CMSC201
Computer Science I for Majors

Lecture 03 – Variables

Prof. Katherine Gibson

Based on slides by Shawn Lupoli and Max Morawski at UMBC

Last Class We Covered

- Algorithms
- Program Development
- Control Structures
  - Sequential
  - Decision Making
  - Loops
- Types of Errors
  - Syntax
  - Logic

Any Questions from Last Time?

Today's Objectives

- To start learning Python
- To learn more about variables
  - How to use them
  - Different types
- To learn how to use input and output
  - To do interesting things with our program
- To play a party game

“Cowboy Coding”

- Jumping right in to writing code
- Disadvantages
  - No formal management of project
  - No standard way of coding
  - Not planning things out
    - Forgetting to include important things
    - Having to make big changes later

Software Development Process

1. Analyze the problem
   - Determine specifications (requirements)
2. Create a design
3. Implement the design
4. Test and debug the program
5. Maintain the program

Example: Temperature Converter

You have been invited to live in Europe during a semester abroad. You aren’t sure how to dress because the temperature is given in Celsius.

- Problem:
  - Temperature is given in Celsius
- Solution:
  - Write a program to convert Celsius to Fahrenheit

Input/Process/Output

- Input
  - – What information do you need for your converter?
- Process
  - – What formulas do you need for your converter?
- Output
  - – What is the output from your converter?

Introduction to Python (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
  - Modules (later in the semester)
  - Functions (later in the semester)

- Expressions
  - Code that manipulates or evaluates identifiers

We Start Python Today!

- Two ways to use python

We will write programs

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

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

Rules for Naming Variables

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

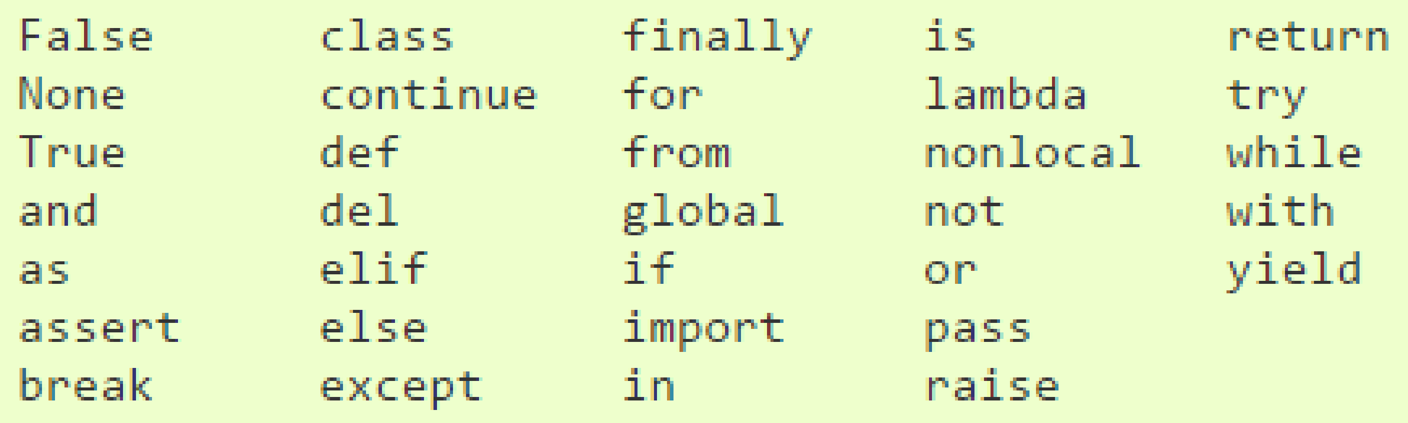
More Rules for Naming Variables

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

- Variables cannot **start** with a digit
  - **`2cool4school`** is not a valid variable
  - **`cool4school`** is a valid variable

Variables and Keywords

- Keywords are the 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

What Is a Variable?

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

Exercise: Variables

- Are the following legal or illegal in Python?

`1spam`	**No – Illegal!**
`raise1`	**Yes – legal!**
`Spam_And_Eggs`	**Yes – legal!**

Using Variables in Python

- Create a variable by declaring it
- Also need to initialize it
  - Use the assignment operator (=)

