Introduction to Software Design

P01. Hello World!

Tae Hyun Kim

Spring 2020

Introduction

- Introduction to Python
- Running the Python Interpreter
- Evaluating expressions
- Storing values in variables
- Strings
- Write & run the first program
  - "Hello world"
  - "My Favorite Stuff"

Introduction to Python

- Python
  - Easier to learn than C.
  - Serious programming language.
  - Popular language in research & scientific community of other areas.

- Python programming
  - Need software called the **Python interpreter.**
  - **Interpreter**
    : a program that understands the instructions that you'll write in the Python language.

Python 2 & Python 3

- Python 2 is still in active use.

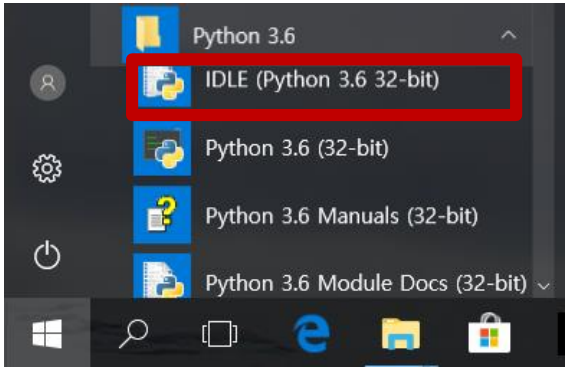
- Python 3 is the future of Python.
  - A lot of very useful features & fixes for well-known problems
  - To do this, **Python 3 breaks backward compatibility**.

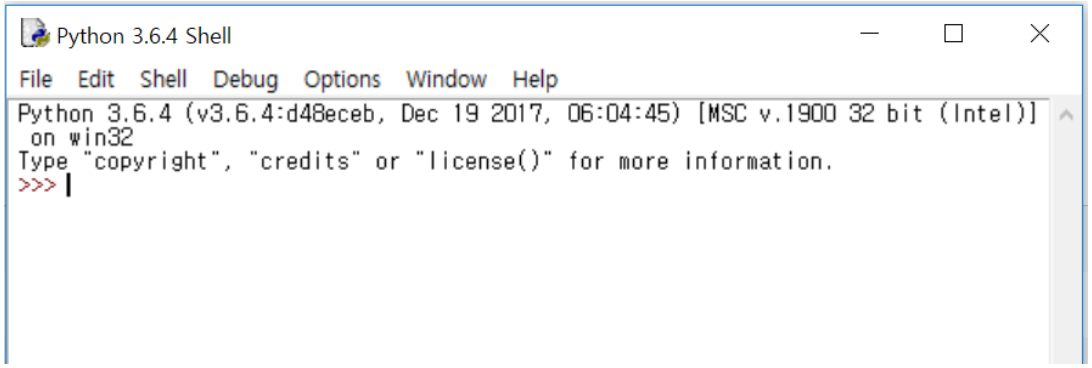
- We use **Python 3** in this class.

IDLE

- : Python's **I**ntegrated **D**evelopment and **L**earning **E**nvironment.
  - Provides both interactive & non-interactive mode.

- Windows: Installed with Python interpreter.





- Ubuntu: You need to install IDLE by

```
$ sudo apt-get install idle-python3.x (자신의 버전에 맞게)
```

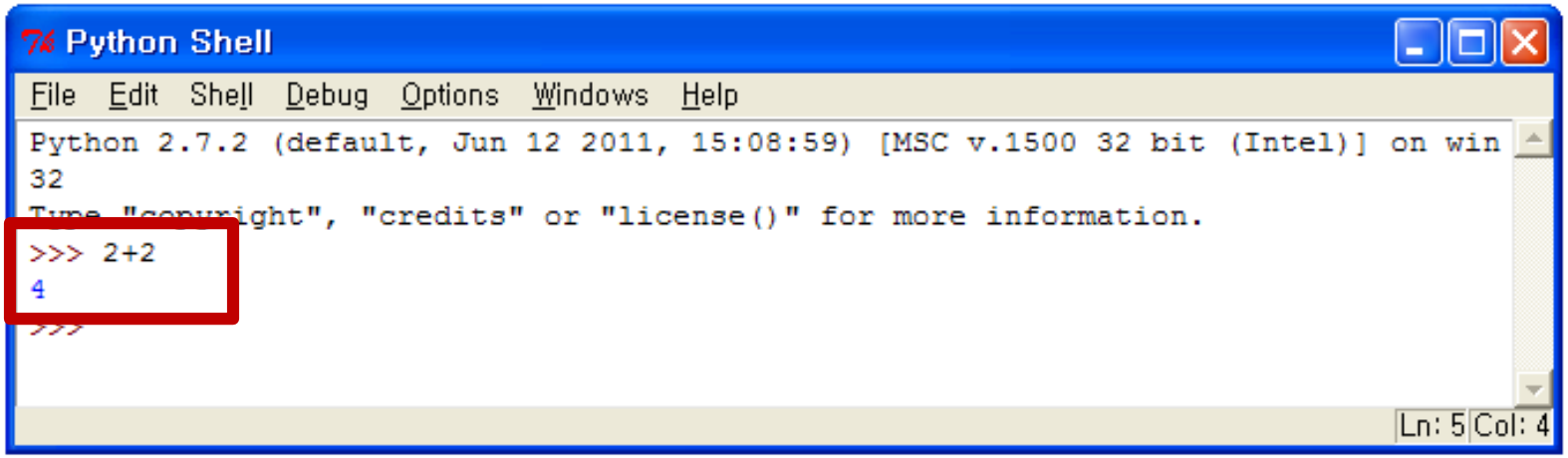
Actually, IDLE is not mandatory

- You can use instead of IDLE...
  - Running Python interpreter in cmd or terminal window directly (for interactive mode).
  - Any editors (for non-interactive mode) - Vim, Notepad++, Sublime Text, Atom, Notepad, gedit…

- Following slides are based on IDLE, just as an example.

IDLE - Interactive Mode

- Some Simple Math Stuff
  - Type **2+2** into the shell and press the **Enter key.**
  - Computer should respond with the number **4.**
    : the sum of **2+2**



Math Operators

- Some Simple Math Stuff
  - The various math operators in Python

2+2	Addition
2-2	Subtraction
2*2	Multiplication
2/2	Division

  - +, -, *, and / are called **operators.**
  - * sign is called an **asterisk** (and also called a “star”)

Numbers

- Integers and Floating Point Numbers
  - **Integers**
    - Whole numbers (like 4, 0, and 99)
  - **Floating point numbers**
    - Numbers with a decimal point (like 5.0)
  - **In Python**
    - The number 5 is an **integer.**
    - But if we wrote it as 5.0 it would **not be an integer.**

```
>>> 2.0/3.0
0.66666
```

Warning: Integer division

In Python 2:

