Python – Input, output and variables

Lecture 23 – COMPSCI111/111G SS 2018

Today's lecture

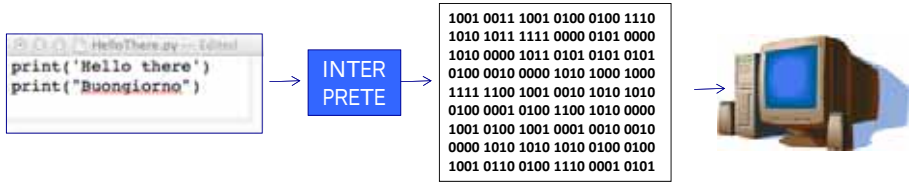
- What is Python?
- Displaying text on screen using `print()`
- Variables
- Numbers and basic arithmetic
- Getting input from keyboard using `input()`

What is a programming language?

- A formal language that specifies how to perform a computational task
- Many programming languages exist:
  - Visual Basic
  - C and C++
  - C#
  - Java
  - Python
- Python was created in 1989 by Guido Van Rossum in The Netherlands

Statements

- A program consists of a series of commands called **statements**
- They are generally executed (ie. run) in the order they appear
- The statements must be written correctly otherwise you will get a syntax error
- Python programs are saved in files with the '.py' extension



Translating code

- The statements in our programs are translated into simpler instructions that the CPU can execute
- Two ways of doing this:
  - Compiler: translates the entire program file at once
  - Interpreter: repeatedly translates one line and runs it
- Python is an interpretative programming language
  - There are also compilers available for Python

IDLE Integrated Development Environment (IDE)

- An IDE is used by programmers to:
  - Write code
  - Check for errors
  - Translate code and run the program
- We use the IDLE IDE; a popular IDE for Python
- IDLE has a shell for the Python interpreter
- You can also create a new file that can be compiled when you've finished writing a program

IDLE IDE

- The interpreter allows you to type statements, translate them and see them run instantly
- Very helpful for experimentation and learning

Interactive Interpreter Vs Running a script

- Interactive Interpreter
  - Allows you to type statements directly at the prompt
  - Statement is executed when you hit <Enter>
  - Very useful for experimentation
  - Good for learning
- Running a Script
  - Type a sequence of statements into a file
  - Save the file with the file extension .py
  - Running the program executes each statement in turn

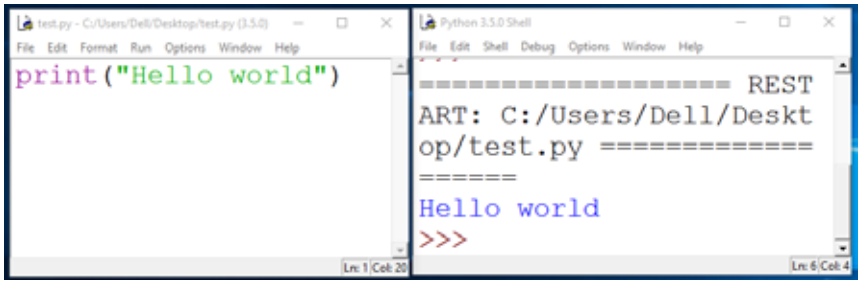
IDLE IDE

- Create a new program by clicking on File → New File
- Type your statements in the file, then click on Run → Run Module…

"Hello world"

DEMO

- Traditional first program is displaying "Hello World" on screen
- To display text on screen you use the `print()` function



"Hello world"

DEMO

- Using the Python interpreter:

Printing output

- Use the print statement

Code	Output
`print("This is text")`	`This is text`
`print(34.9)`	`34.9`

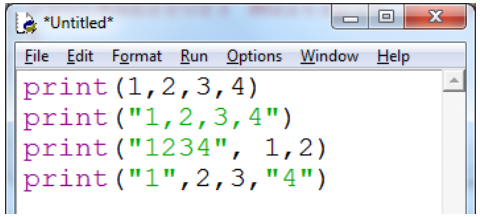
- Printing more than one thing on a single line
  - Separate each thing with a comma
  - Single space used between different things in the output

