5 Languages in 30 minutes 1/5: Python

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Why series?

- Short
- Interesting?
- Broaden horizon
- Stackoverflow developer survey 2019

Why Python?

- TIOBE Hall of Fame 2018
- TIOBE Index 4^{th}
- SO most loved 2^{nd}
- SO most wanted 1^{st}
- Dutch origins

What is Python

- Interpreted
- Multi-paradigm:
  - Imperative
  - Object oriented
  - Functional
  - Aspect oriented
  - Metaprogramming
- Strongly, dynamically typed
- Garbage collected
- Scripting language
- Batteries included
- Significant whitespace
- Easily extendable
- Embeddable

Implementations

- CPython
- Jython (on the JVM)
- IronPython (on .NET)
- PyPy (fast, JIT compiled)
- Stackless (microthreads)
- MicroPython (running on microcontrollers)

History

- Born: 1990
  - Amsterdam (CWI)
  - Guido van Rossum
- Goals:
  - It should be an easy and intuitive language, just as powerful as major competitors.
  - It should be open source, so anyone can contribute to its development.
  - Its code should be understandable as plain English.
  - It should be suitable for everyday tasks, allowing for short development times.
- 16 October 2000: Python 2.0
- 3 December 2008: Python 3.0
- current:
  - 3.7.3
  - 2.7.16

The Zen of Python

- Beautiful is better than ugly
- Explicit is better than implicit
- Simple is better than complex
- Complex is better than complicated
- Readability counts
- ...

In Practice (1/2)

- REPL: Read Eval Print Loop
- python version manager: pyenv (anaconda)
- package manager: pip (176,172 packages)
- very large standard library included:
  - http server

    ```
    python -m SimpleHTTPServer 8000
    ```
  - smtp server

    ```
    python -m smtpd -n -c DebuggingServer 127.0.0.1:10025
    ```
  - csv parser
  - fractions
  - asyncio
  - unittest
  - doctest
- very portable (Windows, MacOS, Linux, BSD's)

In Practice (2/2)

- PEP: Python Enhancement Proposal
- Documentation: doc strings, Sphinx
- IDE's:
  - PyCharm (Jetbrains)
  - IDLE (included)
  - every decent editor
- also for GUI's:
  - PyQt
  - PyGtk
  - WxPython
- cloud:
  - one of the original google cloud platform languages
  - available on AWS, and Azure

Notable features

- Multiple assignment
- Slices

List comprehensions

```
a = [x**2 for x in range(5)]
print(a)

[0, 1, 4, 9, 16]
```

Notable libraries

Numpy, SciPy

```
import numpy as np
a = np.random.random(4).reshape(2,2)
print("a :\n", a)
print("a' :\n", a.transpose())
```

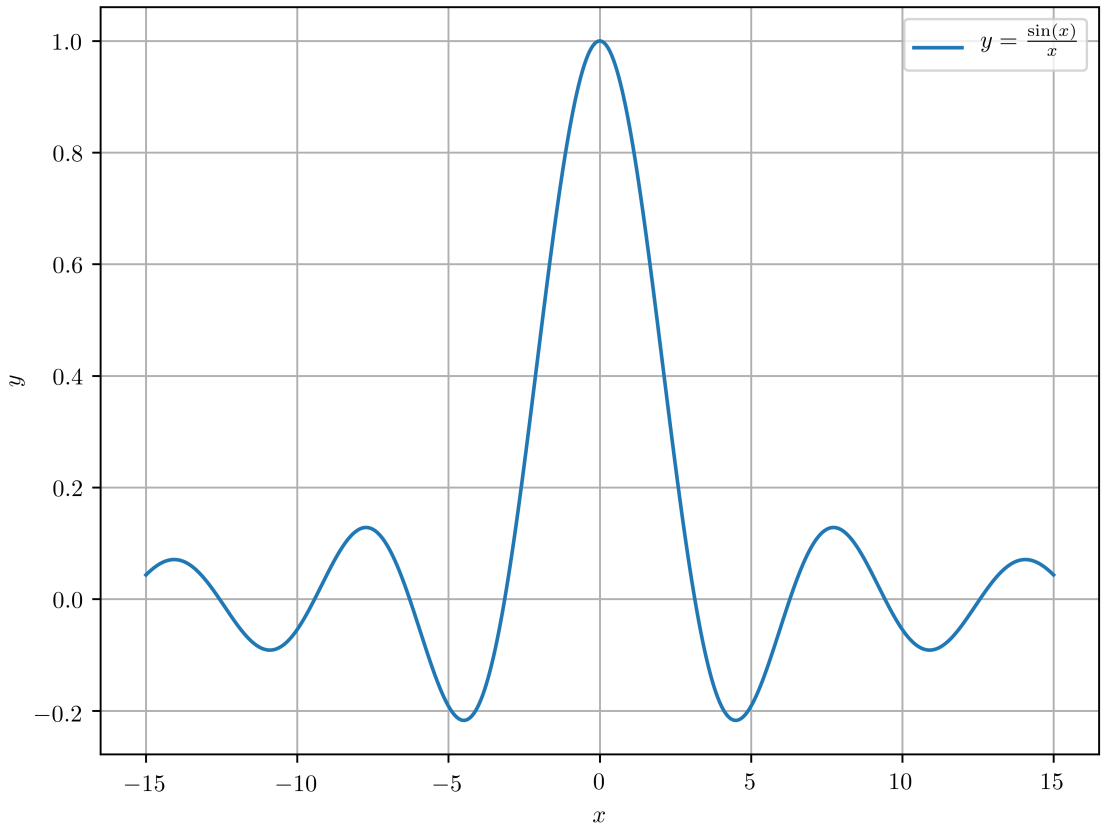
```
a :
 [[0.41042305 0.14184023]
 [0.80446746 0.96514777]]
a' :
 [[0.41042305 0.80446746]
 [0.14184023 0.96514777]]
```

Notable libraries

Matplotlib

```
import matplotlib.pyplot as plt
import numpy as np
plt.rc('text', usetex=True)
plt.rc('font', family='sans serif')
x = np.linspace(-15, 15, 500)
plt.xlabel(r'$x$')
plt.ylabel(r'$y$')
plt.plot(x, np.sin(x)/x, label=r'$y = \frac{\sin (x)}{x}$')
plt.grid(True)
axis = plt.gca()
axis.legend()
plt.tight_layout(0)
plt.savefig('images/python-matplot-fig.png', dpi=600)
```

Result



Notable libraries

- Scikit-Learn (Machine learning)
- TensorFlow (Machine learning)
- Gym (Reinforcement learning)
- Django (CMS)
- Flask (Web framework)
- Twisted (event-driven network programming)

Usages

- Scientific computing
- Extension language
  - GIMP
  - Inkscape
  - GNU Debugger
  - Blender
- Web Apps
- Machine learning
- Installer (Ubiquity, Anaconda)
- Software development:
  - SCons
  - Buildbot
  - robotframework
  - cookiecutter

Rusty washers

- Performance, options
  - use native libraries if needed
  - PyPy
- 2.x vs 3.x

Resources

- Python.org
- Official documentation
- The Zen of Python
- Python Package Index
- Sphinx documentation generator
- Anaconda scientific computing distribution
- Python Beginners Guide
- Python Programming Wikibook
- Pluralsight courses
- IPython, better REPL
- Thonny beginner freindly IDE
- PyCharm Jetbrains IDE
- Spyder Scientific Development Environment
- Python using VS Code
- Jupyter Notebooks