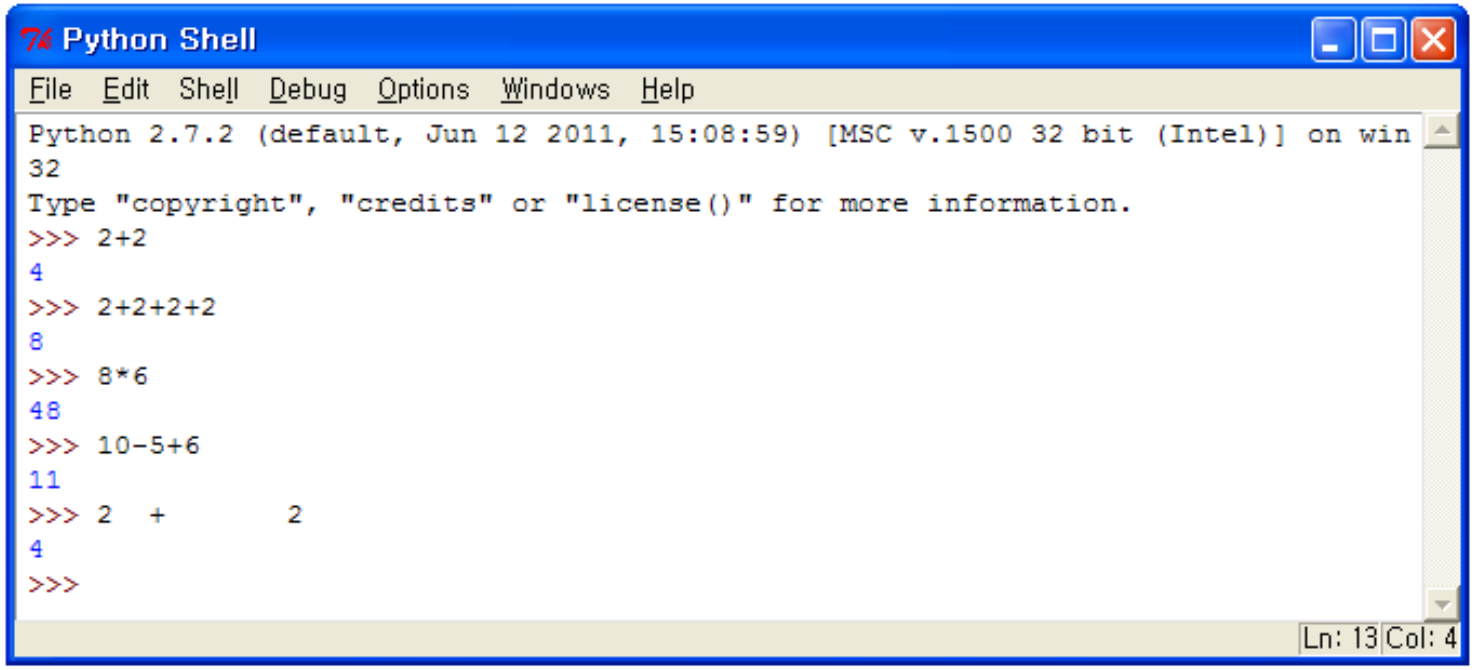
```
>>> 3 / 2
1
```

In Python 3:

```
>>> 3 / 2
1.5
```

Evaluating Expressions

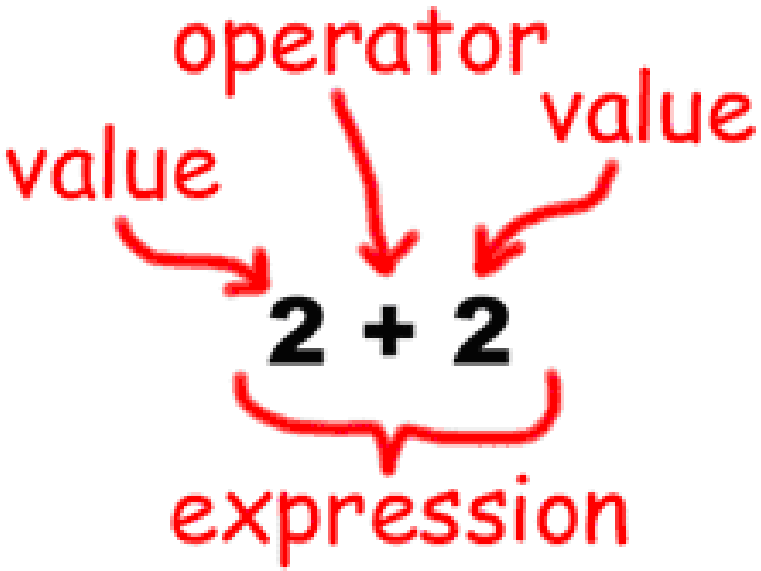
- Expressions



  - These math problems are called **expressions.**
  - These integers are also called **values.**

Evaluating Expressions

- Expressions
  - An expression is made up of **values** and **operators.**



Evaluating Expressions

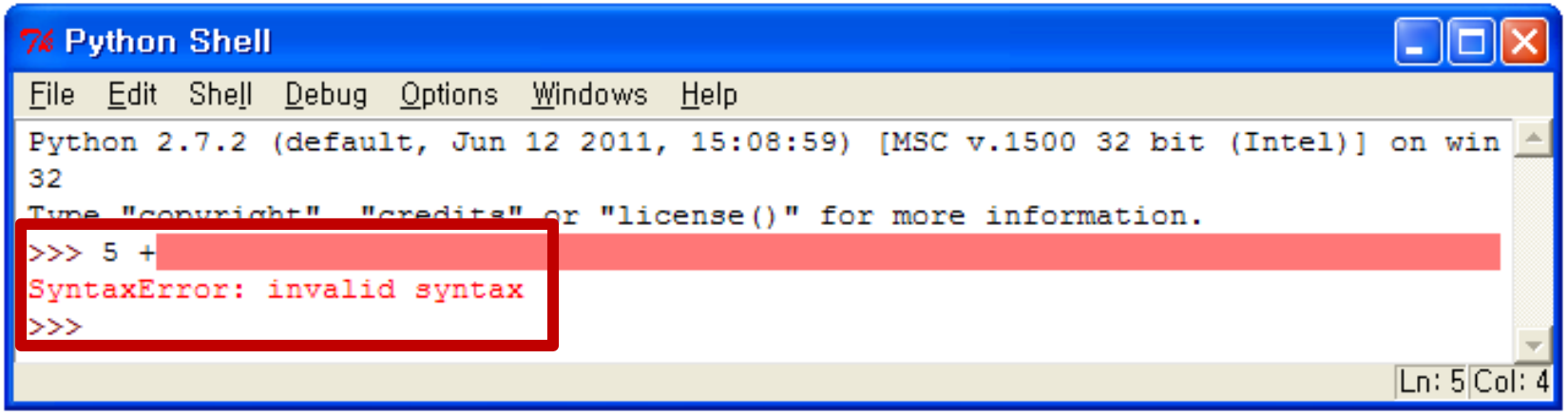
- Computer solves the **expression 10 + 5** and outputs the **value 15.**

- The expressions **10 + 5** and **10 + 3 + 2**
  - have the **same value.**
  - they both **evaluate to 15.**

- Single values are considered expressions.
  - The expression 15 evaluates to the value 15.

Evaluating Expressions

- If you type in just “5 +”,
  - you will get an **error message.**

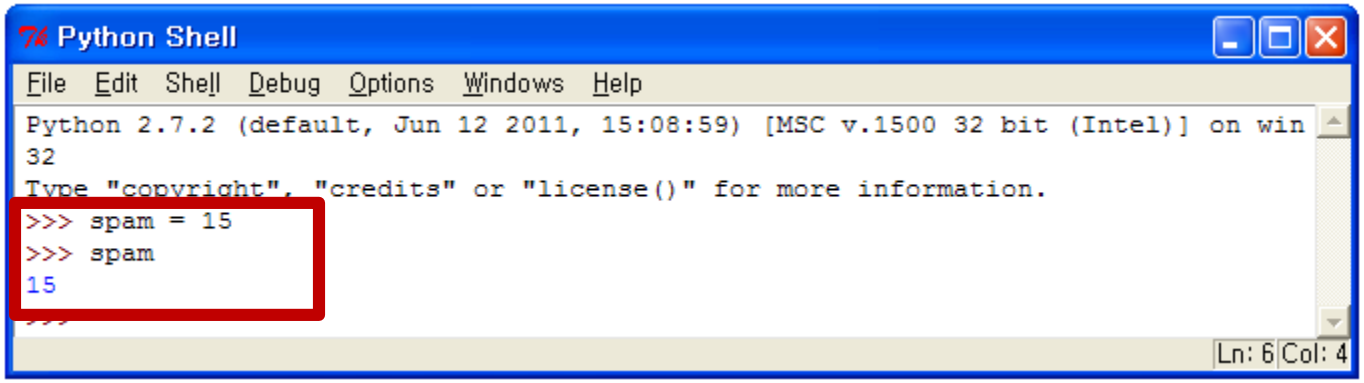


  - It is because **5 +** is **not an expression.**
  - Expressions have values connected by operators.
  - The binary **+ operator** always expects to **connect two things** in Python.

