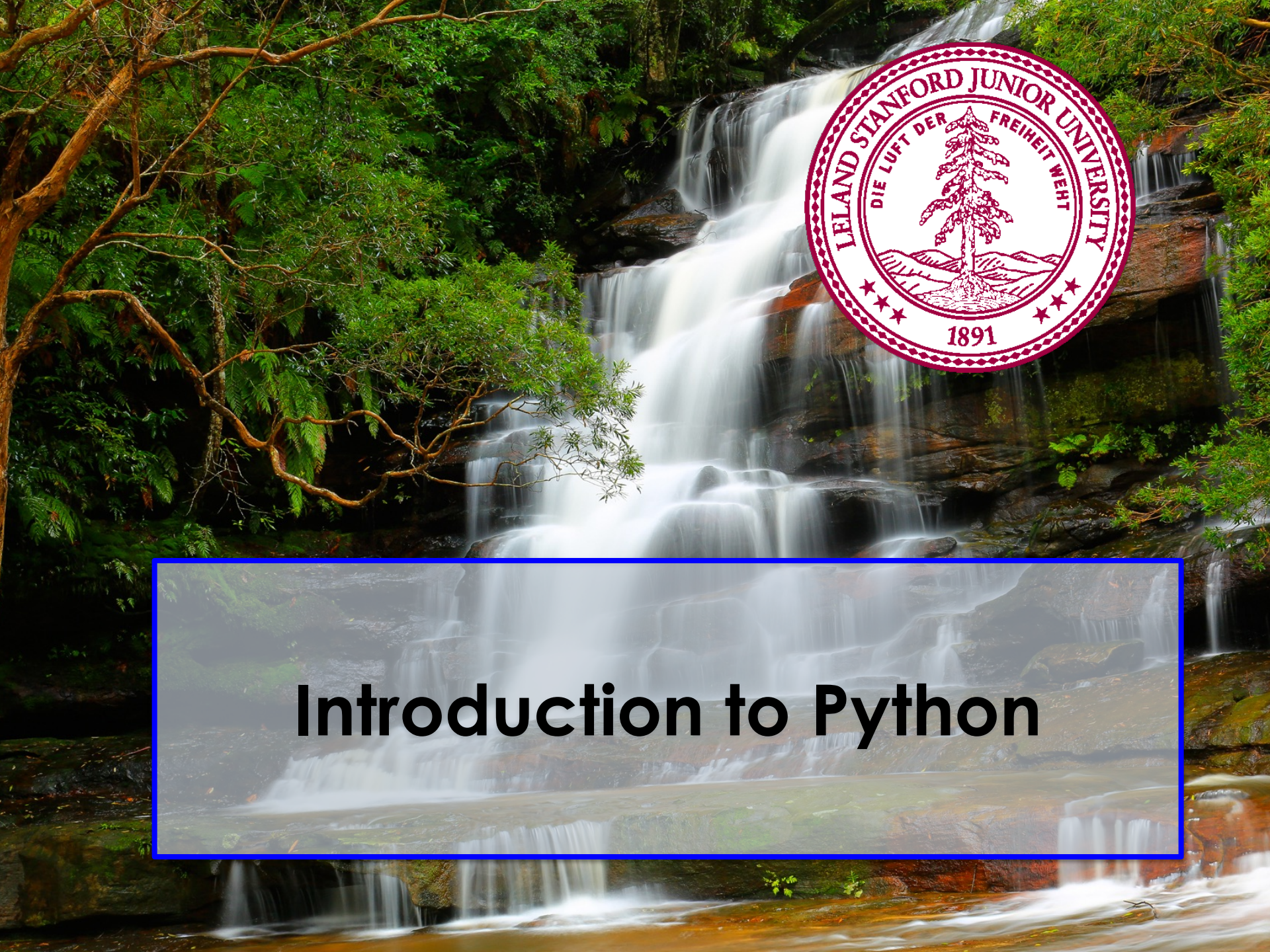
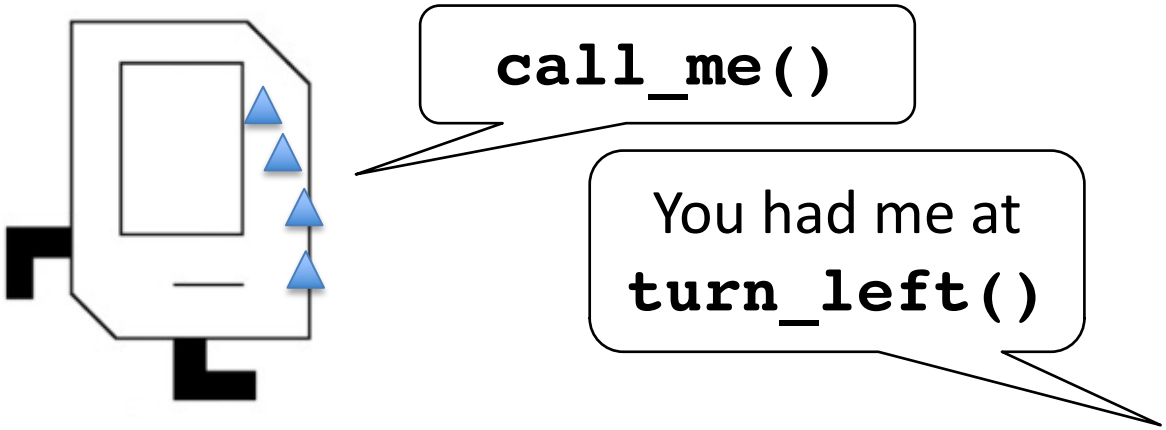


Introduction to Python

Bye, bye, Karel!



