CMSC 201
Computer Science I for Majors

Lecture 02 – Intro to Python

Last Class We Covered

- Syllabus
  - Grading scheme
  - Academic Integrity Policy
    - (Collaboration Policy)
- Getting Help
  - Office hours
- Programming Mindset
  - “Failure” (isn’t really failure)

Any Questions from Last Time?

Today's Objectives

- To start learning Python
- To learn about variables
  - How to use them
  - Different types
- To learn how to use input and output
  - To do interesting things with our program
- Written programs vs Python interpreter

Variables

Python

- Python is a widely used language
  - General purpose
  - High-level language
- Emphasizes code readability
  - More streamlined than some other languages

“Hello World!”

- In Python:

```
print("Hello World!")
```

- In the C++ programming language:

```
#include <iostream>
int main() {
    std::cout << "Hello World!\n";
}
```

Elements of a Program

- Identifiers
  - Variables
  - Functions (later in the semester)

- Expressions
  - Code that manipulates or evaluates identifiers

- Literals
- Operators

What Is a Variable?

- Something that holds a value
  - Can change (unlimited number of times)
- Similar to variables in math
- In simple terms, a variable is a "box" that you can put stuff in

Rules for Naming Variables

- Variable names can contain:
  - Uppercase letters (**`A-Z`**)
  - Lowercase letters (**`a-z`**)
  - Numbers (**`0-9`**)
  - Underscores (**`_`**)
- Variables can't contain:
  - Special characters like **`$`**, **`#`**, **`&`**, **`^`**, **`)`**, **`(`**, **`@`**

More Rules for Naming Variables

- Variables can be any length
  - **`x`**
  - **`IsKanyeRunningForPresidentIn2020`**
  - **`myName`**

- Variables cannot <u>**start**</u> with a digit
  - **`2cool4school`** is not a valid variable
  - **`cool4school`** <u>is</u> a valid variable

Variables and Keywords

- Keywords are "reserved" words in Python

`False`	`class`	`finally`	`is`	`return`
`None`	`continue`	`for`	`lambda`	`try`
`True`	`def`	`from`	`nonlocal`	`while`
`and`	`del`	`global`	`not`	`with`
`as`	`elif`	`if`	`or`	`yield`
`assert`	`else`	`import`	`pass`	
`break`	`except`	`in`	`raise`	

- Variables cannot be keywords
  - **`or`** is <u>not</u> a valid variable name
  - **`orange`** is an acceptable variable name

Exercise: Variables

- Are the following legal or illegal in Python?

```
1spam

raise1

Spam_and_Eggs

EXIT_CODE
```

Exercise: Variables

- Are the following legal or illegal in Python?

`1spam`	No – Illegal!
`raise1`	Yes – legal!
`Spam_and_Eggs`	Yes – legal!
`EXIT_CODE`	Yes – legal!

Exercise: Variables

- Are the following legal or illegal in Python?

`Spam_and_Eggs`

Yes – legal!

But it doesn't follow our coding standards!

`spamAndEggs` or `spam_and_eggs`

Using Variables in Python

- You create a variable as soon as you declare it
- You also need to initialize it before using it
  - Use the assignment operator (equal sign)

assignment operator

```
mascotUMBC = "dog"
newStudents = 1538
dogsAreGood = True
```

Expressions

Expressions

- Programs manipulate data
  - Allows us to do interesting things

- Expressions calculate new data values

- Use assignment operator to set new value

Expressions Example

variable being set

assignment operator

```
numCandy    = 4
priceCandy = 0.58
totalCost  = numCandy * priceCandy
```

value (a "literal")

expression

Common Mistake

- Many new programmers mix up the left and right hand sides of the assignment operator
  - Variable being set must be on the ***left***
  - Expression is on the ***right***
  - Evaluate the expression first, then assign the value

```
numCandy = 4 + 1
```
✓

```
4 + 1 = numCandy
```
✗

Variable Types

- There are many different kinds of variables!
  - Numbers
    - Whole numbers (Integers)
    - Decimals (Floats)
  - Booleans (**`True`** and **`False`**)
  - Strings (collections of characters)

Variables Types: Examples

```
aString   = "Hello class"
float_1   = 1.12
myBool    = True
anInteger = 7

dogName   = "Ms. Wuffington"
classCode = 201
```

Variable Usage

- Variables are designed for storing information
- Any piece of information your program uses or records must be stored in a variable
  - Python doesn't have a "short term memory," so everything needs to be written down for it

Literals and Operators

Literals

- Literals in Python are values you use “literally”
  - Can be assigned to a variable or not
- For example:
  - 2 is an integer literal
  - “Hello” is a string literal
  - 4.0 is a float literal
  - False is a Boolean literal

