Teaching London Computing

Topic 1.2: Python Numbers and Strings

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Aims

- Understand values that can be used in Python
  - Numbers
  - Strings
- Write expressions using numbers and strings
- Understand why some expressions give errors

Try out the example in this topic using the Python shell

Values – Numbers

- Python can work with numbers

- Integers: `10 20 12345`
- Decimals: `7.2 -0.00134`

Values – Strings

- A string is a sequence of letter
  - `'David Cameron'`
  - `"David Cameron"`
- Either single or double quotes can be used but must be the same at either end
  - This allow quote characters in strings

Arithmetic

- Python does arithmetic using operators:

Operation	Meaning
`x + y`	sum of x and y
`x - y`	difference of x and y
`x * y`	product of x and y
`x / y`	x divided by y
`x // y`	integer division of x by y
`x % y`	remainder of x / y
`-x`	x negated
`+x`	x unchanged
`pow(x, y)`	x to the power y
`x ** y`	x to the power y

Arithmetic

- Brackets can be used:
  - `10 – 5 – 2` = 3 left to right order
  - `10 – (5 – 2)` = 7 … as in maths
- Two kinds of division
  - `10/4` = 2.5 real (floating point) division
  - `10//4` = 2 integer division
- The '%' operator mean remainder
  - `10 % 3 = 1`

String Concatenation

- Python can join strings together

`'Hello' + 'World'` *gives* `'HelloWorld'`

`'Hello' + " " + "World"` *gives* `'Hello World'`

- Notice that the same operator '+' has two different uses
  - Adding numbers
  - Joining string

Indexing and Slicing Strings

- Indexing get a character from a string
  - `"william"[0]` – gives ‘W’
  - `"william"[1]` – gives ‘i’
  - `"william"[6]` – gives ‘m’
- Notice that numbering starts from zero

- Slicing is used to get a subrange
  - `"william"[1:4]` – gives ‘ill’
  - Notice that the slice [N:M] includes N but not M

String Length

- You can find the length of a string using ‘len()’
  - `len(“William”)` – gives 7
  - `len(“”)` – gives 0

Finding a Character

- Where is a character in a string? Use the .index() method
  - `"David Cameron".index(" ")` – give 5
  - `"David Cameron".index("a")` – give 1

- Note: index finds the first character

Technical Note
Why is '.index()' written in a different way to 'len()'?
- 'len' is a built in function
- '.index()' is a method

This difference will become clearer later.

Errors

- Python has fewer errors than other languages (e.g. Java)
  - This has both pros and cons
- Not everything we write makes sense
- Syntax error: *"I can't understand what you are asking"*
  - `123abc` – not a number
  - `1 ! 3` – not an operator
  - `"hello` – a string with no end

Evaluation Errors

- *"The text looks ok but when I try to calculate, it makes no sense"*
  - 42 + "hello" – can't combine a number and a string
  - 42 / 0 – can't divide by zero
  - "hello"[17] – can't index beyond the end

Types

- All values belong to a particular type

- Strings
- Numbers
  - Integer
  - Floating point

- An operator works for values of the correct type **or types**

Input a Number

Input a Number

- Input always reads a string
  - Must not confuse string and number
- Consider:

```
#This program calculates your age next year
#... unfortunately it does not work
age = input("How old are you? ")
print("Next year you will be", age+1)
```

- The result is:

```
How old are you? 21
Traceback (most recent call last):
  File “age-wrong.py", line 4, in <module>
    print("Next year you will be", age+1)
TypeError: Can't convert 'int' object to str implicitly
```

Using the 'int' function

- Use the 'int' function to convert a string (of digits) to a number
- Try the corrected program:

```
#This program calculates your age next year
age = input("How old are you? ")
print("Next year you will be", int(age)+1)
```

Where do Functions Come From?