More on Programming Style

```
"""
File: SteepleChaseKarel.py
--------------------------
Karel runs a steeple chase that is 9 avenues long.
Hurdles are of arbitrary height and placement.
"""


"""
To run a race that is 9 avenues long, we need to move
forward or jump hurdles 8 times.
"""
def main():
    for i in range(8):
        if front_is_clear():
            move()
        else:
            jump_hurdle()

"""
Pre-condition:  Facing East at bottom of hurdle
Post-condition: Facing East at bottom in next avenue after hurdle
"""
def jump_hurdle():
    ascend_hurdle()
    move()
    descend_hurdle()
```

Comments for program and *every* function

Consistent indentation

Decomposition principle: Each function should solve one step of problem

Descriptive ***names*** (snake_case)

Short functions (usually 1-15 lines)

What's Mozart Doing Now?

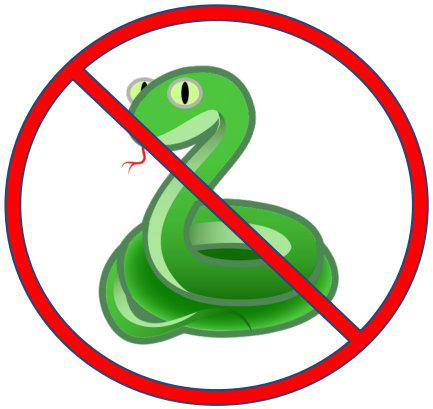
```
if mehran_teaching():
    not_funny()
```

```
while mehran_teaching():
    not_funny()
```

Welcome to Python

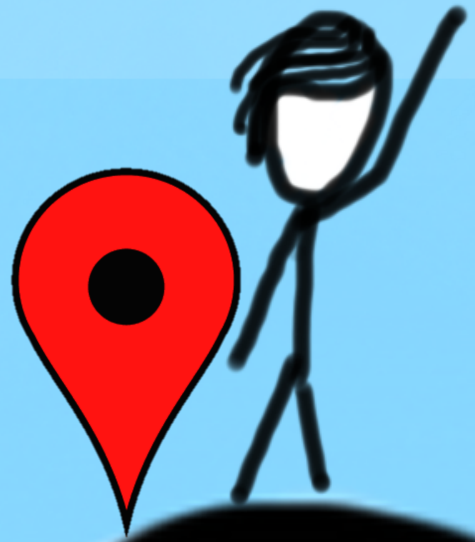
Guido van Rossum
(Creator of Python)

Monty Python's Flying Circus



Today's Goal

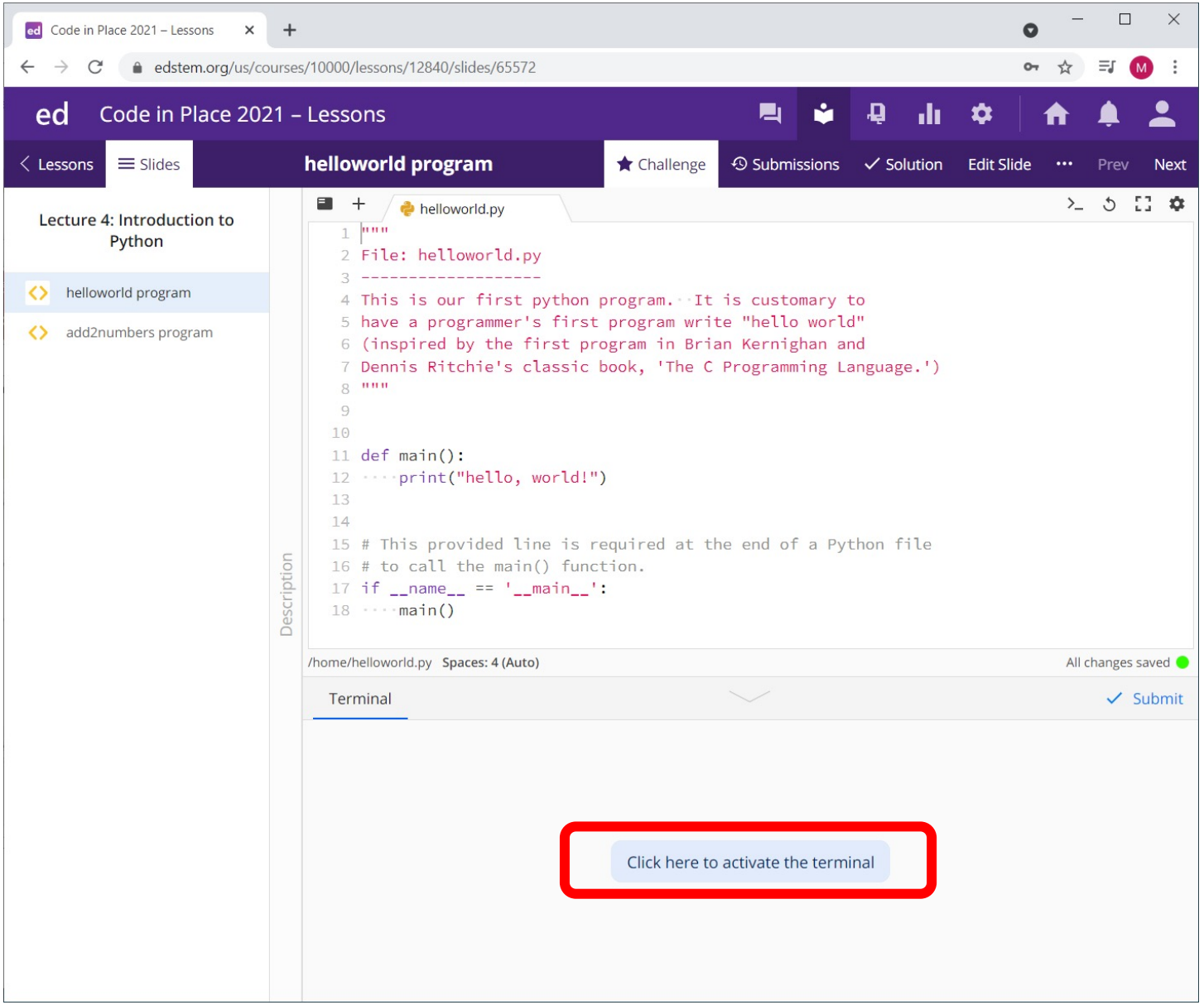
1. Introduction to Python
2. Understanding variables