Storing Values in Variables

- Variables
  - A box that can hold values.
  - We can **store values** in the variables.
    - with the **= sign** (called the **assignment operator**)

  - For example, **to store the value 15** in a variable named **"spam",**



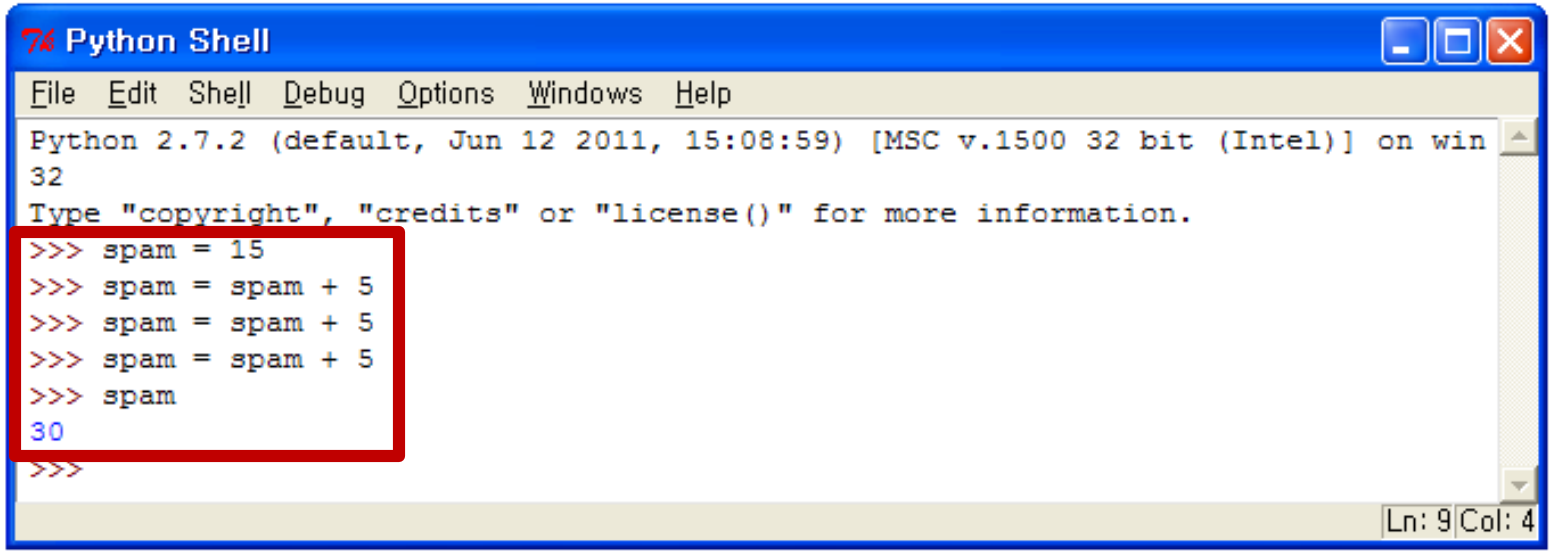
Storing Values in Variables

```
>>> spam = 15
>>> spam + 5
20
```

```
>>> spam = 15
>>> spam + 5
20
>>> spam = 3
>>> spam + 5
8
```

Storing Values in Variables

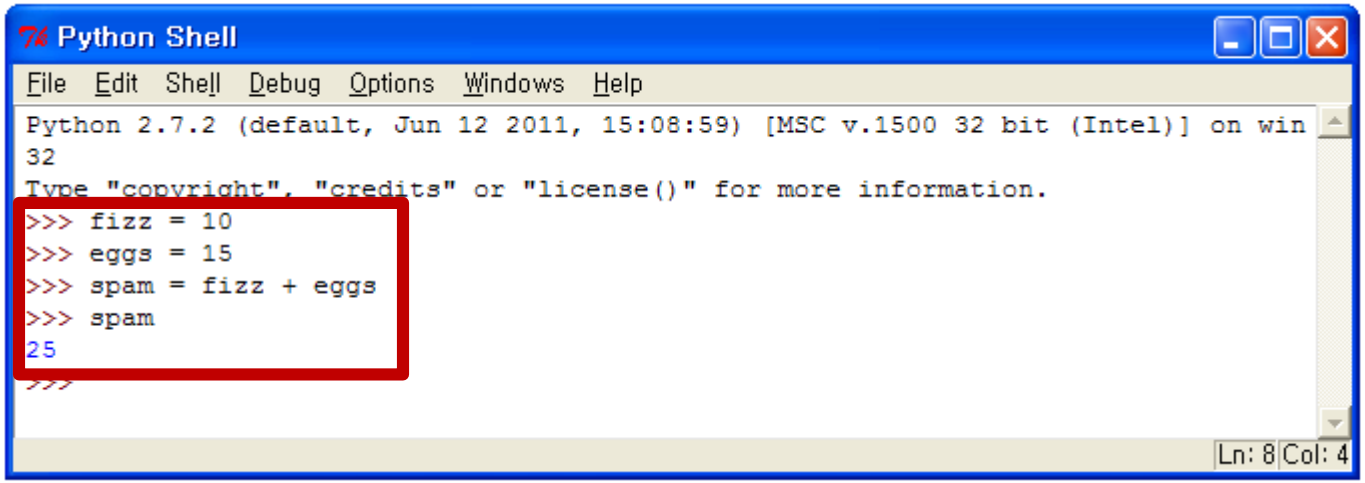
- Write Expressions with Variables

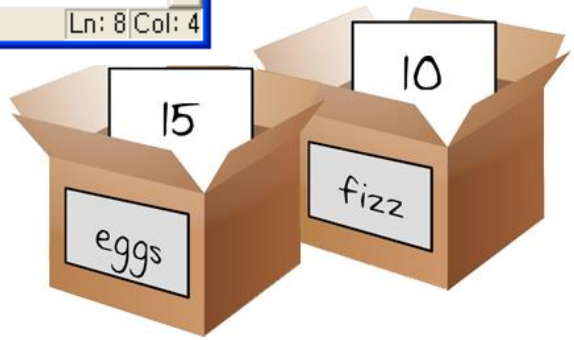


  – The value **15** was **overwritten.**

Storing Values in Variables

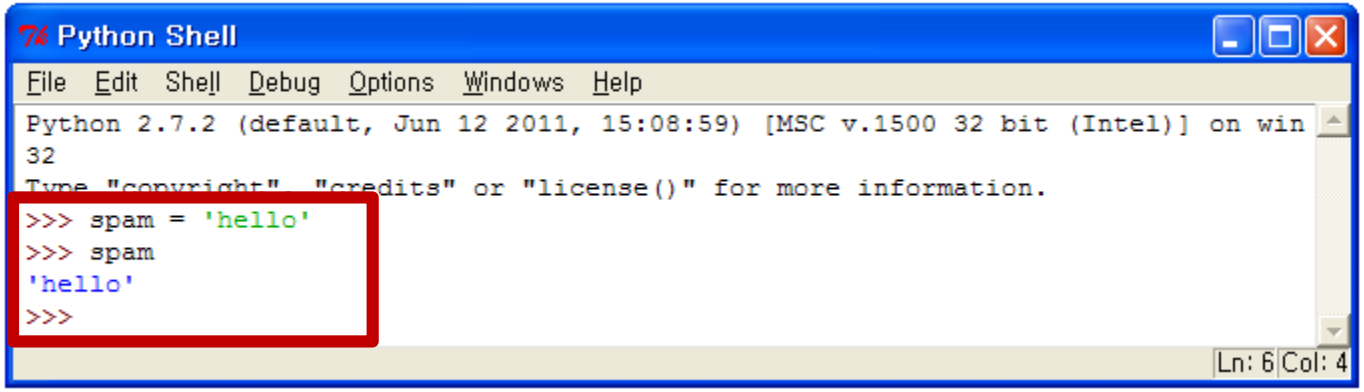
- Using More Than One Variable
  - Often we'll need to use **multiple variables.**
    - The "**fizz**" and "**eggs**" variables have values stored in them.