Using Literals

- The expression below assigns the string literal “CMSC” to a variable called major

```
major = "CMSC"
```

- The expression below prints the integer literal 50 without assigning it to a variable

```
print(50)
```

Operators

- Operators are special symbols that allow Python to perform different operations
- There are many types of operators
  - Mathematical
  - Comparison
  - Assignment
  - Logical

Operator Types

- We won't cover all the types in detail today, but here are some simple examples

- Mathematical

```
+      -      *      /      %
```

- Comparison

```
<      <=     !=     >=     ==
```

- Assignment

```
=      +=     *=
```

we'll cover the "weird" ones later

Practice Exercises

- Print the value of the variable **`myDog`** (but remember to assign a value to **`myDog`** first)
- Set a value for a variable called **`bill`**, and calculate and print the 15% tip for that **`bill`**
- Create your own expression using at least two variables, and print out the result

Input and Output

Output

- Output is text that is printed to the screen
  - So the user can see it

- The command for this is **`print`**
  - Use the keyword "**`print`**" and put what you want to be displayed in parentheses after it

Output Example

```
print (3 + 4)
print (3, 4, 3 + 4)
print()
print("The answer is", 3 + 4)
```

What does this output to the screen?

```
7
3 4 7

The answer is 7
```

Output Exercise 1

- What will the following code snippet print?

```
a = 10
b = a * 5
c = "Your result is:"
print(c, b)
```

```
Your result is: 50
```

Output Exercise 2

- What will the following code snippet print?

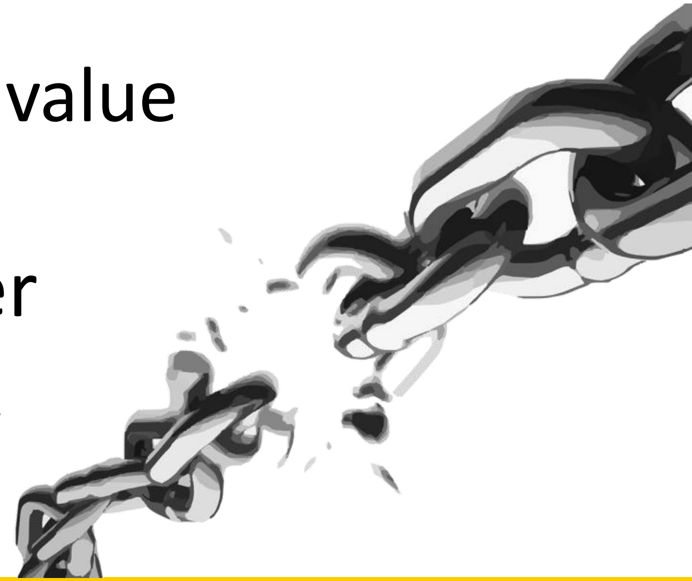
```
a = 10
b = a
a = 3
print(b)
```

There are a few possible options for what this could do! Any guesses?

```
10
```

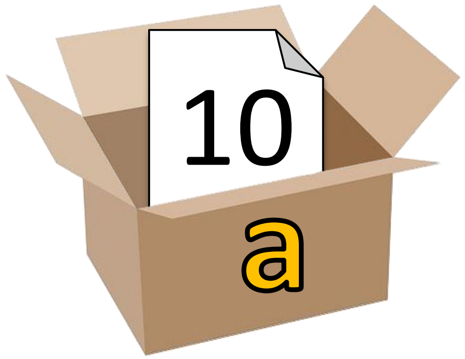
Output Exercise 2 Explanation

- Why does it print out 10?
- When you set one variable equal to another, they don't become linked!
  - They are separate copies of a value
- After **`b`** is set to 10, it no longer has anything else to do with **`a`**



