# Intro to programming in Python

1/29/2020

## First a note on tools

IDE:  Integrated Development Environment

A set of tools that lets you do all of the functions of programming in a single place:

- Write code
- Test code
- Identify errors and debug
- Experiment with output formatting

## This class teaches you programming, NOT use of tools

BUT tools will make your programming easier

So we will download and demonstrate the use of an IDE as a tool

Pycharm

Please note: you don’t have to use pycharm in class, and the TA’s are *NOT* paid to help you with pycharm issues

But if you want to use pycharm or another IDE to initially develop and test code, you might find it easier

## Next: how to download and install pycharm

https://www.jetbrains.com/pycharm/

Get the appropriate version - Windows, Mac, Linux

GET THE FREE COMMUNITY VERSION!!!!

## Okay, now to write some Python

The first program you write in any language is “hello, world”

The program does just what you think: it prints hello, world on the screen

So let’s go.

```
# Our first python program

# Print “hello, world” on the screen

print(“hello, world”)
```

## Just for comparison: the same program in C++

```
#include <iostream>

cout << “Hello, World”
```

## Syntax and Semantics

All languages have syntax and semantics

Syntax refers to the letters, words and punctuation you use

Semantics refers to the underlying meaning of the letters, words and punctuation

You have to get both the syntax and the semantics right for the program to work the way you want it to.

## A few terms you should know

Comment

Variable

Literal

Constant

Reserved Word

Type

## Comments

Notes you write for yourself and other humans to explain what it is you’re trying to do

Mark a comment in Python with a #

Anything after the # on a line is a comment and is not executed by the python interpreter

#this is a comment

print (“hello, world”) # this is also a comment

## Variables

A symbolic name associated with a value

The value may change during the program’s execution

When you use a variable in python, the python interpreter reserves a location in memory and associates the variable’s name with that location. Then, any values assigned to that variable are stored to and read from that location

We’ll go over a few examples:

## The syntax of variable names

In python, variable names MUST start with either a letter or the underscore _ character

- You cannot start a variable name with a digit

Variable names can only contain uppercase letters, lower case letters, and underscores. NO OTHER special characters

Variable names are case sensitive. Height is not the same variable as HEIGHT

Course coding standards enforce additional rules

# Exercise: Variable names

Is each of the following a legal variable name in Python? Why or why not?

1spam

raise1

Spam_and_Eggs

EXIT_CODE!!

## Literals

A literal is an explicit value that is to be taken exactly as it is written in the program.

“Hello, world” is a literal (it’s a string literal, to foreshadow)

3   is a literal

3.14159  is a literal

2.71828 is a literal

## Constants

A constant is a symbolic name associated with a value that *WILL NOT CHANGE* during the execution of a program

You use a constant to represent a “magic number” to make code more readable

```
print(3.14159)   # or
PI = 3.14159
print(PI)
```

Python does NOT provide built in support for constants
We use ALL CAPS to represent a constant

## Reserved Words

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

These words have special defined semantics in Python - you can’t use them as variable names or for any other purpose

These are Case-Sensitive.

False  is not the same as false

## Types

Variables and constants have defined types that determine what operations you can perform on them.

For now, we’ll deal with int, float, string, and boolean

int - integer - whole numbers.  You can do math on them

float - floating point numbers - integer part and decimal part - you can do slightly different types of math on them

string - zero or more characters treated as a whole

Boolean - have the value True or False (note case sensitivity)

## Variables

Assignment is done using the equals sign =

```
Number_of_students = 20

Grade_point = 3.862

Error_message = “Sorry you must enter an integer between 1 and 4 inclusive”

Is_integer = True
```

## Using variables

Declaring variables: unlike some other languages, you do not pre-declare a variable in Python.  When you use a variable, that declares it

- The python interpreter recognizes that you have just declared a new variable and allocates a memory location to store its value