Code	Output
`print("Hello", "World")`	`Hello World`
`print("The year is", 2017)`	`The year is 2017`

Exercise 1

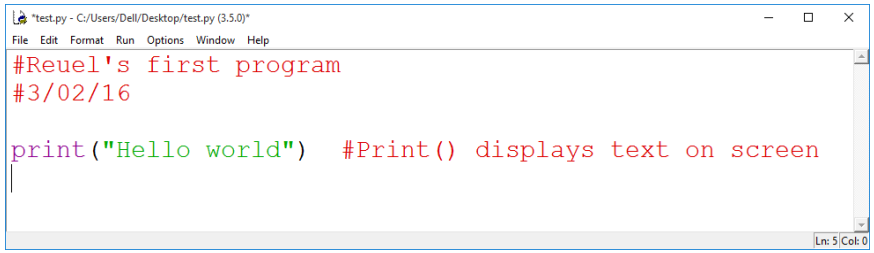
TRY IT OUT!

- What is the output produced by the following statements?



Comments

- When writing a program, it is helpful to leave comments in the code
- You can write a comment in Python by typing a '#' in front of the line
- The compiler will ignore all text after the '#'

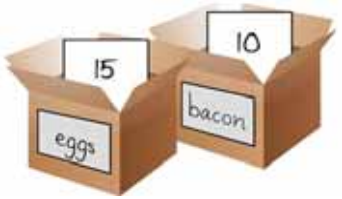


Data types

- Strings:
  - Sequence of characters
  - Plain text (ASCII or Unicode)
  - Enclosed in quote marks
  - Eg: "Hello", "Goodbye"
- Integers:
  - Whole numbers (ie. without a decimal point)
  - Eg. -100, 0, 45
- Floating point numbers:
  - Numbers with a decimal point
  - Eg. 5.2, -1.002, 0.0

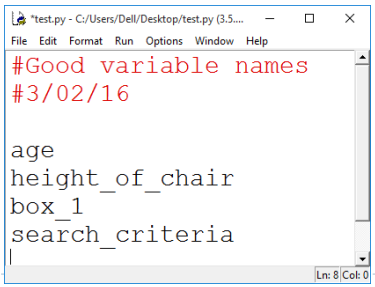
Variables

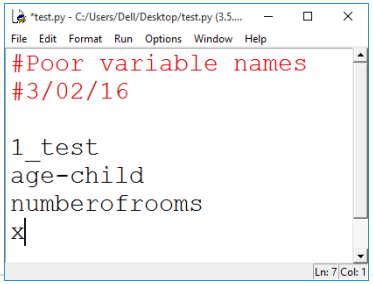
- A 'container' in the computer's memory in which you can store data
- A variable's value can change when the program runs
- Python variables are loosely-typed; they can hold any data type



Variables

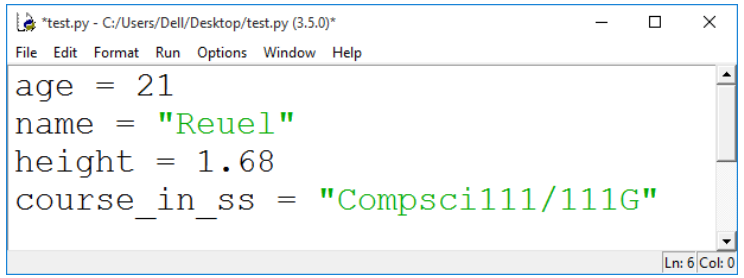
- Rules to follow when naming your variables:
  - Names should reflect what is stored in the variable
  - Can begin with a letter or underscore (eg.'_')
  - Variable names can include numbers
  - Generally, all words are lowercase and words are separated using an underscore





