Compsci 101
Python Code, Variables

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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, like C,G,A,T makes up DNA
- Byte
  - 8 bits that represent a character
- Boolean
  - Type that's true or false

Grace Hopper

- Computer Scientist
- Rear Admiral in US Navy
- One of first programmers for one of first computers: Harvard Mark 1
- Handed out nanoseconds
- First computer bug in 1947

"The only phrase I've ever disliked is, 'Why, we've always done it that way.' I always tell young people, 'Go ahead and do it.'"
Announcements

• Survey coming out—complete this week
• Lab 0 is Friday, no Prelab
• Prelab 1 before lab—Install Python/Pycharm
  • Ways to get help:
    - Office hours, consulting hours
    - Post on Ed Discussion — what type of machine, etc
    - Install Fest at Co-lab, Sept 6-7, 2pm-8pm
• Ed Discussion Back channel during lecture
• QZ03 and reading due Tuesday at 10:15am
• Assignment 0 - Blockly due 2/8

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

Where to sit? Laptops?

• Sit anywhere but the top 2 seater row and the top 5 full rows.
  • Come forward meet someone

• Laptop policy
  • Use your laptop in class only for CompSci 101
    • No watching sports videos, etc
      – RUDE and distracting to other students
      – Don’t come to class if you feel you have to do this
    • Not be doing other coursework
Practice, Practice, Practice

Practice results in Success
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

Finish Slides from Last Time
**Why is programming fun?**

Fred Brooks

- First is the sheer joy of making things
- Second is the pleasure of making things that are useful
- Third is the fascination of fashioning complex puzzle-like objects of interlocking moving parts
- Fourth is the joy of always learning
- Finally, there is the delight of working in such a tractable medium. The programmer, like the poet, works only slightly removed from pure thought-stuff.

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**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

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**How Breakout Groups Work with Google form links**

- Given a bitly link
  - Type it in OR click on it on the calendar page
- 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
What do you think the word does in Python?

What words do you recognize?

```
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")
```

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, your homework for a class?

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?
- Python Console Demo

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"
  ‘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
2) \( y = num + 4 \)

\[
\begin{array}{c}
\text{num} \rightarrow 6 \\
\text{y} \rightarrow 10 \\
\end{array}
\]

Variable idea
3) \( num = y \times 2 \)

\[
\begin{array}{c}
\text{num} \rightarrow 6 \\
\text{y} \rightarrow 10 \\
\end{array}
\]
Variable idea
3) $num = y \times 2$

<table>
<thead>
<tr>
<th>Computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>num</td>
</tr>
<tr>
<td>y</td>
</tr>
</tbody>
</table>

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**

```
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

```python
num1 = 17
num2 = num1 + 12
num1 gets 17
num2 gets 29

var1 = 17
var2 = var1 + 12
var1 gets 17
var2 gets 29

var1 = "hi"
var2 = var1 * 3
var1 gets "hi"
var2 gets "hihihi"
```