Strings

- Strings
  - **Little chunks of text.**
  - Can store string values inside variables.
  - Put them in between **two single quotes (').**



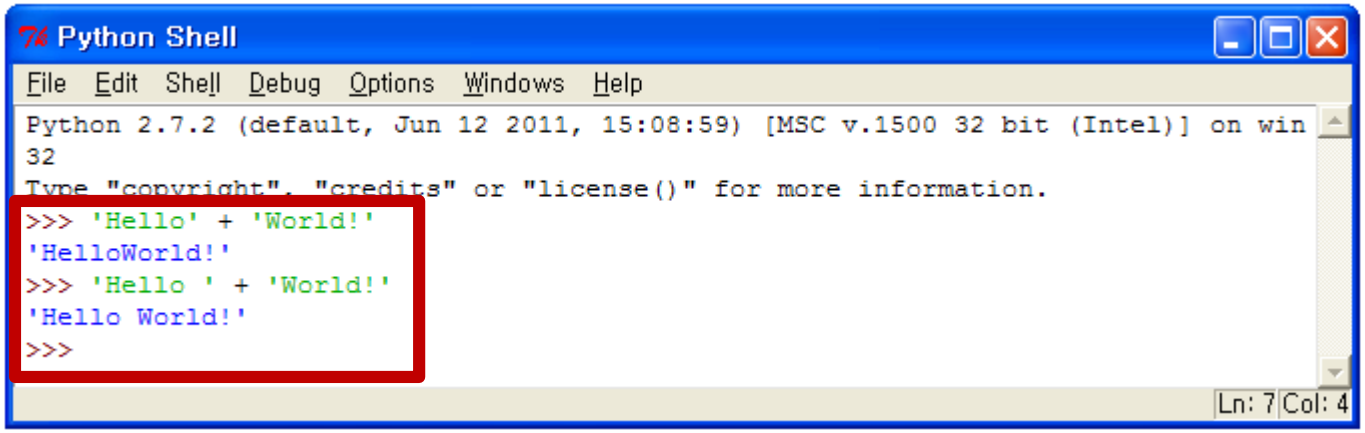
Strings

- Strings
  - Strings can have **spaces** and **numbers** as well.
  - Examples of strings

```
'hello'
'Hi there!'
'KITTENS'
'7 apples, 14 oranges, 3 lemons'
'Anything not pertaining to elephants is irrelephant.'
'A long time ago in a galaxy far, far away...'
'O*&#wY%*&OCfsdYO*&gfC%YO*&%3yc8r2'
```

Strings

- Strings Concatenation
  - Can **add one string** to the end of another by **using the + operator.**
  - Ex) Focus on **a space** at the end of the 'Hello' string.



Statement & Expression

- Expression
  - A statement that evaluates to a **value**.
  - e.g.

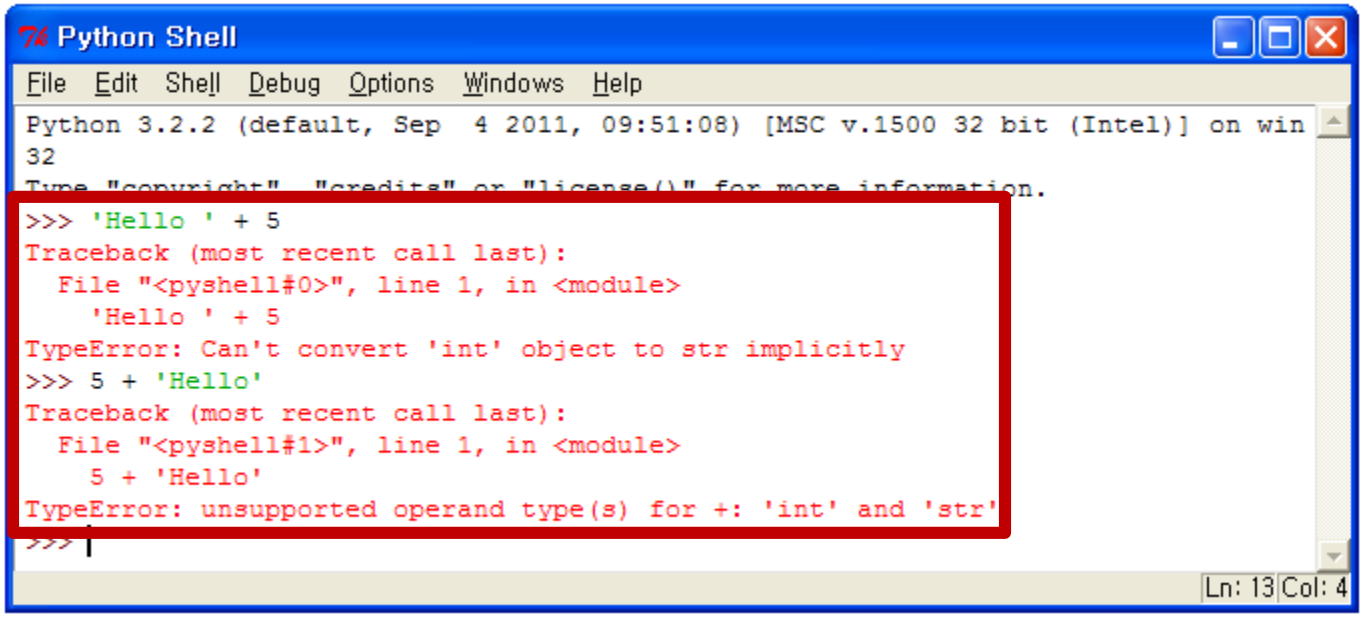
```
3 + 7
min(2, 22)
'foo'
'foo'+'bar'
```

- Statement
  - A unit that expresses some action to be carried out.
  - e.g.

```
3 + 7
if x:
return
a = 7
```

Strings

- Data Types
  - Can't add a **string to an integer**, or an **integer number to a string.**
  - Because a **string** and an **integer** are **different data types.**



Python 3 Data Types

- **Numeric**
  - *int / float / complex*
  - Types that describe numeric content
- **Boolean**
  - *bool*
  - Types that define true/false relationships
  - *Logical operators: and / or / not*
- **Text**
  - *str*
  - Immutable string objects
  - 1,2, or 3 quotes
- **Sequence**
  - **Lists**
    - Typically homogeneous sequences of objects
    - An mutable, ordered array
    - Square Brackets
  - **Tuple**
    - Typically heterogeneous sequences of objects
    - An immutable collection
    - Parenthesis
- **Mapping**
  - **Dictionaries**
    - A mutable, unordered, associative array
    - Curly Brackets

int, float, str

- `int`
  - Integer numbers
  - e.g. 1, 5, 20, ...

- `float`
  - Floating point numbers
  - e.g. 1.0, 3.14., 1.111111111..., ...

- `str`
  - Strings
  - e.g. 'hello world', 'asdf', ' ', '24', ...

Type Casting

- `int(x)`
  - Converts a number or string `x` to an integer number
  - Q: Any string?