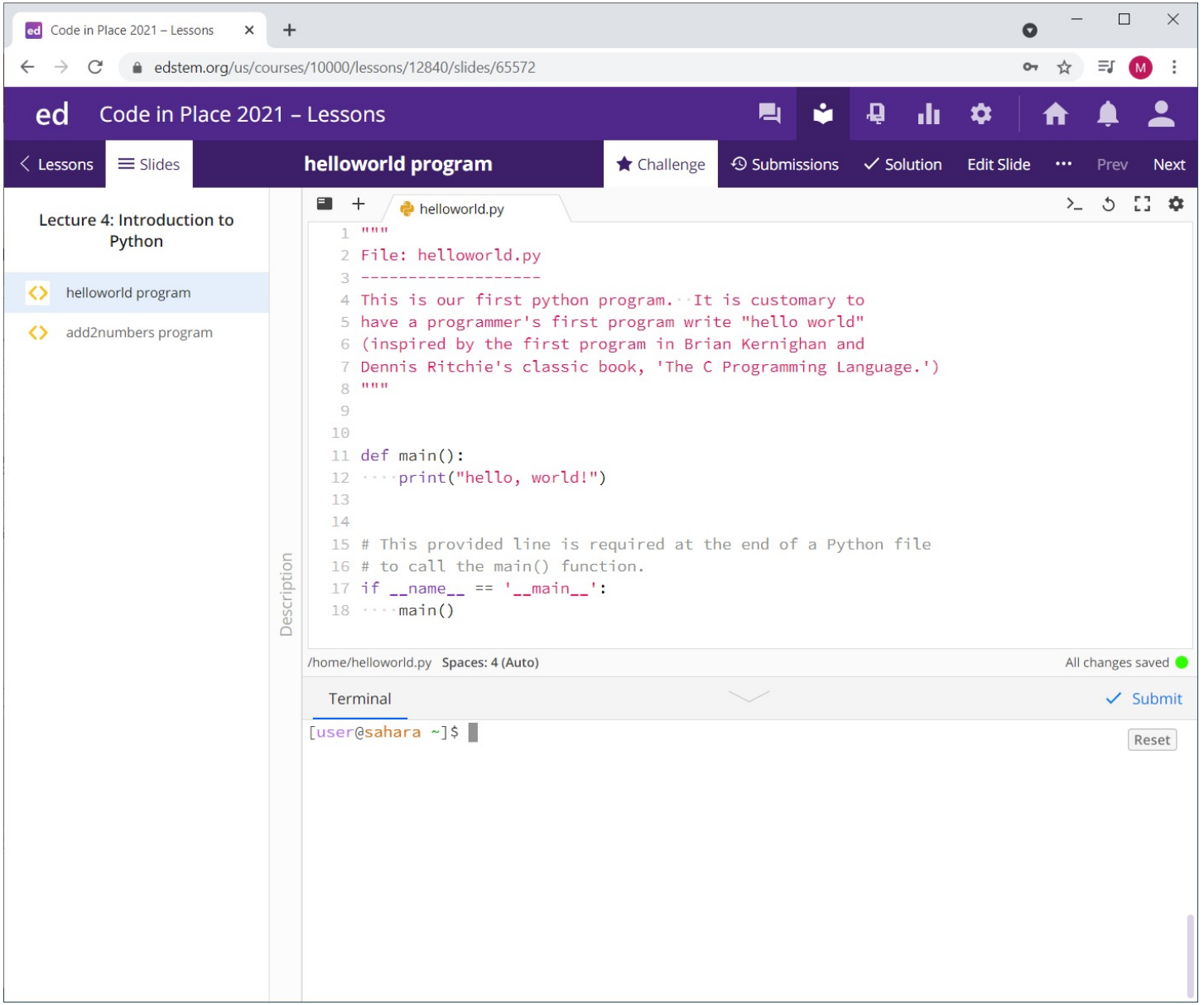
Our First Python Program

```
"""
File: helloworld.py
-------------------
This is our first python program.  It is customary to
have a programmer's first program write "hello world"
(inspired by the first program in Brian Kernighan and
Dennis Ritchie's classic book, 'The C Programming Language.')
"""


def main():
    print("hello, world!")


# This provided line is required at the end of a Python
# file to call the main() function.
if __name__ == '__main__':
    main()                    # little bit different than in Karel
```

