenation and Slicing
  - Adding and taking apart?
    - Today just adding

- Demo in Python Console
Types and Conversion

• How do you convert a .jpg to a .png?
  • Change the bits from one format to another

• Can we add a string and an integer?
  • What does 5 + "cow" mean?
  • What does 5 * "cow" mean?
  • Why?
Using Python Console

• Not writing a whole program
• Just checking out values or writing simple code

• What is the difference in Python Console of:
  >>> print("a" + " " + "b")

  >>> "a" + " " + "b"
Using Python Console

• Not writing a whole program
• Just checking out values or writing simple code

• What is the difference in Python Console of:
  >>> print("a" + " " + "b")
  a b

  >>> "a" + " " + "b"
  ‘a b’
Variables

• We use variables to store values so we can use them and re-use them in expressions
  • Name associated with storage (spot in memory)
  • Assign value to a variable

• How to read: num = 5, word = "hello"
  • Why say 'gets' or 'is assigned' and not 'equals’
  • We’ll use ‘equals’ later to mean equality
Variable idea
1) num = 6

Computer
Variable idea
1) \( \text{num} = 6 \)
Variable idea

1) num = 6
Variable idea

2) \( y = \text{num} + 4 \)
Variable idea

2) \[ y = num + 4 \]
Variable idea
2) \( y = \text{num} + 4 \)
Variable idea

3)   \( \text{num} = y \times 2 \)
Variable idea

3) \[ \text{num} = y \times 2 \]
Variable idea

3) \( \text{num} = y \times 2 \)
Anatomy of a variable

- Variables in Python have a type, changeable
  - Initially `var = 5`, change to `var = “hello”`
  - Use the `type(...)` function to determine type, but documentation/comments are better

- Variables are names/labels, references to an object stored elsewhere (basically)
  - My address is “202 Main Street”
  - That’s the name/label, my house is elsewhere
  - For `var = “hello”`, the string is elsewhere
Subtleties

- Variables on LHS and RHS
  - Value compared to Name
  - LHS – Left Hand Side
  - RHS – Right Hand Side

- What happens here?
  - Value compared to Name

- In expressions? What is value

```plaintext
num1 = 17
num2 = num1 + 12

var1 = 17
var2 = var1 + 12
var1 = "hi"
var2 = var1 * 3
```
Subtleties

- Variables on LHS and RHS
  - Value compared to Name
  - LHS – Left Hand Side
  - RHS – Right Hand Side
  - 1) Evaluate RHS, 2) Store in LHS

- What happens here?
  - Value compared to Name

- In expressions? What is value

```plaintext
num1 = 17
num2 = num1 + 12

num2 gets 29

var1 = 17
var2 = var1 + 12

var1 gets "hi"
var2 gets "hihihi"

var2 gets 29
var1 gets "hi"
var2 gets "hihihihi"
```
Basic Python