- `float(x)`
  - Converts a number or string `x` to a floating point number

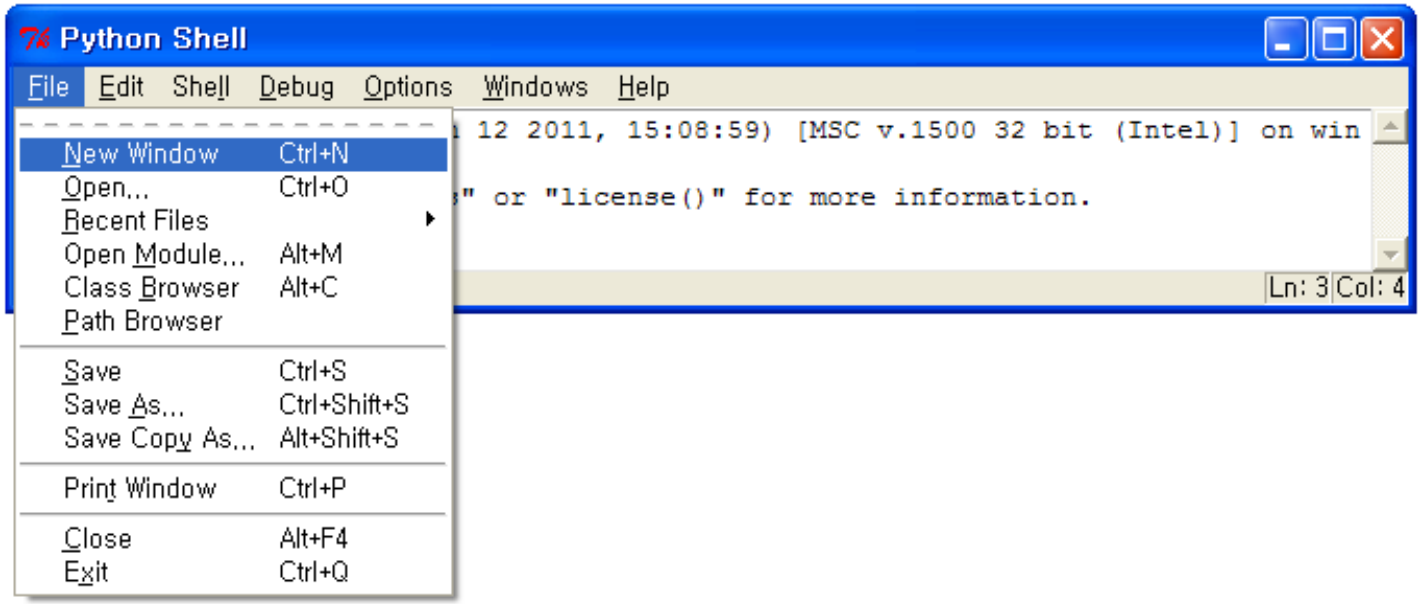
- `str(x)`
  - Converts any object `x` to a string

Type Castings

```
>>> 2 + 1.1
3.1
>>> 2 + '1.1'
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: unsupported operand type(s) for +: 'int' and 'str'
>>> 2 + float('1.1')
3.1
>>> 2 + int('1.1')
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ValueError: invalid literal for int() with base 10: '1.1'
>>> 2 + int('1')
3
>>> str(2) + '1.1'
'21.1'
>>> str(2) + 'hello'
'2hello'
>>> fstr = '1.1'
>>> 2 + float(fstr)
3.1
>>>
```

IDLE - Non-Interactive Mode

- Program “Hello World!”



- You will see “New File” instead of “New Window” from Python 3.6.4.
- Of course, you can use any other editors instead of IDLE.

Write the First Program "Hello World!"

- Program "Hello World!"
  - We call this text the **source code** of the program.

```
# This program says hello and asks for my name.
print 'Hello world!'
print 'What is your name?'
myName = raw_input()
print 'It is good to meet you, ' + myName
```

  - ***raw_input()*** is for Python 2, whereas ***input()*** is used for Python 3.
  - With Python 2, we have ***print x*** (no parentheses), which becomes ***print(x)*** in Python 3.

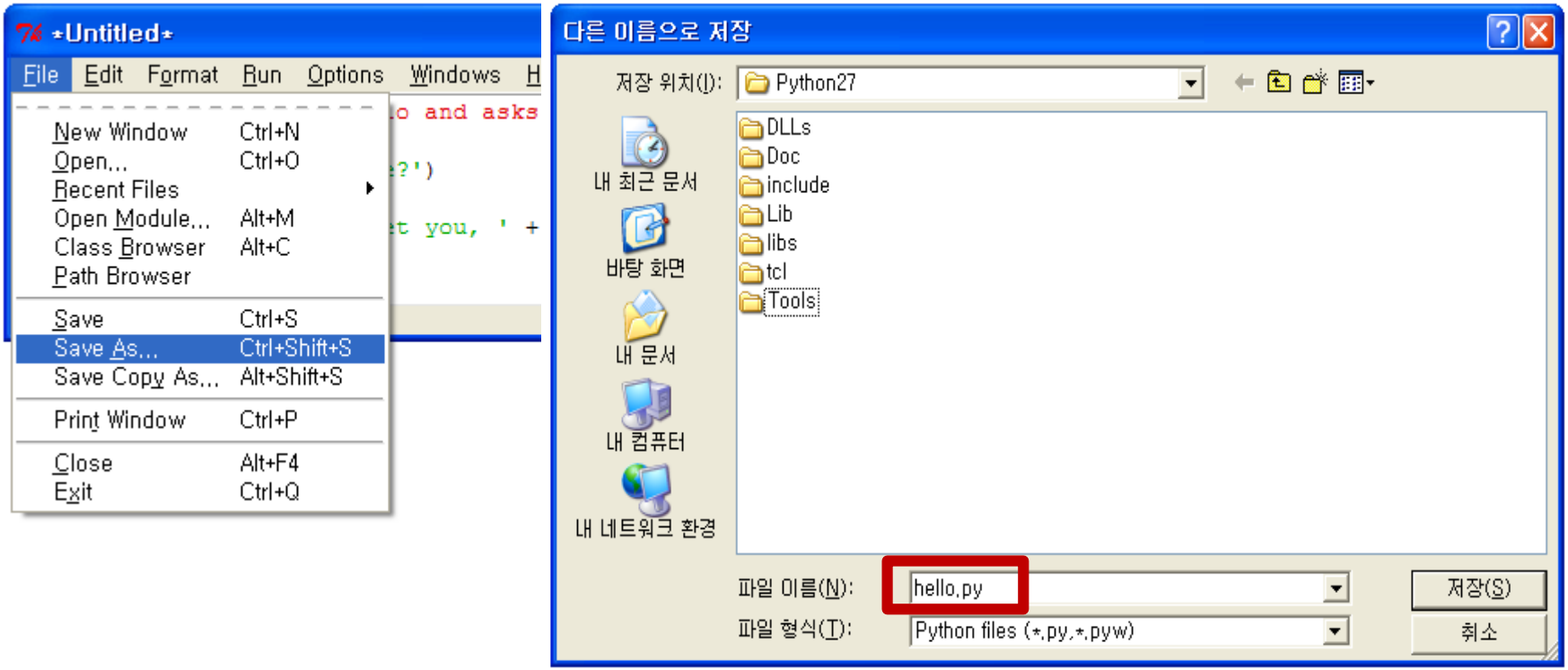
Write the First Program “Hello World!”

