6.009: Fundamentals of Programming

Lecture -1: Programming Beyond 6.009

- Review of 6.009 Big Ideas
- What's Next?

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17 May 2021

6.009: Goals

Our goals involve helping you develop your programming skills, in multiple aspects:

- **Programming:** analyzing problems, developing plans
- **Coding:** translating plans into Python
- **Debugging:** developing test cases, verifying correctness, finding and fixing errors

So we will spend time discussing (and practicing!):

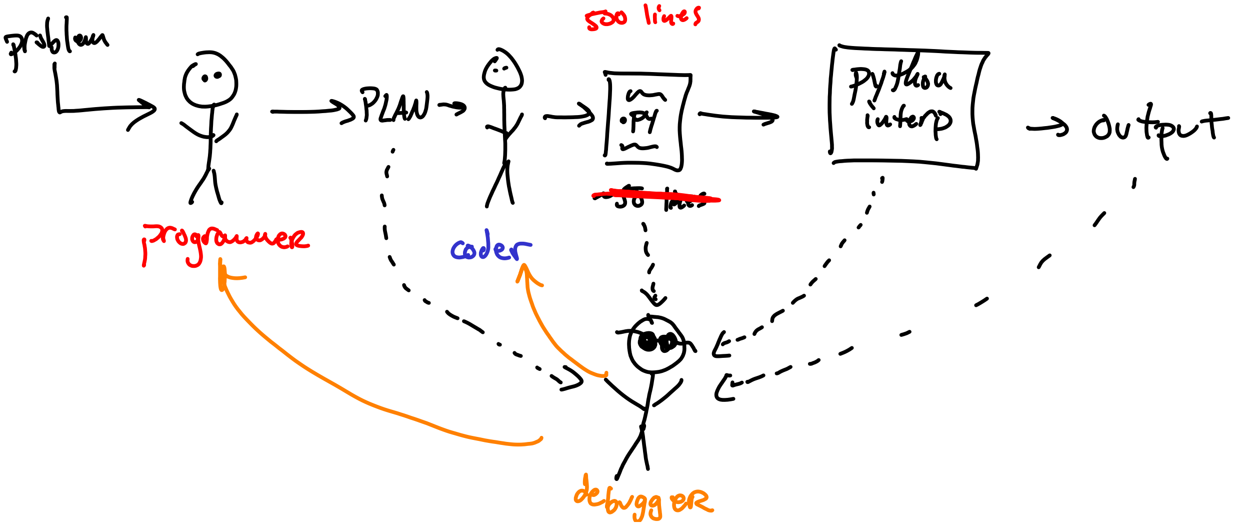
- high-level design strategies
- ways to manage complexity $\rightarrow$ style (PEP 8), abstraction
- details and "goodies" of Python
- a mental model of Python's operation
- testing and debugging strategies

Lots of Cool, Challenging Problems!

- Audio Processing
- Image Processing
  - Convolutional Filters
  - Color Images
  - Seam Carving
- Bacon Numbers / Path Finding
- Path Planning in the USA
- N-dimensional Minesweeper
- SAT Solver
- Autocomplete
- Symbolic Algebra
- LISP Interpreter

6.009 Overview

- improving “behind the scenes” understanding
- managing complexity as programs grow
- filling your “toolbox” with common techniques/strategies
- practice with programming, coding, and debugging



Growth, not Perfection

ONE YEAR
Baby step
Baby step
Baby step
Baby step
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What's Next?

