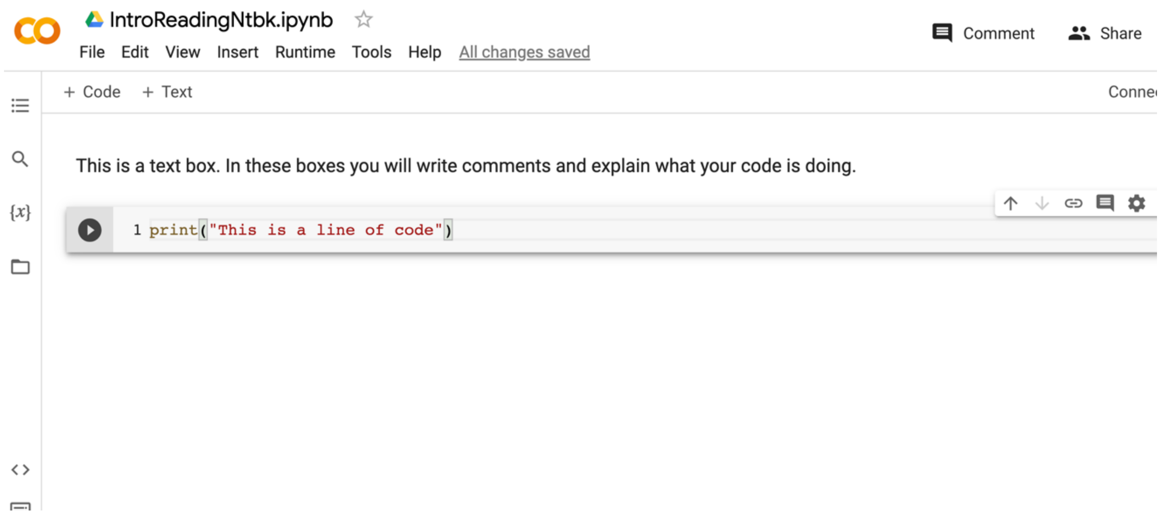
Using Google Colab to Program with Python

In this course, we will be using a tool called Google Colab to write and test Python programs. Our goal is to learn how to manipulate the digital versions of images and sounds. To do this, we are going to be using several libraries in Python, including PIL, matplotlib, NumPy, SciPy, and IPython . These libraries contain functions that we will use to access and edit pixels from pictures and samples from sounds.

Introduction to Google Colab

As we just mentioned, we will be writing our programs in Google Colab. This will require programmers to have a Google account. The following is an example of what you might see when you open a notebook in Google Colab.



This is a text box. In these boxes you will write comments and explain what your code is doing.

```
print("This is a line of code")
```

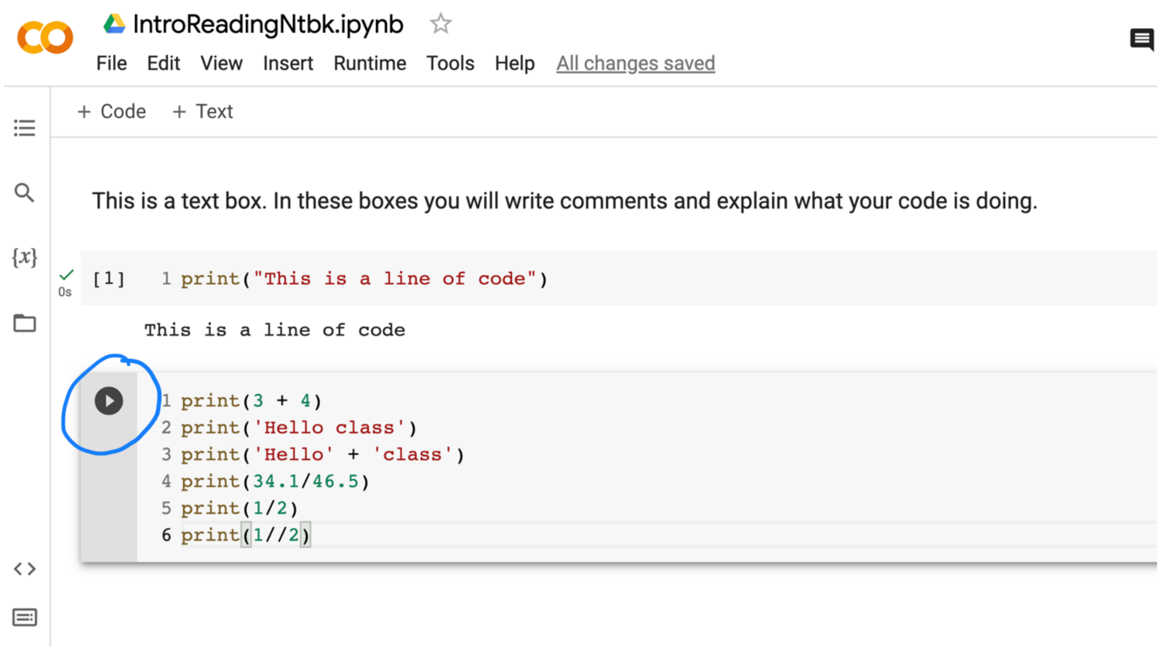
The files that we will be working with are called notebooks and have a .ipynb ending (short for IPython notebook). In these notebooks, we will have **Code cells** and **Text cells**. The Code cells are where we will write our programs and the Text cells are where we will write comments and explain what the code does.