- Program “Hello World!”
  - Type the following text into this new window.

```
# This program says hello and asks for my name.
print('Hello world!')
print('What is your name?')
myName = input()
print('It is good to meet you, ' + myName)
```

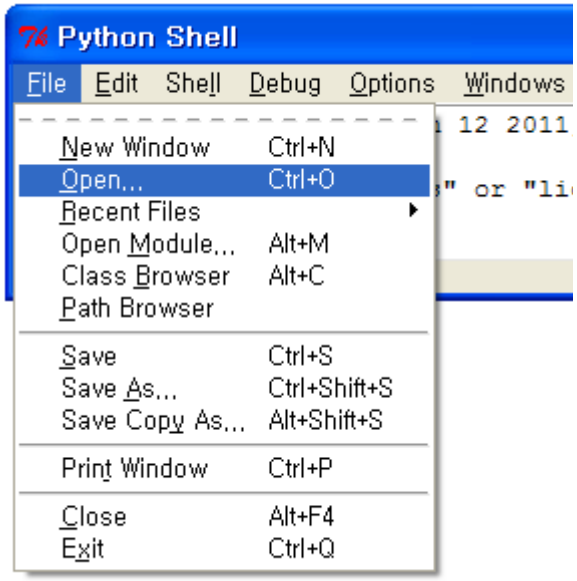
Write the First Program “Hello World!”

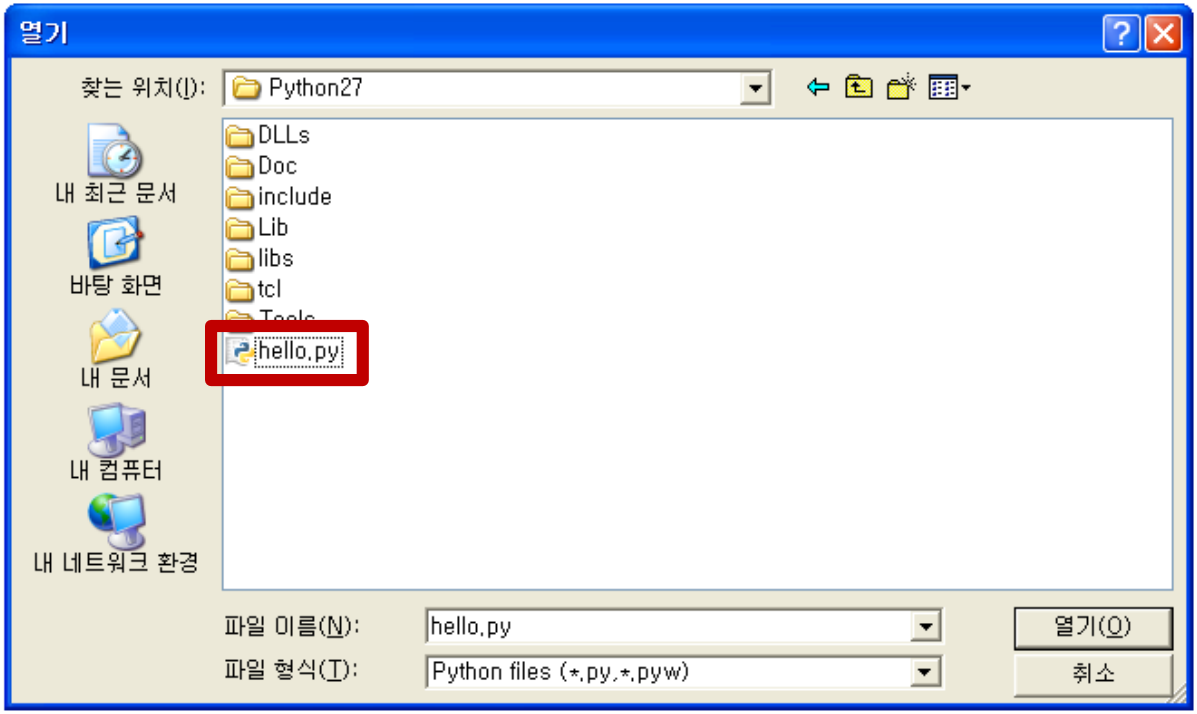
- Program “Hello World!”
  - Save the program.



Write the First Program “Hello World!”

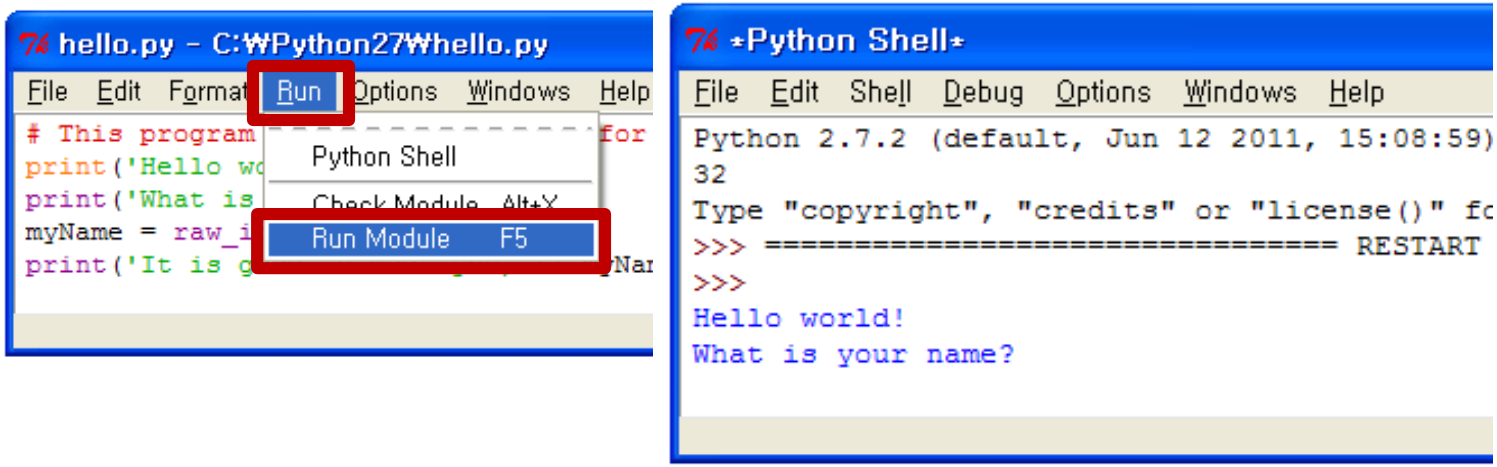
- Program “Hello World!”
  - Open the program you've saved





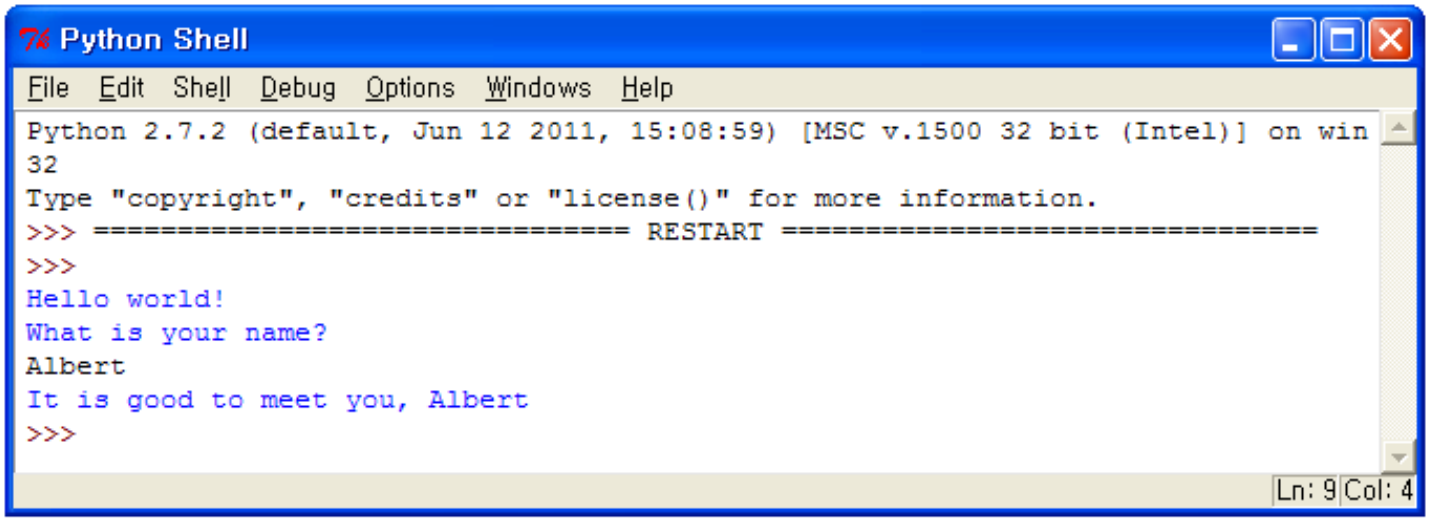
Run the First Program “Hello World!”