Two perspectives:

- ~~What else exists within Python?~~ what next programming?
- What comes next in terms of subjects?

course 6

Python Standard Library Highlights

Another reason to like Python (which we've not really utilized so far) is that it has a huge *standard library* of useful modules/functions/classes. We certainly can't talk about it all here (see `https://docs.python.org/3/library/index.html`, the list is **huge**), but we can talk briefly about a couple of highlights:

- various collections (beyond lists, sets, etc): `collections`
- tools for working with iterators and functions: `itertools`, `functools`
- mathy things: `math`, `cmath`, `random`, `statistics`
- rational numbers: `fractions`
- tools for working with functions: `functools`
- implementations of built-in operations as functions: `operator`
- tools for interacting with operating system: `os`, `sys`
- tools for dealing with errors/reporting: `traceback`, `logging`
- tools for creating/interacting with Internet protocols/etc
  - `email`, `smtplib`, etc
  - `http.server`, `urllib.request`, etc

lambda x,y: x+y
lambda x,y: x-y

These modules can be super useful, but aren't really worth talking about here.

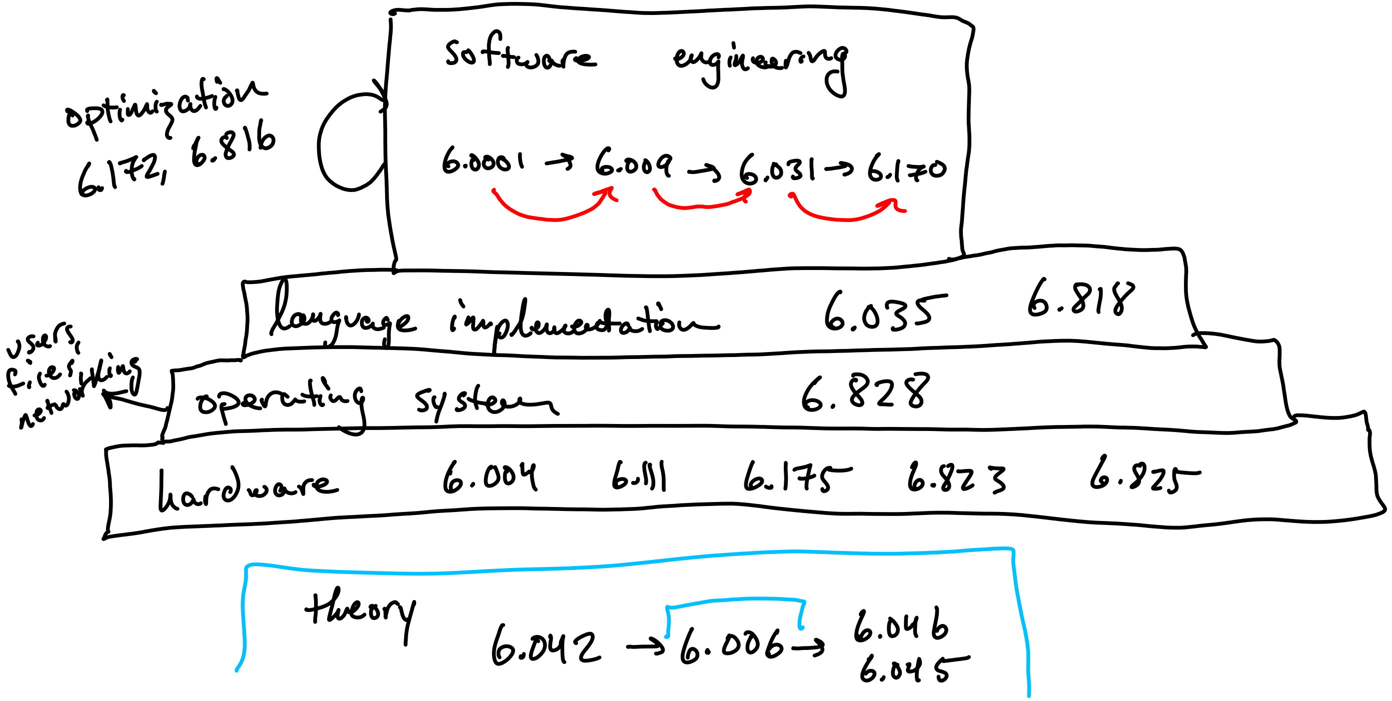
External Packages

Outside of the standard library, there are a wealth of other useful packages!

