A Short and Incomplete Introduction to Python

Part 1: Basic Python syntax

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Python basics

Lines of Python code

Line of Python code are ended by the "new line" character. (I.e., when you press the *Enter* key.)

A line can be continued onto the next by ending it with the character '\'; for example:

```
In [1]: "hello" + \
   ...: " world!"
Out[1]: 'hello world!'
```

The prompt changes to '. . .' on continuation lines.

Reference:

http://docs.python.org/reference/lexical_analysis.html#line-structure

String literals, I

There are several ways to express string literals in Python.

Single and double quotes can be used interchangeably:

```
In [2]: "a string" == 'a string'
Out[2]: True
```

You can use the single quotes inside double-quoted strings, and viceversa:

```
In [3]: a = "Isn't it ok?"
In [4]: b = '"Yes", he said.'
```

String literals, II

Multi-line strings are delimited by three quote characters.

```
In [5]: a = """This is a string,
   ...: that extends over more
   ...: than one line.
   ...: """
```

In other words, you need not use the backslashes "\" at the end of the lines.

Operators

All the usual unary and binary arithmetic operators are defined in Python: `+`, `-`, `*`, `/`, `**` (exponentiation), `<<`, `>>`, etc.

Logical operators are expressed using plain English words: `and`, `or`, `not`.

Numerical and string comparison also follows the usual notation: `<`, `>`, `<=`, `==`, `!=`, ...

Reference:

- http://docs.python.org/library/stdtypes.html#boolean-operations-and-or-not
- http://docs.python.org/library/stdtypes.html#comparisons

Your first exercise

How much is 2^{144} ?

(You have 1 minute time.)

Operators, II

Some operators are defined for non-numeric types:

```
>>> "Py" + 'thon'
'Python'
```

Some support operands of mixed type:

```
>>> "a" * 2
'aa'
>>> 2 * "a"
'aa'
```

Some do not:

```
>>> "aaa" / 3
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: unsupported operand type(s) for /: 'str' and 'int'
```

Operators, III

The "`%`" operator computes the remainder of integer division.

```
In [6]: 9 % 2
Out[6]: 1
```

It also doubles up as *string interpolation operator*, but the '**`format`**`()`' method (see next slide) is more convenient.

String interpolation

The `.format()` method can be used to substitute values into placeholder strings.

Placeholders can indicate substitutions by ordinal number:

```
>>> "This is slide {0} of {1}".format(20, 1001)
'This is slide 20 of 1001.'
```

You can use names instead of numbers (then the order parameter occur in `format()` does not matter):

```
>>> "Today is {month} {day}".format(day=2, month='March')
'Today is March 2'
```

Reference: https://pyformat.info/

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Assignment, I

Assignment is done via the '=' statement:

```
In [7]: a = 1
In [8]: print(a)
Out[8]: 1
```

There are a few shortcut notations:

- `a += b` is short for `a = a + b`,
- `a -= b` is short for `a = a - b`,
- `a *= b` is short for `a = a * b`,

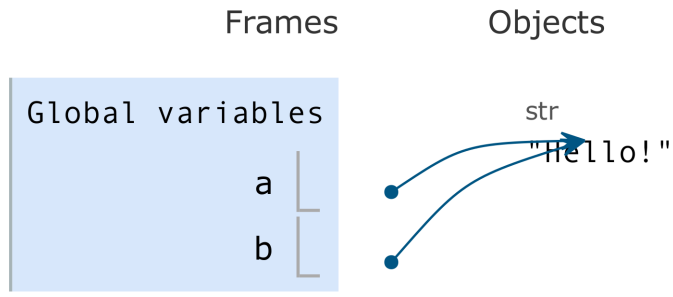
etc. — one for every legal operator.

Assignment, II

Python variables are just "names" given to values.

This allows you to *reference* the string `'Python'` by the *name* `a`. But also by another name `b`:

```
1  a = "Hello!"
2  b = a
```



The *same* object can be given many names!

See also: http://excess.org/article/2014/04/bar-foo/

The `is` operator

The `is` operator allows you to test whether two names refer to the same object:

```
>>> a = 1
>>> b = 1
>>> a is b
True
```

Basic types

Basic object types in Python 3:

bool	The class of the two boolean constants `True`, `False`.
int	Integer numbers: `1`, `-2`, ...
float	Double precision floating-point numbers, e.g.: `3.1415`, `-1e-3`.
bytes	String of byte-size characters.
str	Text (string of UNICODE characters).
list	Mutable list of Python objects
dict	Key/value mapping

The type of a Python object can be gotten via the `type()` function:

```
In [3]: type('hello')
Out[3]: str
```

Appendix

All variables are references

In Python, **all objects are ever passed by reference**.

In particular, **variables always store a reference to an object**, never a copy!

Hence, you have to be careful when modifying objects:

```
>>> a = [1,2,3]
>>> b = a
>>> b.remove(2)
>>> print(a)
???
```

Q: How many items are in the `a` list now?

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```
>>> a = [1,2,3]
>>> b = a
>>> b.remove(2)
>>> print(a)
[1, 3]
```

Run this example in the Online Python Tutor to better understand what's going on.

This applies particularly for variables that capture the arguments to a function call!

All variables are references (demo)

www.pythontutor.com

```
1  a = [1, 2, 3]
2  b = a
3  b.remove(2)
4  print a
5  print b
```

Frames Objects

All variables are references (demo)

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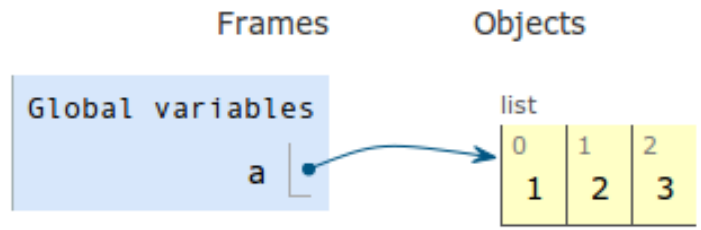

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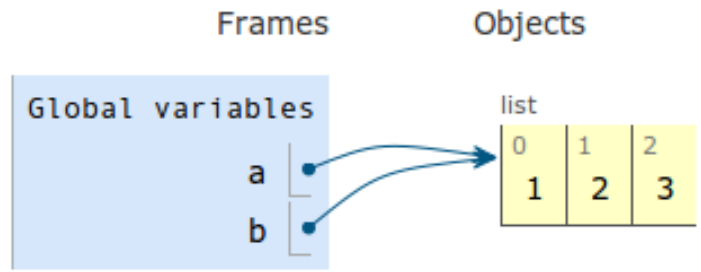

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