

Compsci 101

Python Code, Variables

Susan Rodger
January 17, 2023

```
st = f.read().decode('utf-8')  
st = st.lower()  
total = len(st)
```

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B is for ...



- **Bug**
 - What you will always have and need to fix
- **Bits**
 - Zeros (0) and Ones (1), like C,G,A,T makes up DNA
- **Byte**
 - 8 bits that represent a character
- **Boolean**
 - Type that's true or false

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Every lecture: DO NOT SIT IN THE LAST 5 FULL ROWS

or the small 2 seater row at the top!

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B is for ...



- **Bug**
 - What you will always have and need to fix
- **Bits**
 - Zeros (0) and Ones (1), like C,G,A,T makes up DNA
- **Byte**
 - 8 bits that represent a character

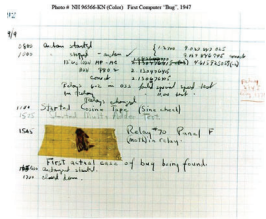
01000001 code for letter "A"
- **Boolean**
 - Type that's true or false

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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.”

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Grace Hopper Celebration of Women in Computing Conference



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Announcements

- **Prelab 1 before lab 1– 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, Last day this afternoon
- **Ed Discussion Back channel during lecture**
- **QZ03 and reading due Thursday at 10:15am**
- **Assignment 0 - Blockly due 1/19**

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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?

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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

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Practice, Practice, Practice

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Where to sit? Laptops?

- Sit anywhere but the top 2 seater row and the top 5 full rows. **NEVER SIT THERE, WE will ask you to move!**
 - Come forward meet someone
- **Laptop policy**
 - Use your laptop in class only for CompSci 101
 - No watching sports videos, or shop, 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

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Practice, Practice, Practice

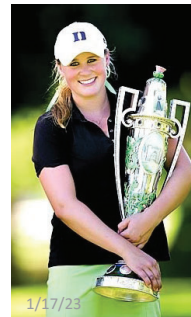


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Practice results in Success

Practice results in Success

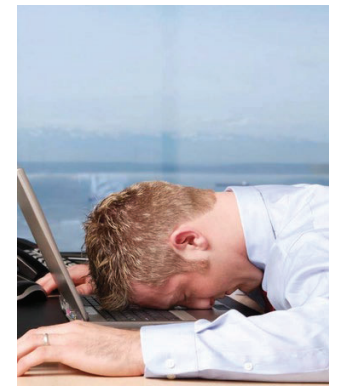


Don't get behind!!!

- **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

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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 Wotos Work with Google form links

- Given a bitly link
 - Type it in OR click on it on the calendar page
 - <http://bit.ly/101s23-0117-1>
- 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

Links on Course
Webpage on
Today's date:

- [Link 1](#)
- [Link 2](#)
- [Link 3](#)
- [Link 4](#)

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WOTO-1 Understanding Code <http://bit.ly/101s23-0117-1>

```
7 import urllib.request
8
9
10 def processURL(url):
11     f = urllib.request.urlopen(url)
12     st = f.read().decode('utf-8')
13     st = st.lower()
14     total = len(st)
15     print("total # chars = ", total)
16     print("total # z's = ", st.count("z"))
17     for ch in "abcdefghijklmnopqrstuvwxyzt":
18         print(ch, st.count(ch))
19
20
21 if __name__ == '__main__':
22     processURL("https://www2.cs.duke.edu/csed/data/kjv10.txt")
```

What words do you recognize?

What do you think the word does in Python?

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WOTO-1 Understanding Code

<http://bit.ly/101s23-0117-1>

WOTO-2 Understanding Code

<http://bit.ly/101s23-0117-2>

```
7 import urllib.request
8
9
10 def processURL(url):
11     f = urllib.request.urlopen(url)
12     st = f.read().decode('utf-8')
13     st = st.lower()
14     total = len(st)
15     print("total # chars = ", total)
16     print("total # z's = ", st.count("z"))
17     for ch in "abcdefghijklmnopqrstuvwxyz":
18         print(ch, st.count(ch))
19
20
21 if __name__ == '__main__':
22     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
...
```

WOTO-2 Understanding Code

<http://bit.ly/101s23-0117-2>

Names, Types, and Values

- Relate to a file. Consider: [homework.pdf](#)
- What is its name?
- What is its type?
- What is its value?