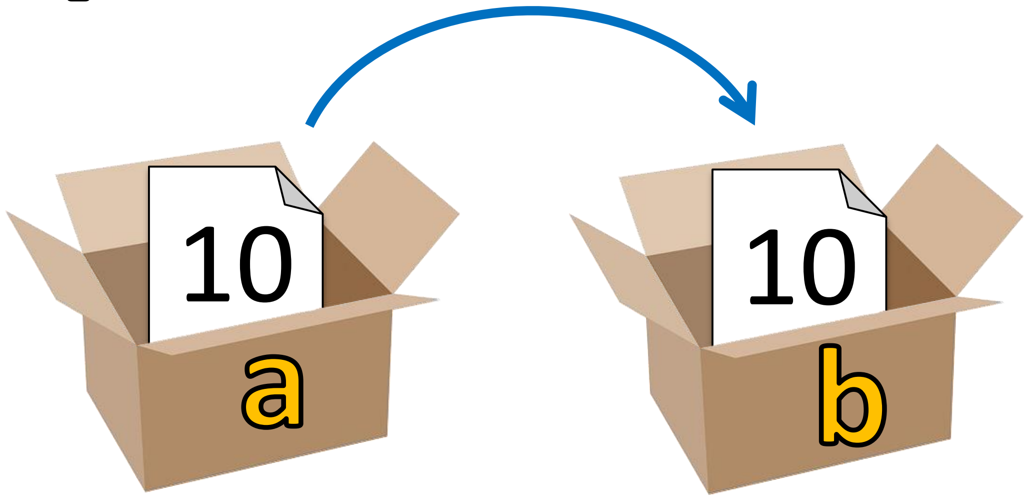
Output Exercise 2 Explanation

```
a = 10
b = a
a = 3
print(b)
```



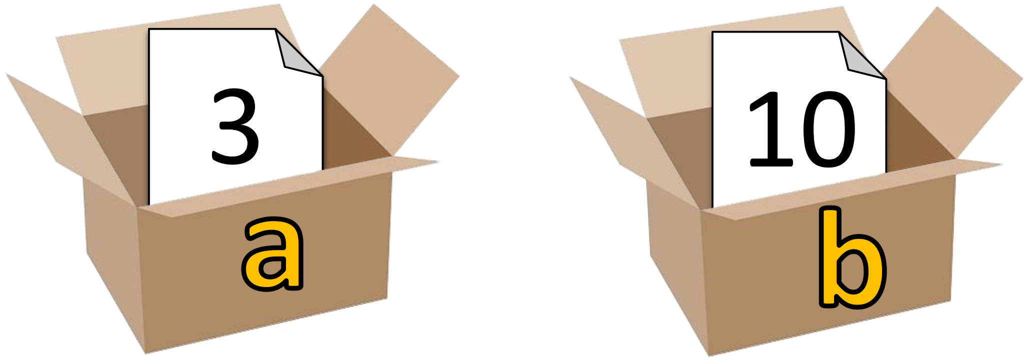
Output Exercise 2 Explanation

```
a = 10
b = a
a = 3
print(b)
```



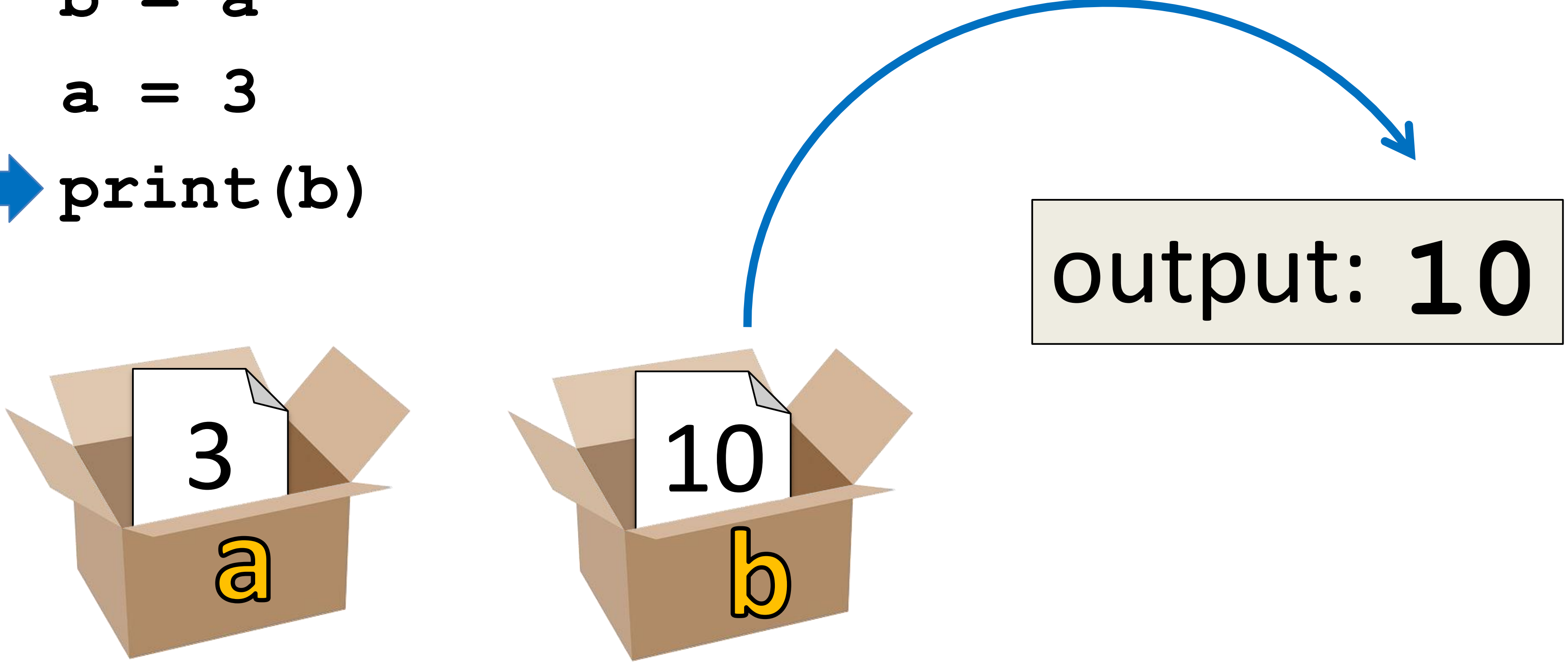
Output Exercise 2 Explanation

```
a = 10
b = a
a = 3
print(b)
```