- Programs “Hello World!”
  - Run “Hello World!” program.
  - choose **Run** > **Run Module** or just press the **F5 key.**



The First Program “Hello World!”

- Program “Hello World!”



Users	**run** and **use the program**
Programmers	**write** the program
Flow of execution or **execution**	program starts at the very top and then **executes** each line
	Executes each statement **step-by-step**

The First Program “Hello World!”

- Code Explanation
  - **Comment**
    - Any text following a **# sign** (called the **pound sign**) is a comment.
    - Not for the computer, but for the programmer.

```
1. # This program says hello and asks for my name.
```

  - **Print function**
    - The **print** keyword followed by an expression enclosed in parentheses.
    - Will **display** the text on the screen.

```
2. print('Hello world!`)
3. print('What is your name?`)
```

The First Program “Hello World!”

- Code Explanation
  - **Function**
    - a bit of code that does a particular action.
    - a function can take any expression as an argument.
  - **Function call**
    - a piece of code that tells our program to run the code inside a function.
  - **Return value**
    - The **value that the function call** evaluates to is called the return value.
    - Function output!
  - **Ending the Program**
    - Once the program executes the **last line, it stops.**
      At this point, your monitor displays **terminated** or **exited.**

The First Program “Hello World!”

- Code Explanation

*hello.py - C:₩Users₩Lee₩AppData₩Local₩Programs₩Python₩Python36-3...

File Edit Format Run Options Window Help

```
# This program says hello and asks for my name.
print('Hello ₩orld!')
print('₩hat is your name?')
myName = input()
print("it is good to meet you, " + myName)
```

Ln: 1 Col: 47

– **Variable**
  - myName

– **Function**
  - print(), input()

“My Favorite Stuff”

- Program “My Favorite Stuff”

Python 3.6.4 Shell

File Edit Shell Debug Options Window Help

```
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)]
 on win32
Type "copyright", "credits" or "license()" for more information.
>>>
 RESTART: C:\Users\Lee\AppData\Local\Programs\Python\Python36-32\favorite.py
Tell me what your favorite color is
blue
Tell me what your favorite animal is
cats
Tell me what your favorite food is
pasta
You entered: pasta cats blue
Color: blue
Animal: cats
Food: pasta
>>>
```

Ln: 15 Col: 4

“My Favorite Stuff”

- Program “My Favorite Stuff”

```
# Favorite stuff
print('Tell me what your favorite color is')
favoriteColor = input()

print('Tell me what your favorite animal is')
favoriteAnimal = input()

print('Tell me what your favorite food is')
favoriteFood = input()

# display our favorite studff
print('You entered: ' + favoriteFood + ' ' + favoriteAnimal + ' ' + favoriteColor)

# print 'Here is a list of your favorite things."
print('Color: ' + favoriteColor)
print('Animal: ' + favoriteAnimal)
print('Food: ' + favoriteFood)
```

“My Favorite Stuff”

- Code Explanation
  - **Comment**
    - The program **ignores it.**
    - All the text after the **pound sign(#)** will be ignored by the program.

```
1. # Favorite stuff
```

  - Display a bit of text asking the user to type in their **favorite color.**

```
2. print('Tell me what your favorite color is.‘)
```

“My Favorite Stuff”

- Code Explanation
  - **`input()` function**
    - Let the user type in their favorite color.
    - string the user entered is stored in the variable **`favoriteColor`**.
    - reads any input as a **string**

```
3. favoriteColor = input()
```

“My Favorite Stuff”

- Code Explanation
  - **`input()` function**
    - It used to be **`raw_input()`** for Python 2.
    - There is a **blank line** before the print statement, which is ignored in Python.

```
5. print('Tell me what your favorite animal is.‘)
6. favoriteAnimal = input()
```

```
8. print('Tell me what your favorite food is.‘)
9. favoriteFood = input()
```

“My Favorite Stuff”

- Code Explanation
  - **Another comment**
    - It does not have to be at the top all the time (can be **anywhere**).

```
11. # display our favorite stuff
```

  - **`print()` function**
    - Show us the favorite food, animal, and color we entered.
    - The **plus sign** is used to combine the strings.

```
12. print('You entered: ' + favoriteFood + ' '
    + favoriteAnimal + ' ' + favoriteColor)
```

“My Favorite Stuff”

- Code Explanation
  - Another comment line

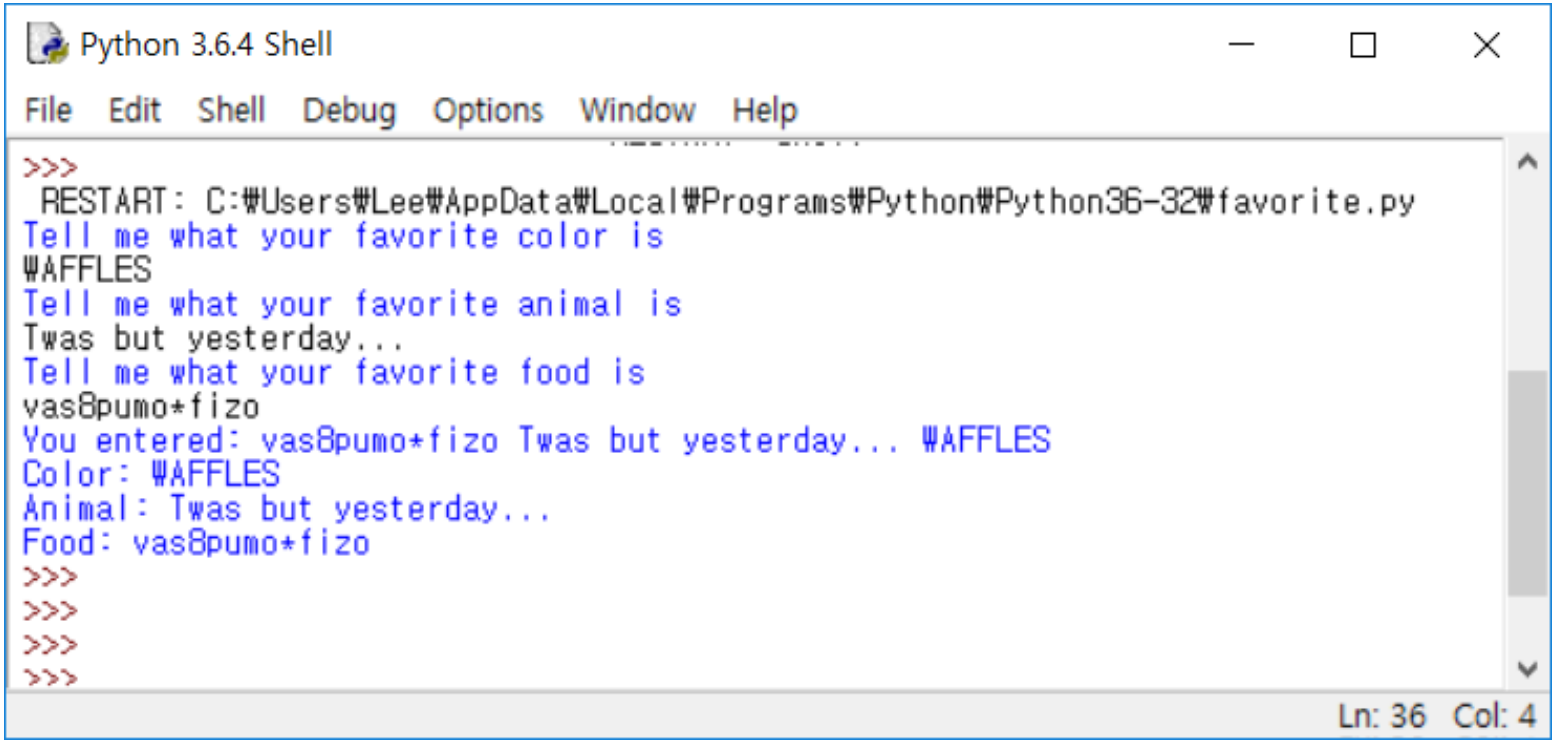
```
13. # print the list of favorite things
```