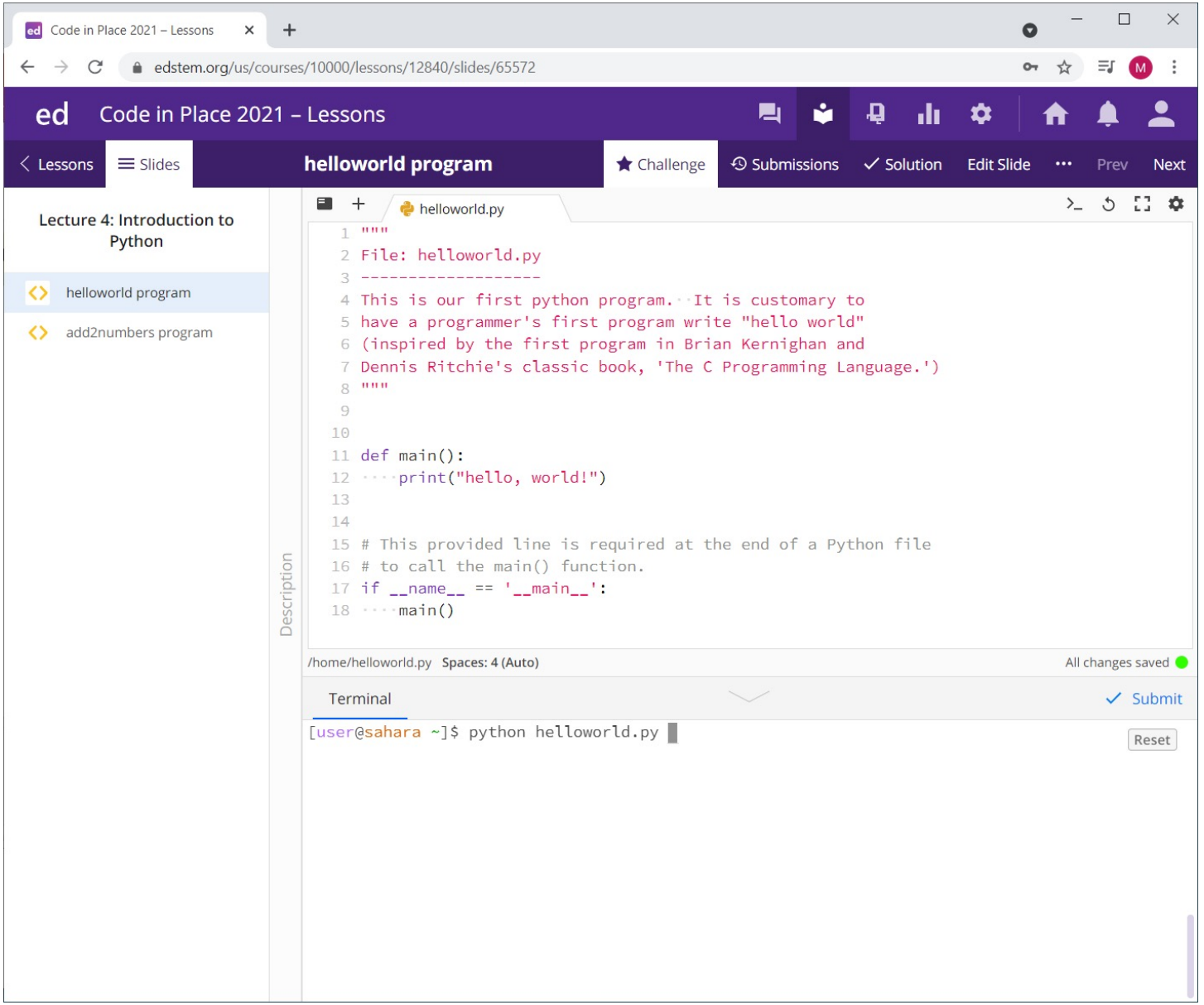
Our First Python Program



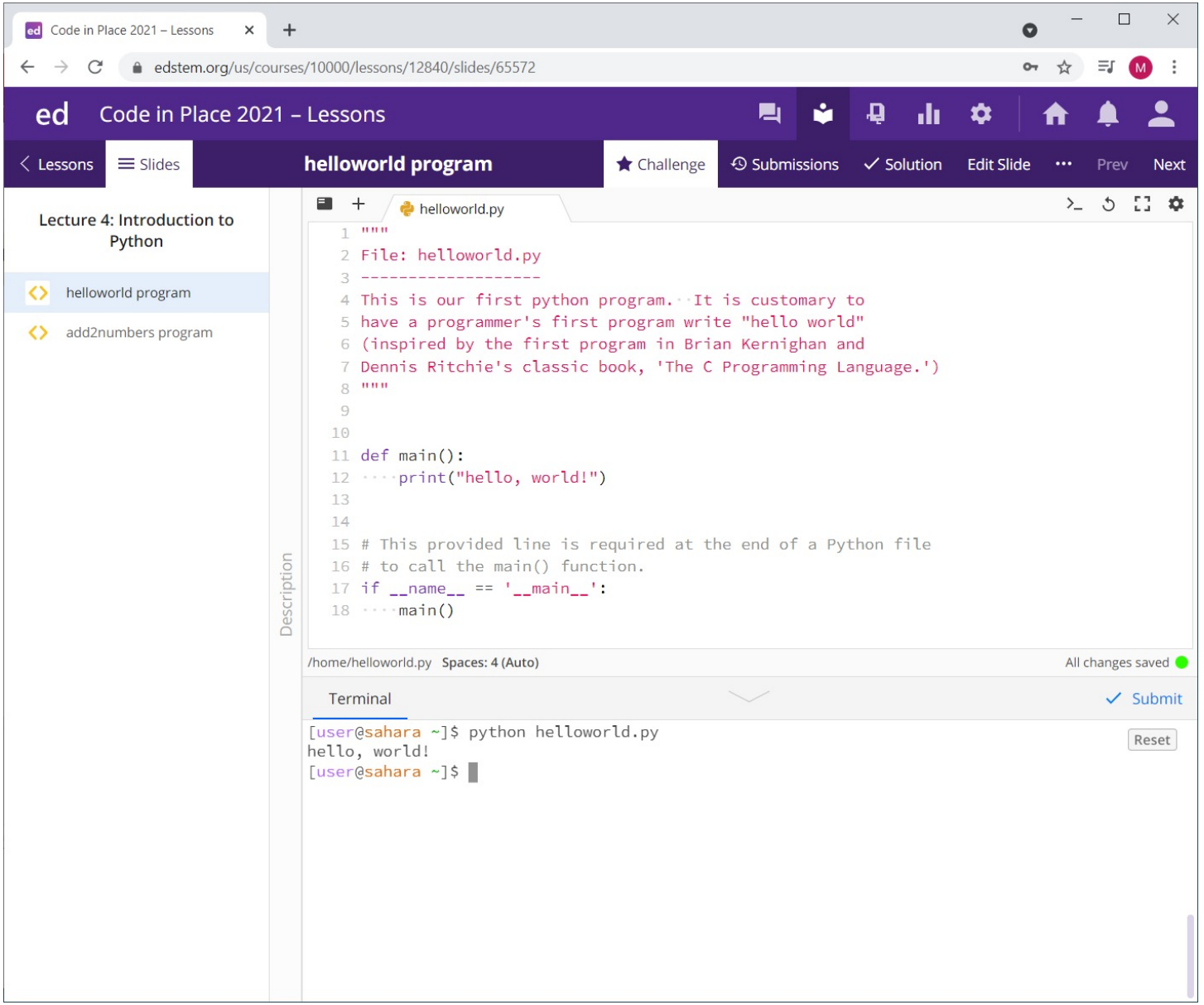
Our First Python Program



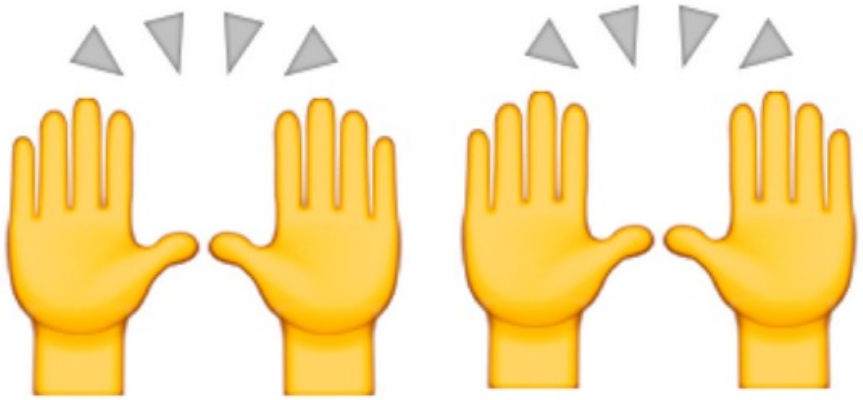
Our First Python Program

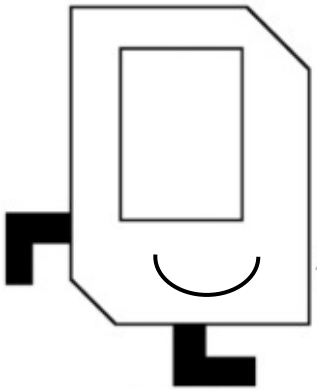


Our First Python Program



You're now all Python programmers!





```
hey_that_looks_
like_what_I_
taught_them()
```

Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

```
This program adds two numbers.
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

```
This program adds two numbers.
Enter first number:
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | "9"

```
This program adds two numbers.
Enter first number: 9
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9

```
This program adds two numbers.
Enter first number: 9
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9

```
This program adds two numbers.
Enter first number: 9
Enter second number:
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9 | num2 | "17"

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9 | num2 | 17

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1	9	num2	17	total	26

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Another Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1	9	num2	17	total	26

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
The total is 26.
```