assignment operator

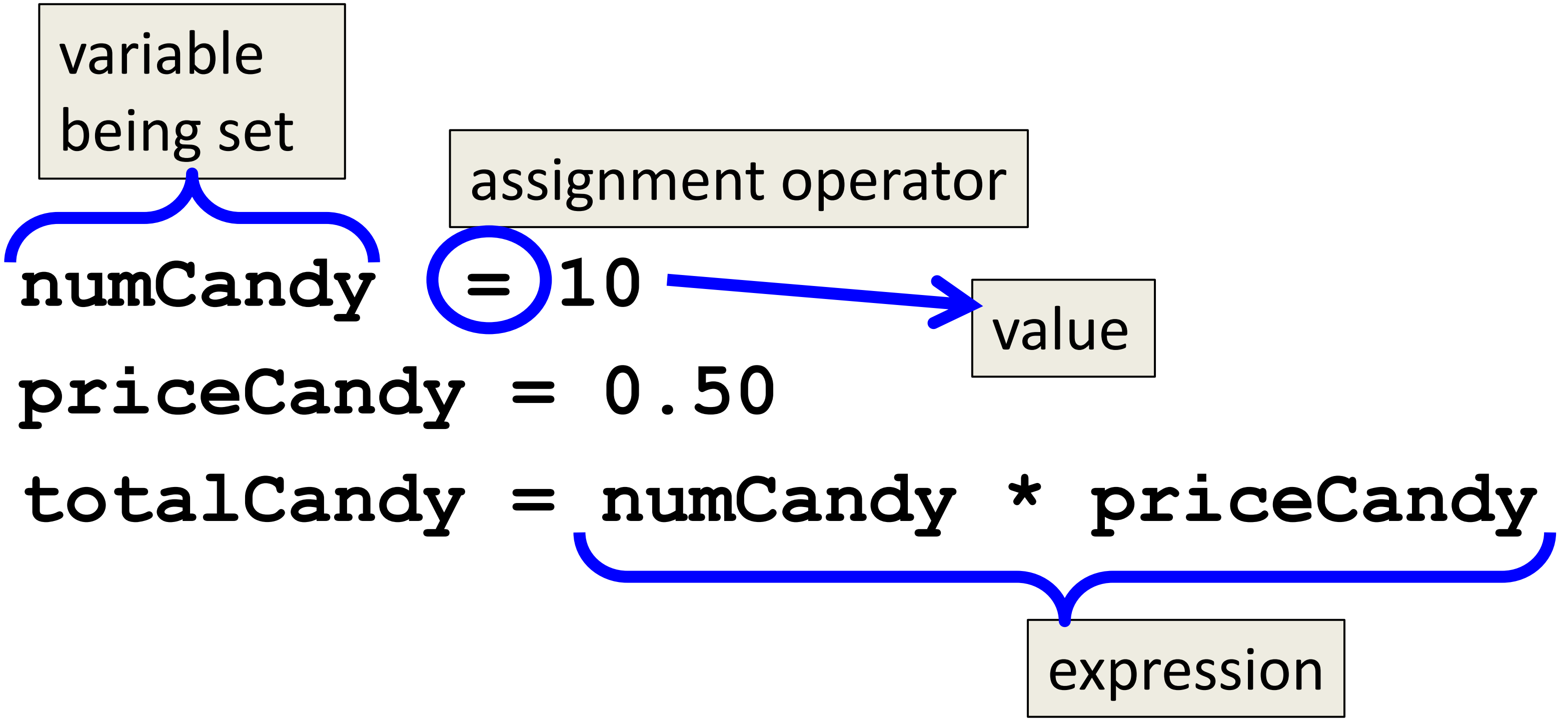
```
richFiddy  = 50000000
poorFiddy  = 0.50
brokeFiddy = 0
```

Introduction to Python (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

value

expression

```
numCandy = 10
priceCandy = 0.50
totalCandy = numCandy * priceCandy
```

Common Mistake

- Many new programmers mix up the left and right hand sides of the assignment operator

- Variable being set is on the ***left***
- Expression is on the ***right***

```
numCandy = 10    ✓

10 = numCandy    ✗
```

Variable Types

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

Variables Types: Examples

```
aString   = "Hello class"
decimal_1 = 1.12
myBool    = True
wholeNum  = 7

dogName   = “Mrs. 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

Introduction to Python
(Input and Output)

Output

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

- One command for this is **`print`**

Output Example

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

```
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 two 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!
- After **`b`** is set to 10, it no longer has anything else to do with **`a`**

Input

- Input is text we get from the user

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

- The output will look like this:

```
Please enter a number: 10
10
```

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 comes through **`input()`** will come in the form of a string

- There is a difference between **`"10"`** and **`10`**
  - **`"10"`** is a two character long string
  - **`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)

Class Exercise: Mad Libs

- Mad Libs is a phrasal template word game where one player prompts others for a list of words to substitute for blanks in a story, before reading the – often comical or nonsensical – story aloud.
- The game is frequently played as a party game or as a pastime

Exercise: Calculating Averages

- Write, on paper or on your computer, a program that asks the user for two numbers a prints out the average.

- Does the order of operations come into play for this exercise?

Exercise: Assignment Weighting

- Pretend you're writing a program to compute someone's weight grade. You have so far:

```
hwWeight         = 0.4
examWeight       = 0.5
discussionWeight = 0.1
```

- Write a program that then asks the user for their homework grade, exam grade, and discussion grade and prints out their total grade in the class.

Announcements

- Your Lab 1 is an online lab this week!
  - Due by this Thursday (Sept 3rd) at 8:59:59 PM
- Homework 1 is out
  - Due by next Tuesday (Sept 8th) at 8:59:59 PM
- Both of these assignments are on Blackboard
  - Weekly Agendas are also on Blackboard