  - **`print` function**
    - These three lines say your favorite things

```
14. print('Color: ' + favoriteColor)
15. print('Animal: ' + favoriteAnimal)
16. print('Food: ' + favoriteFood)
```

“My Favorite Stuff”

- Crazy Answers and Crazy Names for our Favorite Stuff
  - The computer doesn’t really care what you type in.



“My Favorite Stuff”

- Crazy Answers and Crazy Names for our Favorite Stuff
  - The program also **does not care** what name we give our variables.

```
# Favorite stuff 2
print('Tell me what your favorite color is.‘)
q = input()

print('Tell me what your favorite animal is.')
fizzy = input()

print('Tell me what your favorite food is.')
AbrahamLincoln = input()

# display our favorite stuff
print('You entered: ' + q + ' ' + fizzy + ' ' + AbrahamLincoln)
# print 'Here is a list of your favorite things.'
print('Color: ' + q)
print('Animal: ' + fizzy)
print('Food: ' + AbrahamLincoln)
```

“My Favorite Stuff”

- Capitalizing our Variables
  - This is to make the variable names **easier to read.**
    - Because variable names can’t have spaces within them.

```
thisnameiskindofhardtoread
thisNameIsEasierToRead
```

  - Leave the first word in **lowercase.**
    - But start all the following words with a **uppercase letter.**
  - This is what is called a **camelCase naming convention.**

“My Favorite Stuff”

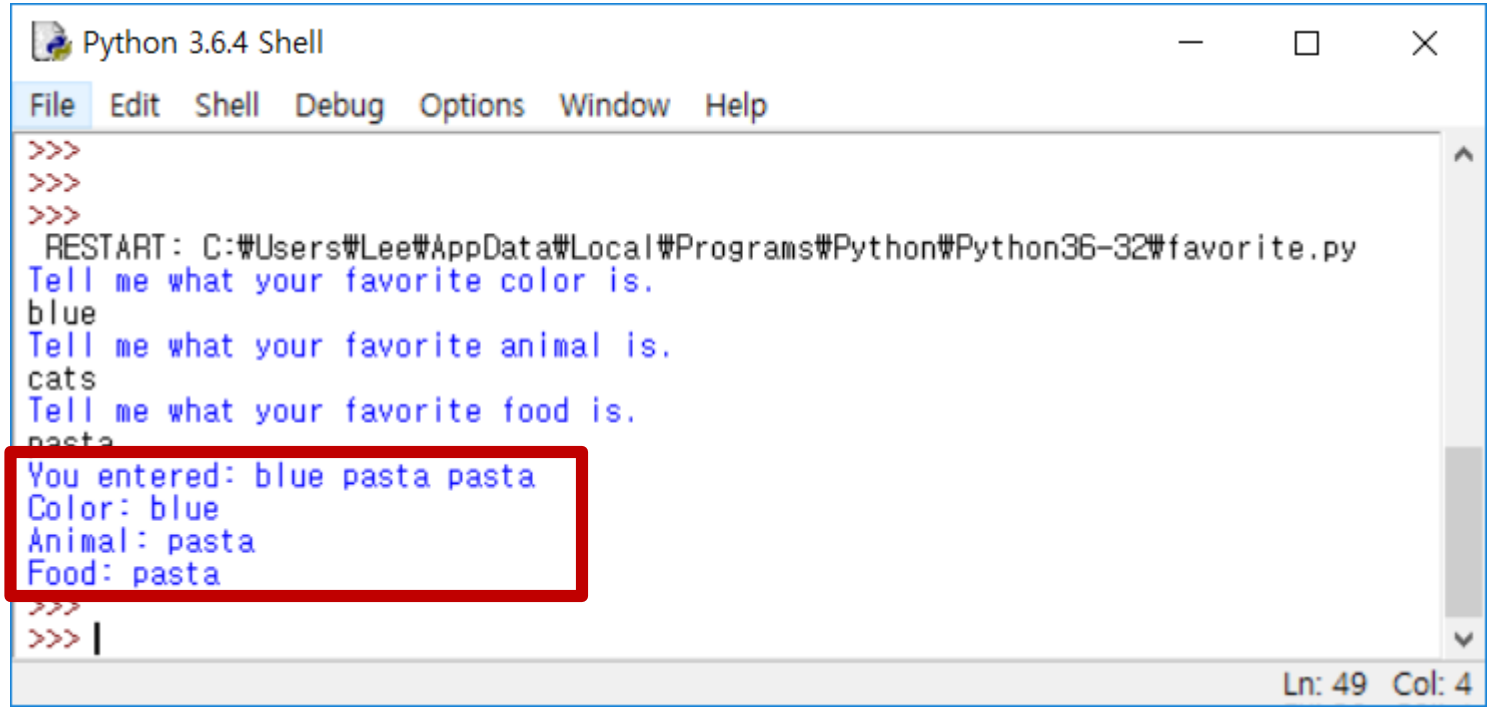
- What happened here?

```
1. # Favorite stuff 3
2. print('Tell me what your favorite color is.‘)
3. q = input()
4.
5. print('Tell me what your favorite animal is.')
6. AbrahamLincoln = input()
7.
8. print('Tell me what your favorite food is.')
9. AbrahamLincoln = input()
10.
11. # display our favorite stuff
12. print('You entered: ' + q + ' ' + AbrahamLincoln + ' ' + AbrahamLincoln)
13. # print 'Here is a list of your favorite things.'
14. print('Color: ' + q)
15. print('Animal: ' + AbrahamLincoln)
16. print('Food: ' + AbrahamLincoln)
```

“My Favorite Stuff”

– The favorite animal value was **overwritten.**

- A variable can only store **one value at a time.**



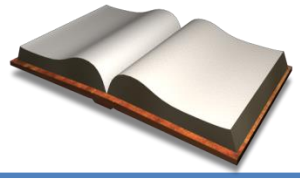
“My Favorite Stuff”

- Case-sensitivity
  - The computer considers these names to be **four different variables.**

```
fizzy
Fizzy
FIZZY
fIzZy
```

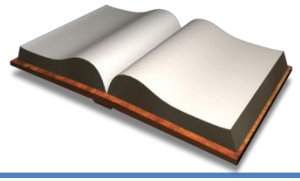
  - The computer doesn’t know of a function named **`INPUT()`.**
  - It only knows a function named **`input()`.**

Things Covered In This Chapter(1/2)



- Introduction to Python
- Using IDLE's interactive shell to run instructions
- Flow of execution
- Expressions and their evaluations
- Statements
- Integer
- Operators (such as + - *)
- Variables
- Assignment statements
- Overwriting values in variables

Things Covered In This Chapter(2/2)



- Strings and string concatenation
- Data types (such as strings or integers)
- Type casting
- Using IDLE to write source code
- Saving and running programs in IDLE
- The `print()` function
- The `input()` function
- Comments
- Naming Convention
- Case-sensitivity