# COMP10001 Foundations of Computing Python Basics

Semester 2, 2021 Chris Leckie, Marion Zalk and Farah Khan



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#### Reminders

- All workshops start this week
- Complete Worksheets 0, 1 and 2 by the end of Friday (11:59pm) this week
- Email the lecturers urgently if you are having issues accessing the Grok materials:

comp10001s2-lecturers@lists.unimelb.edu.au

#### Lecture Agenda

- Last lecture Grok Worksheet 0
  - Programming basics with Blockly
- This lecture Grok Worksheets 1–2
  - Literals
  - Types

#### Lecture Outline

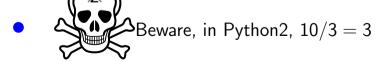
1 Python Basics

2 Types

## Python Basics

To start out, let's use Python as a glorified calculator:

- basic arithmetic: + (addition) (subtraction)/ (division) \* (multiplication)
- also: \*\* (exponent), % (modulo),
  // (integer/"floor" division)



## Python Basics

- Python uses "BODMAS" to associate "operands" (the targets of operations) by default, which you can override with "parentheses":
  - 1 + 2 \* 3 vs. (1 + 2) \* 3
- special character \_ stores the value of the last calculation

#### Class Exercise

- Armed just with these operators, let's explore the limitations of what we can do; is it possible to:
  - calculate n! (=  $n \times (n-1) \times ...2 \times 1$ ) for an arbitrary n?
  - calculate the ith Fibonacci number?
  - numerically "break" Python?

## Turtle Programming Redux

- Let's return to Turtle graphics briefly to introduce Python "commands":
  - forward(N): advance forward N units
  - left(N): turn left N degrees
  - circle(X): draw a circle of radius X
- Need to have the following line of code before issuing any of these commands:

```
from turtle import *
```

#### Class Exercise

What does the following code do:

```
from turtle import *
left(30)
forward (50)
right (120)
forward (50)
right (120)
forward (100)
left(120)
forward (50)
left(120)
forward (50)
```

#### The print Function

 The print() function can be used to print the value of the operand (of any type)

```
>>> print(1)
1
```

 In the terminal, there is no noticeable difference between printing and executing a variable:

```
>>> print(1)
1
>>> 1
1
```

but when you "run" code from a file, you will only see the output of print() functions

## The print Statement



• In Python 2, you can use either the <u>print</u> statement (<u>print</u> ...) or the <u>print</u> function (<u>print(...)</u>), but Python 3 only allows the <u>print</u> function

```
>>> print(1)
1
>>> print 1  # Python 2
1
```

so if you use Python2 code from the web, remember to convert print statements to print functions

#### Jargon Alert

 Syntax: "the arrangement of words and phrases to create well-formed sentences in a language"

```
print hello''() incorrect syntax
print('hello') correct syntax
```

Semantics: "the meaning of a word, phrase, or text"

```
print(1 + 2) "+" = add two numbers
```

#### Lecture Outline

1 Python Basics

2 Types

# Types (1)

- In Python, every object has a "type", which defines: (a) what operators, "functions", and "methods" can be applied to it, and (b) its semantics
- The two number types we will see most of are:
  - int (integer)
  - float (real number)
  - also complex for complex numbers
- So how does Python work out the type for a given (real) number? If it contains a decimal place (.), it's a float, otherwise it's an int

# Types (2)

• Use the function type to determine the type of an object:

```
>>> print(type(1))
<type 'int'>
>>> print(type(1.0))
<type 'float'>
```

 The semantics of operators and functions is determined by the types of the operands:

```
>>> print(type(1 + 2))
<type 'int'>
>>> print(type(1.0 + 2))
<type 'float'>
```

#### Type Conversion

- Python implicitly determines the type of each literal and variable, based on its syntax (literals) or the type of the assigned value (variables)
- To "convert" a literal/variable to a different type, we use functions of the same name as the type: int(), float(), complex()

```
>>> print(float(1))
1.0
>>> print(int(1.5))
1
>>> int('a')
Traceback (most recent call last):
   File "<stdin>", line 1, in <module>
ValueError: invalid literal for int() with base 10: 'a'
```

## Lecture Summary

- Types: what are they, what basic types have we learned, and how do you determine the type of an object?
- What are the basic numeric types, what operators are associated with them, and what interactions are there between the types and operators?
- Type conversion: how do we test the type of an object, and how do you convert the type of an object?