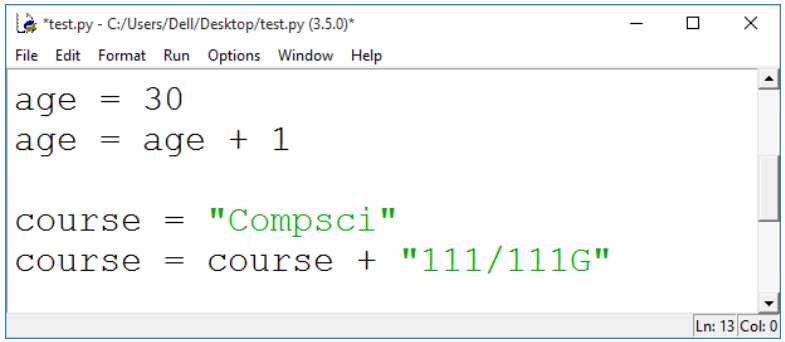
Assignment statement

- Assigning a value to a variable:



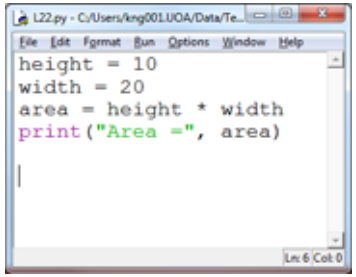
Assignment statement

- Changing the value in a variable:



Exercise 2

- What is the output produced by the following statements?



Arithmetic operations

Operation	Symbol	Example
Exponent	**	2 ** 3 = 8
Multiply	*	2 * 2 = 4
Divide	/	10 / 3 = 3.333
Divide (integer)	//	10 // 3 = 3
Remainder	%	10 % 3 = 1
Add	+	8 + 9 = 17
Subtract	-	9 - 7 = 2

Print() function

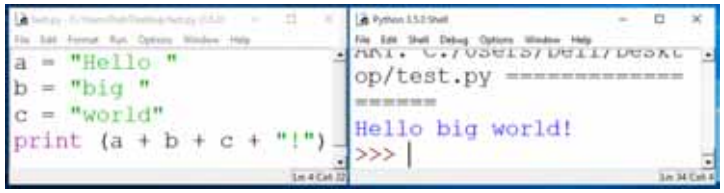
- Used to display information on the screen

Code	Output
`print("This is text")`	This is text
`print(10 / 3)` `print(2 ** 5)`	3.3333333333333335 32
`age = 21` `print("You are", age, "years old")`	You are 21 years old
`age = age * 2` `print("You are actually", age, "!")`	You are actually 42 !

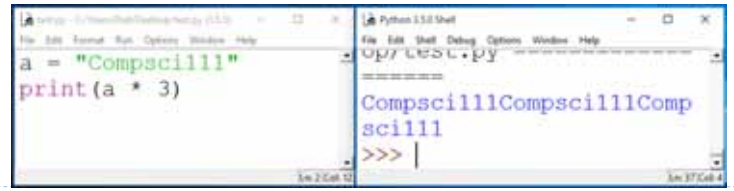
Print() function

DEMO

- Concatenation: this involves joining two or more strings together



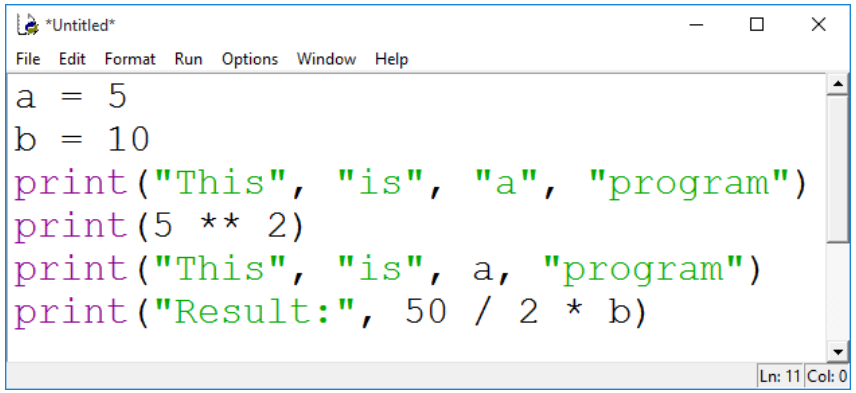
- Repetition: lets you print a string multiple times



Exercise 3

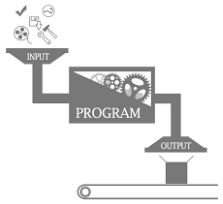
Kahoot!