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 Acrobat
- **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 %

What can you do with numbers?

Add (+)
Subtract(-)
Multiply(*)
Divide(/)
Exponent(**)

Integer division (//)
Mod (%)

- **Demo in Python Console**

Numeric Python Building Blocks

- **Numbers are not everything! But good start**
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- **Demo in Python Console**

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Summary of Numbers

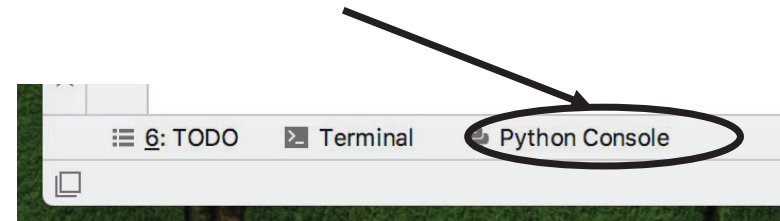
- **Integers are arbitrarily large in Python 3**
- **Float values do not have infinite precision**
 - Floats are for decimal values
- **Be attentive to parentheses and precedence**
- **Understand / and // and %**
 - Modulus or remainder

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Interactive Console

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



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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**

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Types and Conversion

- How do you convert a .jpg to a .png?
- Can we add a string and an integer?

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"
```

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'