Python Library

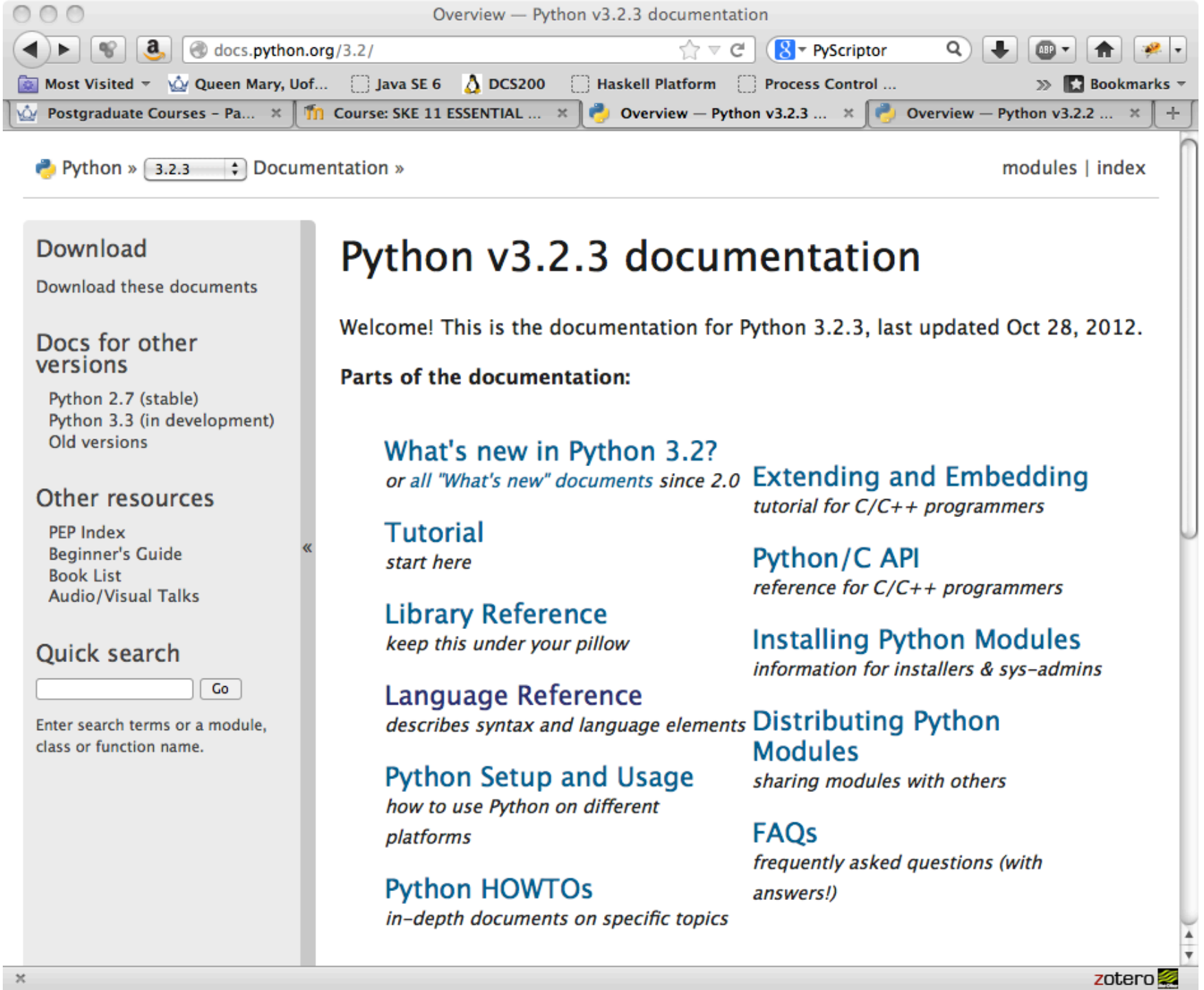
Functions So Far

Function	Description
`print`	Write some output
`input`	Get keyboard input
`len`	Find length of a string
`int`	Convert string to integer

- Where do the functions come from?
- How do we find about these functions?

Library

- Software written (and tested) by someone else for you to use in your program
- Good news
- BUT
  - More complex than the language
  - Just learn the bits you need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zotero

Built-In Functions

- Look at the documentation for built in functions: http://docs.python.org/3.2/library/functions.html
  - It may be available on your machine, from the IDE
- Look up the functions we have already covered
  - print, input, len, int
- Also look at:
  - min, max, ord, chr, pow, abs, bin
- … and string methods
  - http://docs.python.org/3.2/library/stdtypes.html#string-methods

Summary

- Introduced some Python expressions
- An expression has a value
- … unless it creates an error

- Some expressions are numbers
- … others and string
- … more to learn about.

- There is a library
  - Good news: lots of code for you to use