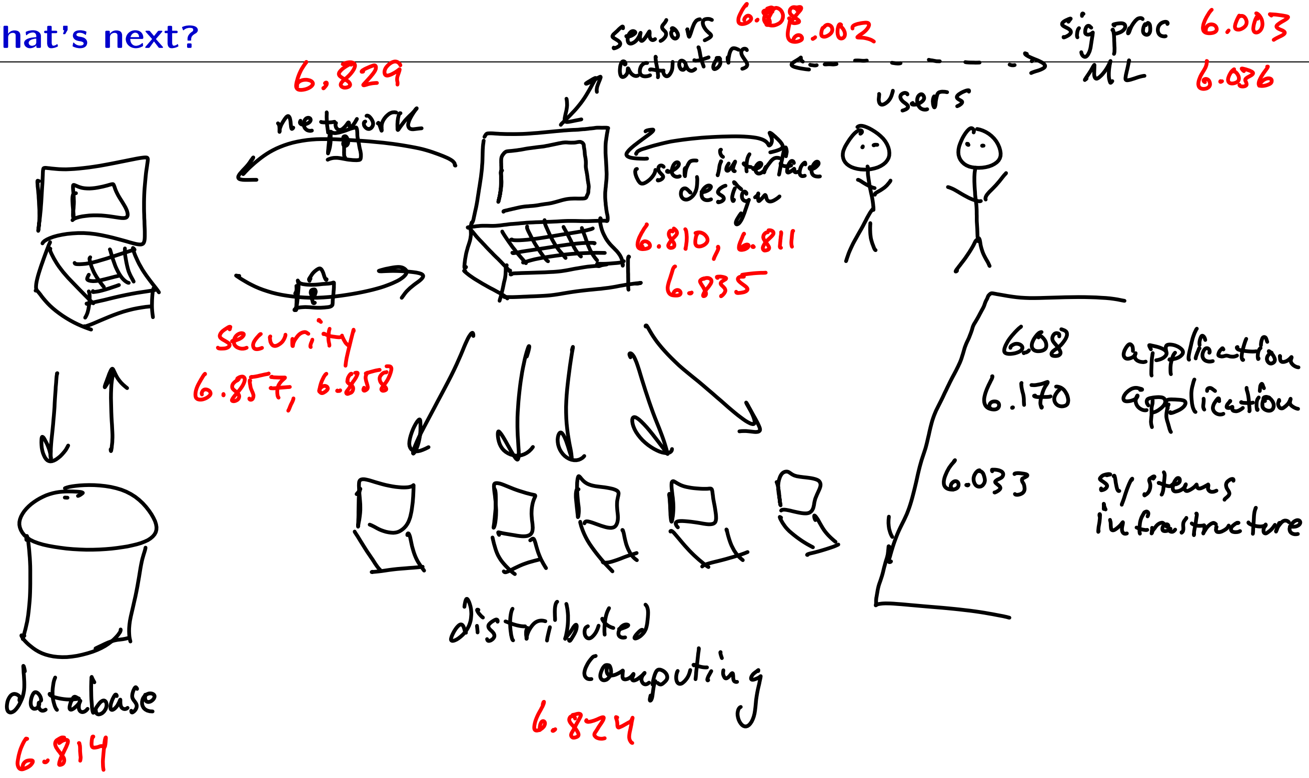
Examples:

- `sympy` for symbolic algebra
- `numpy` for numeric computation (fast operations on large multi-dim arrays+matrices)
- `matplotlib` for generating plots
- `nltk` for natural language processing
- `mypy` for static analysis of code
- etc, etc, etc

What's next? in terms of course 6 subjects



What's next?


sensors actuators
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sig proc 6.003
ML 6.036
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network
security
6.857, 6.858
user interface design
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6.835
users
6.08 application
6.170 application
6.033 systems infrastructure
database
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distributed computing
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