Print means:
output

Value of the
expression

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

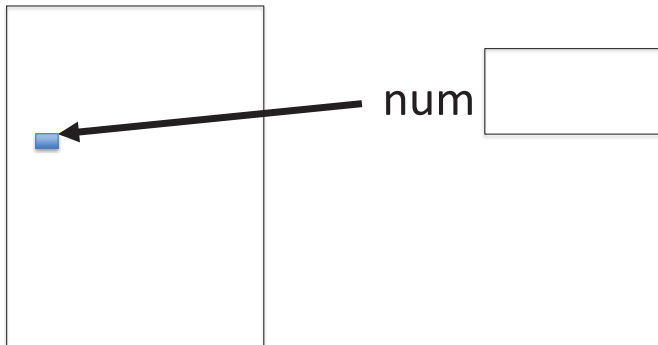
1) num = 6



Computer

Variable idea

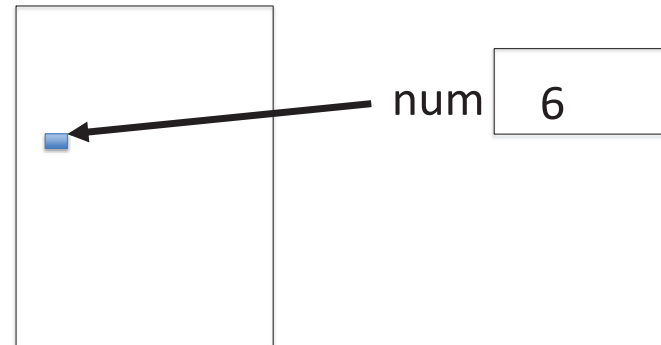
1) num = 6



Computer

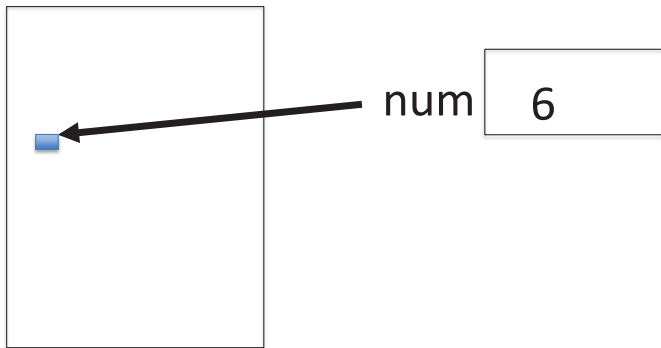
Variable idea

1) num = 6



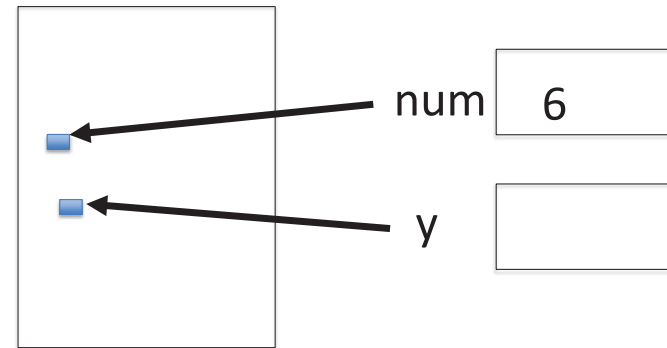
Computer

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



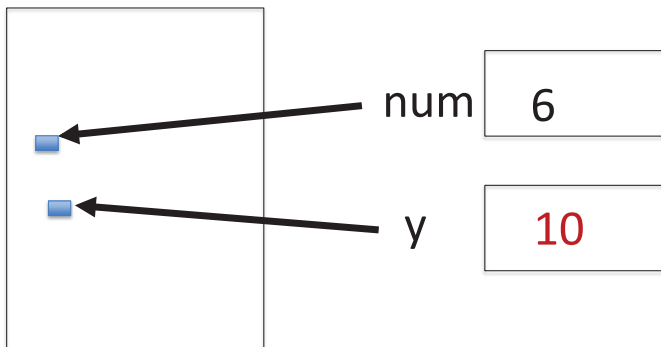
Computer

Variable idea
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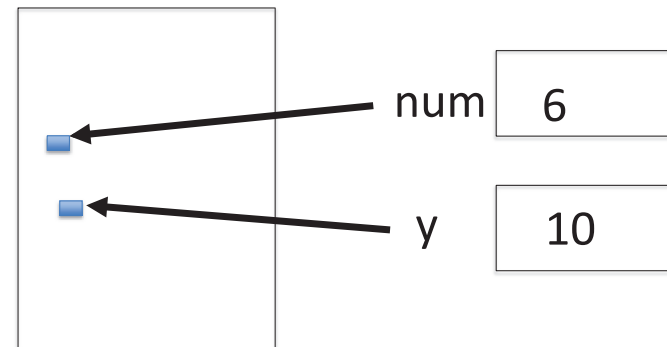
Computer

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



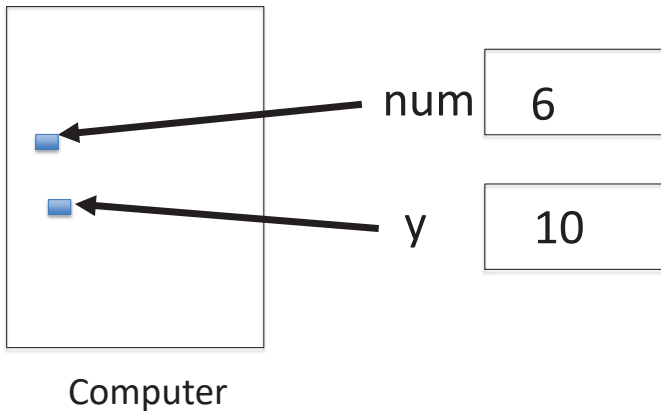
Computer

Variable idea
3) $\text{num} = y * 2$

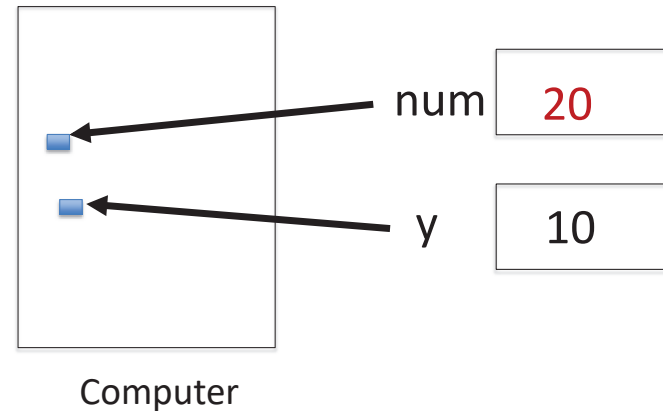


Computer

Variable idea
3) $\text{num} = \text{y} * 2$



Variable idea
3) $\text{num} = \text{y} * 2$



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)**
 - `address = "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**



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

num1 gets 17

num2 gets 29

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

var1 gets 17

var2 gets 29

var1 gets "hi"

var2 gets "hihihi"

Basic Python

<http://bit.ly/101s23-0117-3>