`print` function

```
print("This program adds two numbers.")
```

- **`print`** command prints text to the terminal
- Text printed is between double quotes ("text")
  - Can also be between single quotes ('text')
  - Choice of quotes depends on text you are printing
    - Double quotes when text contains single quotes

    `print("no, you didn't")` ➔ `no, you didn't`
    - Single quotes when text contains double quotes

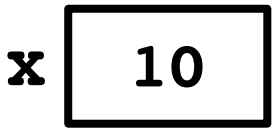
    `print('say "hi" Karel')` ➔ `say "hi" Karel`

`input` function

```
num1 = input("Enter first number: ")
```

- **`input`** command gets text input from the user
- Prints text specified in double/single quotes
  - Then waits for user input
  - Here, user input from **`input`** is put in a **variable** (**`num1`**)
  - The user input is considered text, even if user entered a number
- We'll talk more about **`input`** function later

What is a Variable?



- A **variable** is a place to store information in a program
- It associates a **name** with a **value**
- You can create a new variable by assigning a value:

```
x = 10
```

What is a Variable?

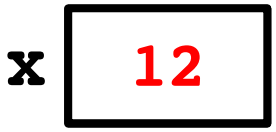
- A **variable** is a place to store information in a program
- It associates a **name** with a **value**
- You can create a new variable by assigning a value:

```
x = 10
```

  - The value can change with a new assignment

```
x = 5
```

What is a Variable?



- A **variable** is a place to store information in a program
- It associates a **name** with a **value**
- You can create a new variable by assigning a value:

```
x = 10
```

  - The value can change with a new assignment

```
x = 5
```

  - You can set the value using mathematical expressions

```
x = 5 + 7
```

  - More about expressions next class

Variable Assignment

- You use the equal sign (=) to assign to a variable
  - The first time you assign a value to a variable, you create it
  - Subsequent assignments give the variable a new value
- Assignment is not the same as "equals" in math
  - Assignment: first evaluate right-hand side, then assign to the variable on the left-hand side
  - Consider the following code:

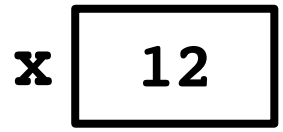
```
total = 5
total = total + 1
```

- Variables are only visible inside the function in which they are created (called "scope" of variable)
  - If you create a variable in **`main()`**, its only visible in **`main()`**
  - More on that next class

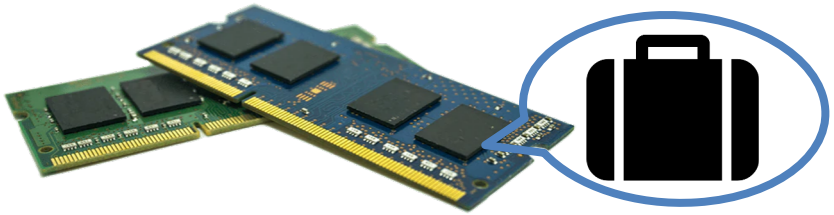
Variable Names

- Variable names must:
  - Start with a letter or an underscore (_)
  - Contain only letters, digits, or underscores
  - Cannot be a "built in" command in Python (e.g., **`for`**)
- Variable names are case sensitive
  - **`Hello`** is not the name as **`hello`**
- Variable names should:
  - Be descriptive of the value they refer to
    - E.g., **`x`** is only a good name if it's a coordinate
  - Be in snake case (e.g., **`num_students`**)

Suitcase Analogy



- When you store information in a variable, it becomes a Python *object*
  - Objects come in different sizes and types
- Think about a Python object as a suitcase stored in your computer's memory
  - Object take up different amounts of RAM depending on what you're storing.



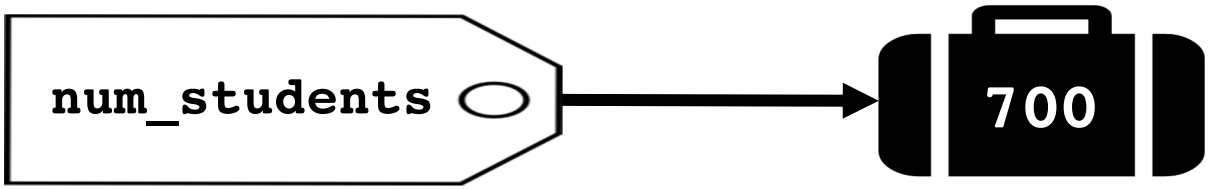
You have space for millions on suitcases!