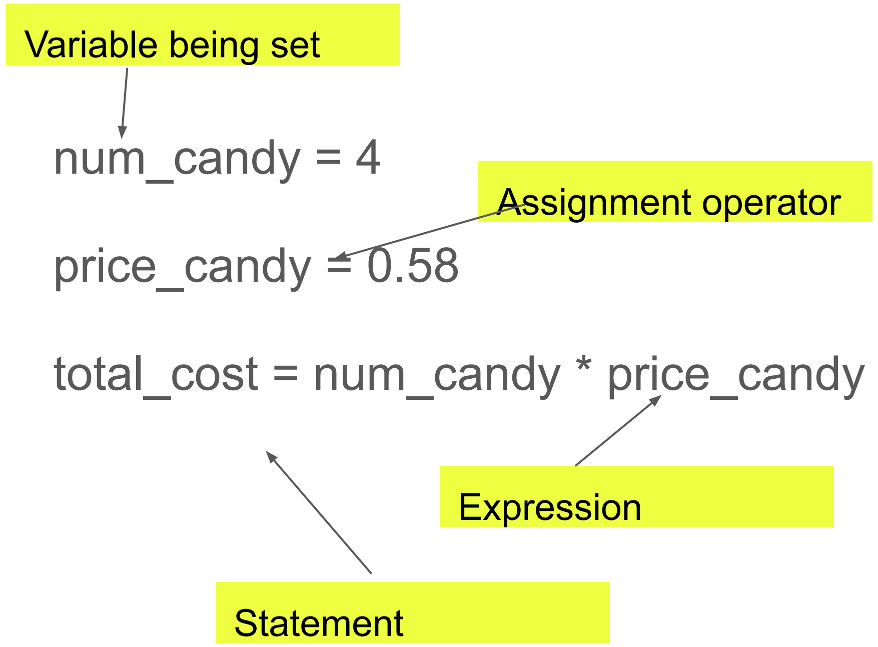
But you do have to initialize a variable before trying to use it

- Initialize means assign it a value

A very common error is to try to use an uninitialized variable - use it before it has been assigned a value

## Expressions

A way of calculating a new value to assign to a variable



```
num_candy = 4

price_candy = 0.58

total_cost = num_candy * price_candy
```

## “Sides” of the assignment operator

“Left hand side” and “right hand side”

- Left hand side is before - to the left of - the equals sign. This is where the value of the expression will be store
- Right hand side is after the equal sign. Evaluate everything to the right of the equal sign, and the store that value in the variable on the left

```
num_candy = 4 * 12

4 * 12 = num_candy  X not legal
```

## Operators

Special symbols that perform defined operations:

- Mathematical
- Comparison/Relational
- Assignment
- Boolean/Logical/Conditional

## Mathematical Operators

+ - * / // % **

+ - addition; works as you would expect

- Subtraction; works as you would expect

* multiplication

/ floating point division - results in a float number

// Integer division. Only valid if you have two integers; produces an integer.

% modulo

** exponentiation

Some examples:

5/3

5//3

5%3

## Comparison Operators

<   less than

<=  less than or equal to

> greater than

>= greater than or equal to

==   equal to

!=  not equal to

Be careful that you don’t confuse =  and ==

= is the assignment operator; it sets the value on the right to the variable on the left

== is a test to see if what’s on the left is equal to what’s on the right

# Assignment operators

| | |
|---|---|
| = | Some examples |
| += | num_candy = num_candy + 1 |
| * = | num_candy += 1 |
| -= | num_candy *= 2 |
| /= | num_candy -= 2 |
| | num_candy /= 2 |

## Boolean operators

and

or

not

A boolean is either True or Fals

Boolean operators take Boolean values, combine them and yield a single Boolean value

9 > 8 and 5 < 9

num_candy != 0 or choice = ‘yes’

## Practice

Set the variable meal_bill to 30 dollars and 51 cents. Then calculate a 20 percent tip on meal_bill, and print out the total amount due

Calculate a GPA.  Assign values to the number of hours earned and total quality points. Calculate the GPA as number of quality points divided by number of hours earned. Print the GPA.

## Input and Output

Initially, we will read in all input from the keyboard and print all results to the screen.

- We’ll cover reading from files and printing to files later

Input is done with the “input” statement; output is done with the “print” statement

```
print (3 + 4)

print (3, 4, 3+ 4)

print()

print (“the answer is”, 3 + 4)
```

## Examples

```
a = 10

b = a * 5

c = “your result is:’

print(c, b)
```

```
a = 10

b = a

a = 3

print(b)
```

## Input from the keyboard

If you expect the user to input a meaningful value, you have to tell him or her what you want. The input statement lets you enter a string to be printed out as a prompt

```
user_num = input(“please enter your student number:”)

print(user_num)
```

When the input statement is executed by the interpreter, the program stops until the user has entered the required data

In python 3, input is always entered as a string. Even if it’s supposed to be an integer or a floating point number

If the user types 10, you get the string “10” NOT the integer 10.

If the user types 42.75, you get the string “42.75” NOT the floating point number 42.75

You can’t do math on a string!!!

## Changing the type of a value

If a variable’s value is the wrong type, you can change its type by casting it to the type you want

To change a string to an integer, use int(the value)

```
  age = int(input(“enter your age in years as a whole number:”))
```

To change a string to a floating point number, use float()

```
  gpa = float(input(“enter your GPA to 3 decimal places: “)
```