Some examples of commands we could type into a Code cell are:

```
    print(3 + 4)
    print('Hello class')
    print('Hello' + 'class')
    print(34.1/46.5)
    print(1/2)
    print(1//2)
```

(Note: Python understands many of the standard math operators.)

Exercise: Go to Google Colab in a browser. (If you are not familiar with Google Colab, you may want to wait to do this at the beginning of the first in-class activity, where there will be more detailed instructions on starting your first program.) Create a new notebook and try entering the commands from the previous example into a Code cell. Each command should be on a different line. Your program might look something like the following:



This is a text box. In these boxes you will write comments and explain what your code is doing.

```
[1]  print("This is a line of code")
```

```
This is a line of code
```

```
print(3 + 4)
print('Hello class')
print('Hello' + 'class')
print(34.1/46.5)
print(1/2)
print(1//2)
```

To run this program (*i.e.,* to make the computer execute each line of code), click on the little triangle on the left side of the Code cell. (It is circled above.)
Your results should show up underneath your Code cell.

You may choose to run only one Code cell at a time, or you may want to run them all, from the beginning of the program. To do this, go up to the top of your screen and select **Runtime**, then **Run all** from the drop-down menu.

Follow-up Analysis: Were the results from this exercise what you expected? Why or why not? Was there a (small) difference between the 2nd and 3rd examples? If so, what was it? What happened in the last example? (You may need to discuss this with your instructor or class.)

We have just seen that we can use arithmetic operators and commands to make things happen in a program. When we used the `print` command, the word `print` is actually a **keyword** – a predefined word that has a specific meaning in the language. Programming languages often have a number of keywords. We will learn additional Python keywords as necessary.

In addition to using arithmetic operators and commands in a program, there are times when we will want to hold onto values for later use in a program. We will do this through the use of **constants** and **variables**. A **constant** is a value that does not change (*i.e.*, it is *constant*). Some examples of constants include 3, -15.2, “A”, and “Hello”. A **variable** is a value that can change throughout a program. In order to use variables, we need to give them identifiers (names). Identifiers can be almost anything (but cannot be the same name as a keyword), although good programmers try to give their variables names that reflect what the value represents. For example, if we have a variable that stores a file, we might name it *myFile*, or if we have a variable that represents a sum of numbers, we might name it *sum*. One of the features that makes Python easier to learn and use than some other languages is that you do not have to decide what type of data your variables will hold. Python takes care of those details behind the scenes. When you need to use a variable in a program, you just make up a name and use it. We do need to have some caution, though, because if you use the same name for two different values, the first value will be lost when you define the second.

Helpful Hint

When you need to use a variable in a program, you can just make up a name and use it. Be careful not to use the same name for two different values.

Aside: Rules and Conventions for Identifiers

- Names must start with a letter (usually lower case) or underscore character, but then may contain any number of letters, numbers, or other underscore characters.
- Names are case-sensitive: *Sum* and *sum* are different identifiers.
- It is a common convention that variable names that contain more than one word use underscores to separate the words, as in *my_file* or *average_of_three_numbers*, or use a capital letter at the beginning of words after the first, as in *myFile* or *averageOfThreeNumbers*.

It is now time to try out a few things. In this first mini-lab, you will learn some basics of JES and some basics for choosing and showing some pictures (and sounds).

Activity: Getting Started with Google Colab and Python