Suitcase Analogy

- Variable is a luggage tag that gives a ***name*** to suitcase

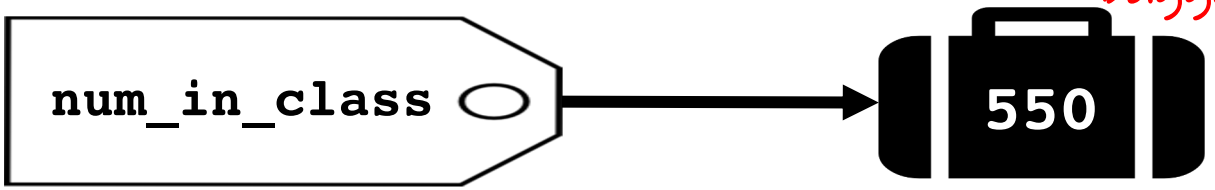
```
num_students = 700
```

  - ***Value*** is what is stored in the suitcase
  - Create the tag/suitcase the first time you assign to variable

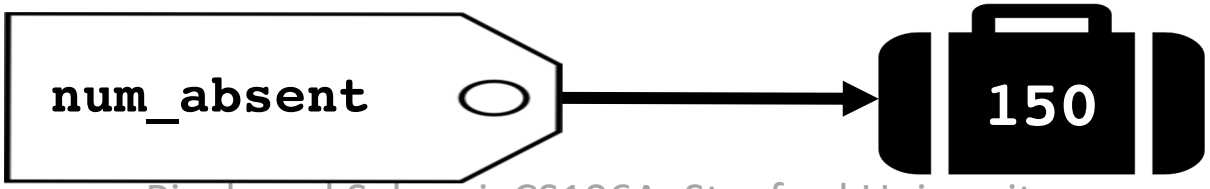



```
num_in_class = 550
```

Python handles the baggage for you!



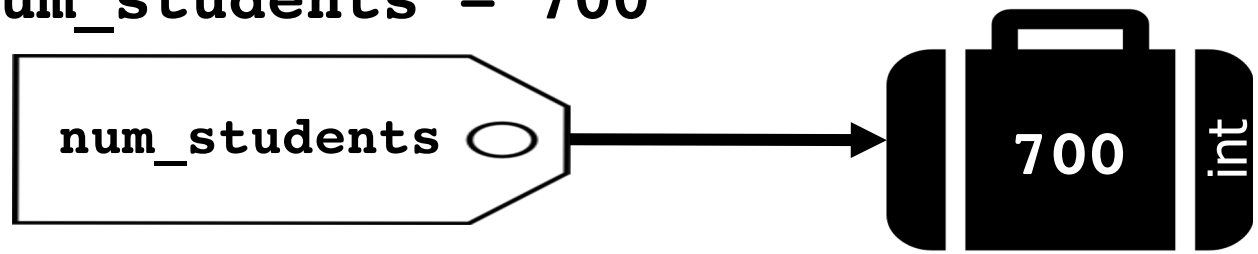

```
num_absent = num_students – num_in_class
```



Types

- Each suitcase knows what ***type*** of information it carries

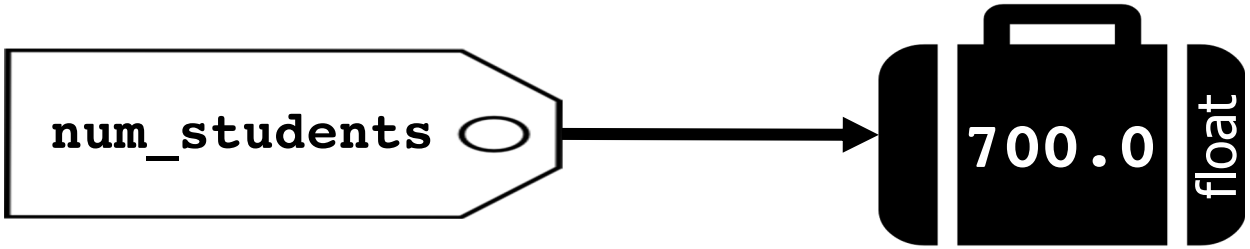
```
num_students = 700
```



  - Value stored in suitcase is an integer (called an **`int`** in Python)
  - Suitcase keeps track of **type** of data that is stored there

```
num_students = 700.0    # note decimal point
```

  - Now, value stored is a real number (called a **`float`** in Python)



Some Types in Python

- **int**: integer value (no decimal point)

```
x = 10        y = -2
```

- **float**: real number value (has decimal point)

```
x = 5.0       y = -3.7
```

- **string**: text characters (between single/double quotes)

```
x = "hello"   y = '10'
```

  - Note: the string "5" is ***not*** the same as the integer 5

- **bool**: Boolean logical values (`True`/`False`)

```
x = True      y = False
```

- More on strings and bools in a few days

Why Do We Have int and float?

- How much do I weigh?
  - Answer can be a real valued number
  - There is no "next" number
  - This would be a **float**

- How many children do I have?
  - Answer is an integer
  - There is a well-defined "next" number
  - This would be an **int**

Recall, Our Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

Recall, Our Program

```
def main():
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    num1 = input("Enter first number: ")
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    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

```
This program adds two numbers.
```

- **`print`** command is displaying a **string**

Recall, Our Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | "9"

```
This program adds two numbers.
Enter first number: 9
```

- **`input`** command gives you back a **string**
  - Even if the user types in a number

Recall, Our Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9

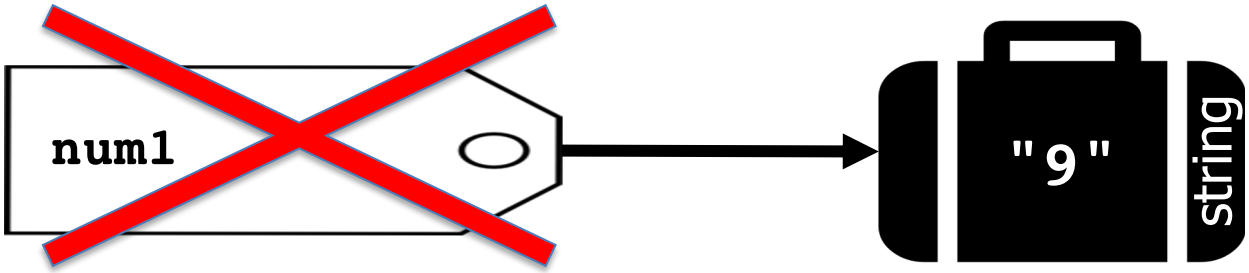
```
This program adds two numbers.
Enter first number: 9
```

- Create **int** version of **string** and assign it back to **num1**

Show Me The Luggage!

- **`input`** command gives you back a **string**