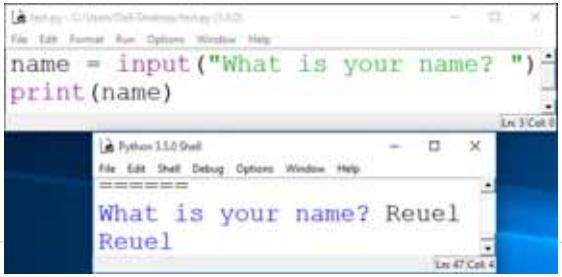
- What is the output for the following code?



Getting input

- Primary source of input for our programs will be the keyboard
- The `input()` function:
  - Prints a prompt for the user to read
  - Captures the user's keystrokes
  - When the user presses 'Enter', stores the string in a variable





Getting input

DEMO

- Converting the string value returned by input() to an integer or floating point value
  - You need to do this when you want the actual numerical value the user is entering
- `age = int(input("Enter your age: "))`
- `height = float(input("Enter your height: "))`
- `height = height + 1.5`

Exercise 4

DEMO

- Write a Python program that converts feet to meter. The conversion formula is:

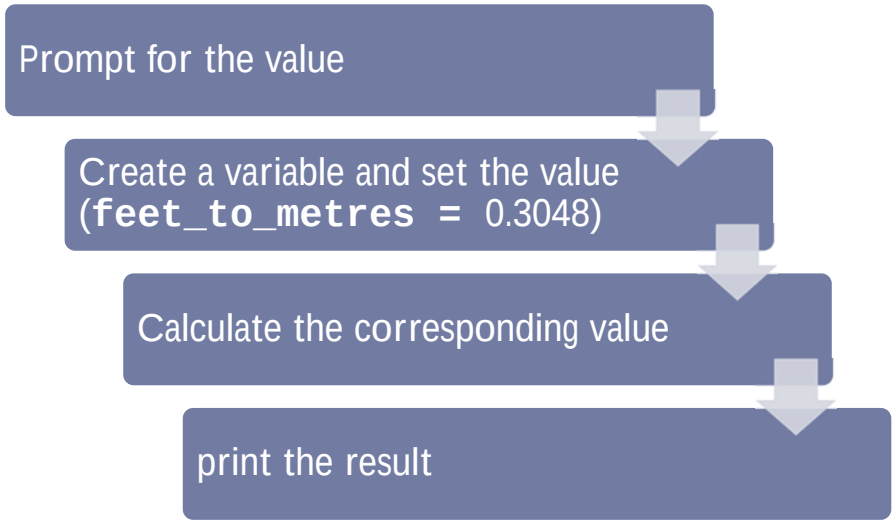
  1 foot = 0.3048 meters

- Your program's output should look like this:

```
Enter feet: 34
34 feet is equal to 10.3632 meters
```

- You will need to use:
  - Variables
  - Arithmetic operator
  - `input()` and `print()`
- Link: https://coderunner2.auckland.ac.nz/moodle/mod/quiz/view.php?id=629

Algorithm



Summary

- Python programs consist of statements that are translated by an interpreter or compiler into instructions that the CPU can execute
- We've discussed the Python programming language and its features:
  - `print()`
  - Data types: `string`, `int`, `float`
  - Arithmetic operators
  - Variables and variable naming conventions
  - `input()` and `int()`, `float()`
- Post-Lecture-Quiz: PLQ_23
  - https://coderunner2.auckland.ac.nz/moodle/mod/quiz/view.php?id=630