Output Exercise 2 Explanation

```
a = 10
b = a
a = 3
print(b)
```



Input

- Input is text we get from the user
  - We must tell them what we want first

```
userNum = input("Please enter a number: ")
print(userNum)
```

- The input and output will look like this:

```
Please enter a number: 22
22
```

How Input Works

```
userNum = input("Please enter a number: ")
```

- Takes the text the user entered and stores it
  - In the variable named **`userNum`**

- You can do this as many times as you like!

```
userNum  = input("Enter another number: ")
userNum2 = input("Enter a new number: ")
userAge  = input("Please enter your age: ")
```

Input as a String

- Everything that is stored via `input()` will come through in the form of a string
- There is a difference between `"10"` and `10`
  - `"10"` is a string containing two characters
  - `10` is understood by Python as a number

Converting from String

- To turn an input string into a number, you can do the following:

```
aNum = input("Enter a number: ")
aNum = int(aNum)
```

- "int" stands for "integer" (a whole number)

- You can also do it in one line:

```
aNum = int(input("Enter a number: "))
```

Converting from String

- We can cast to other data types as well

```
gpa = float(input("Enter GPA: "))
```

- Do you think the string `"1,024"` will work if we try to cast it as an integer? Why?
- It won’t work
  - The comma character isn’t a number

Written Programs vs Python Interpreter

We Started Python Today!

- Two ways to use Python

  We will write programs for assignments

  - You can write a program as a series of instructions in a file and then execute it

  Use the interpreter to help you test things

  - You can also test simple Python commands in the Python interpreter

Written Programs

- Create, write, and save a Python file (.py)
- File is run via the command line

```
python myProgram.py
```

- File must be complete to run correctly
- Program cannot be edited on the fly
  - Must be exited, file re-opened, changes made, file saved and closed, and then re-run the program

Python Interpreter

- The "interactive" interpreter evaluates each individual line of code as it's typed in
- Type "**`python`**" to launch the interpreter

>>> is where the user types their code

```
>>> print("Hello")
Hello
>>> 4 + 7
11
>>>
```

lines without a ">>>" are Python's response

Reminder: Python 3

- Don’t forget to enable Python 3 before you run any code, whether in a program, or via the Python interpreter
- Type “**`scl enable python33 bash`**” to turn on Python 3
  - Type “**`exit`**” to exit Python 3 (or GL entirely)
  - Type “**`exit()`**” to exit the interpreter

Time For…

LIVECODING!!!

Daily emacs Shortcut

- **`CTRL+X, CTRL+S`**
  - Saves the file and <u>stays</u> in emacs
  - Allows you to keep editing the file

- **`CTRL+X, CTRL+C`**
  - <u>Closes</u> emacs, does <u>not</u> automatically save the file
  - Will prompt you to save if changes were made

Announcements

- Your discussions (Labs) start next week!
  - Go to your scheduled location and time
  - Pre Lab quiz will be posted and announced on BB
- HW 0 and Lab 1 are due Friday at 8:59:59 PM
- HW 1 will be out (on Blackboard) Saturday
  - You must first complete the Syllabus/Course Website Quiz to see it (also released by Saturday)

Image Sources

- Cardboard box:
  - https://pixabay.com/p-220256/
- No cursing sign (adapted from):
  - https://www.flickr.com/photos/rtgregory/1332596877
- Rock candy:
  - https://commons.wikimedia.org/wiki/File:Rock-Candy-Sticks.jpg
- Broken chain:
  - https://pixabay.com/p-297842/