```
num1 = input("Enter first number: ")
```

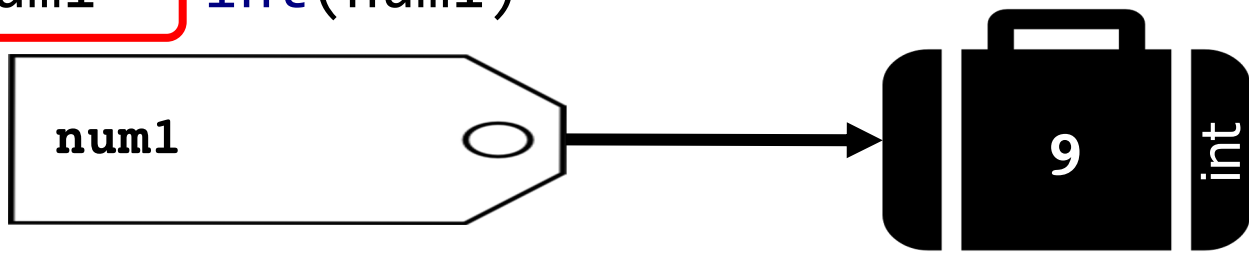


  - We create an integer version of **`num1`**

```
num1 = int(num1)
```

  - Create a new suitcase that has **int** version of **`num1`**
  - Then assign the tag num1 to that piece of luggage

```
num1 = int(num1)
```



Recall, Our Program

```
def main():
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    num1 = input("Enter first number: ")
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    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9

```
This program adds two numbers.
Enter first number: 9
```

- Create **int** version of **string** and assign it back to **num1**

Recall, Our Program

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def main():
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    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9

```
This program adds two numbers.
Enter first number: 9
Enter second number:
```


Recall, Our Program

```
def main():
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    num1 = input("Enter first number: ")
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    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9 | num2 | "17"

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Recall, Our Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1 | 9 | num2 | 17

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Recall, Our Program

```
def main():
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    print("The total is " + str(total) + ".")
```

num1	9	num2	17	total	26

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
```


Recall, Our Program

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def main():
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```

num1	9	num2	17	total	26

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
The total is 26.
```


What's Going on With `print`

- Adding strings in **`print`** command?!

```
print("The total is " + str(total) + ".")
```

- The **+** operator concatenates strings together

```
str1 = "hi"
str2 = " "
str3 = "there"
str4 = str1 + str2 + str3
```

- **`total`** is integer, so we need to create a string version

```
str(total)
```

  - String version of **`total`** is a new value that is concatenated to produce final string that is printed
  - Original variable **`total`** is still an **int**

Recall, Our Program

```
def main():
    print("This program adds two numbers.")
    num1 = input("Enter first number: ")
    num1 = int(num1)
    num2 = input("Enter second number: ")
    num2 = int(num2)
    total = num1 + num2
    print("The total is " + str(total) + ".")
```

num1	9	num2	17	total	26

```
This program adds two numbers.
Enter first number: 9
Enter second number: 17
The total is 26.
```


Side note about `print`

- You can **`print`** numbers by themselves directly
  - Only need to create string version of numbers when printing other text (strings) with them

```
def main():
    x = 10
    y = 3.5
    print(x)
    print(y)
    print("x = " + str(x))
```

```
10
3.5
x = 10
```


Multiple values in `print`

- You can also **`print`** multiple items separating them with commas
  - By default, a space is printed between each item

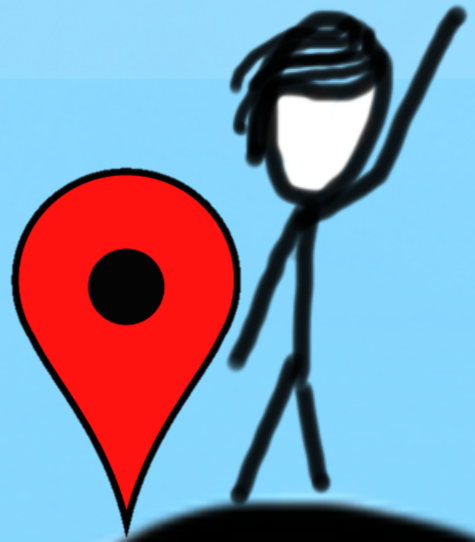
```
def main():
    x = 4
    y = 0.2
    print(x, y)
    print("x =", x, "and y =", y)
```

```
4 0.2
x = 4 and y = 0.2
```


You just wrote your first Python program and learned about variables!

Today's Goal

1. Introduction to Python
2. Understanding variables



add2numbers.py