Code Archeology

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Reminder: if you are in Sections A/B, fill out our survey so we can figure out what we're doing.

Technical homework question protocol.

- First: we want to help you, don't suffer for days!
  - Some of you don't ask *enough* questions.
- But: the online environment can make it almost a little, well, *too* easy.

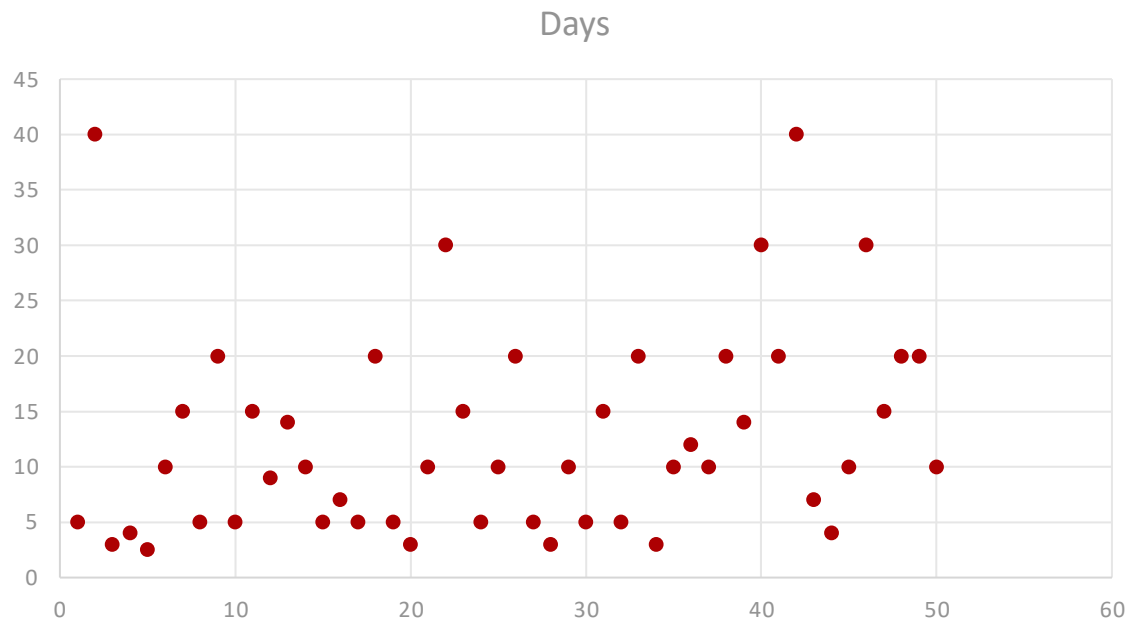
Chris is great! But there's only one of him, and 60+ of you…

Requests for technical homework assignment.

- Please read the ”protocol” I posted on #announcements
- Highlights:
  - Check the #homework-techsupport channel to see if someone else has had the same problem.
  - *Ask your question on #homework-techsupport.*
    - Do you REALLY want us to have both piazza AND Slack? No, you do not.
  - Once it is answered, *do not delete your question, that misses the whole point.*
  - If you insist on DMing instead, DM all three of us.

Task: Estimate Time

- A: Simple web version of the Monopoly boardgame with Pittsburgh street names
  - Team: just you



- Left out: two outliers, 180 and 1125

Learning goals

- Ask for technical help on homework effectively while being a good citizen.
- Understand and scope the task of taking on and understanding a new and complex piece of existing software.
- Appreciate the importance of configuring an effective IDE.
- Enumerate both static and dynamic strategies for understanding and modifying a new codebase.

Context: big ole pile of code.

…do something to it.

Like: Fix a bug, implement a feature, write a test…

You cannot understand the entire system.

Goal: develop and test a working model or set of working hypotheses about how (some part of) a system works.

- Working model: an understanding of the pieces of the system (components), and the way they interact (connections).
- It is common in practice to consult documentation, experts.
- Prior knowledge/experience is also useful (see: frameworks, architectural patterns, design patterns).
- Today, we focus on individual information gathering via observation, probes, and hypothesis testing.

TWO PROPERTIES OF SOFTWARE THAT ARE USUALLY ANNOYING THAT WE CAN TAKE ADVANTAGE OF.

Software constantly changes → Software is easy to change!

Guess so!

Is this wall load-bearing?

Software is a big redundant mess → there's always something to copy as a starting point!

NYTimes quiz: http://bit.ly/problemQuiz

BUT FIRST! AN EXERCISE.

Beware of cognitive biases.

Beware of cognitive biases

- **anchoring**
- **confirmation bias**
- **congruence bias**: The tendency to test hypotheses exclusively through direct testing, instead of testing possible alternative hypotheses
- conservatism (belief revision)
- curse of knowledge
- default effect
- expectation bias
- overconfidence effect
- plan continuation bias
- pro innovation bias
- recency illusion

https://en.wikipedia.org/wiki/List_of_cognitive_biases

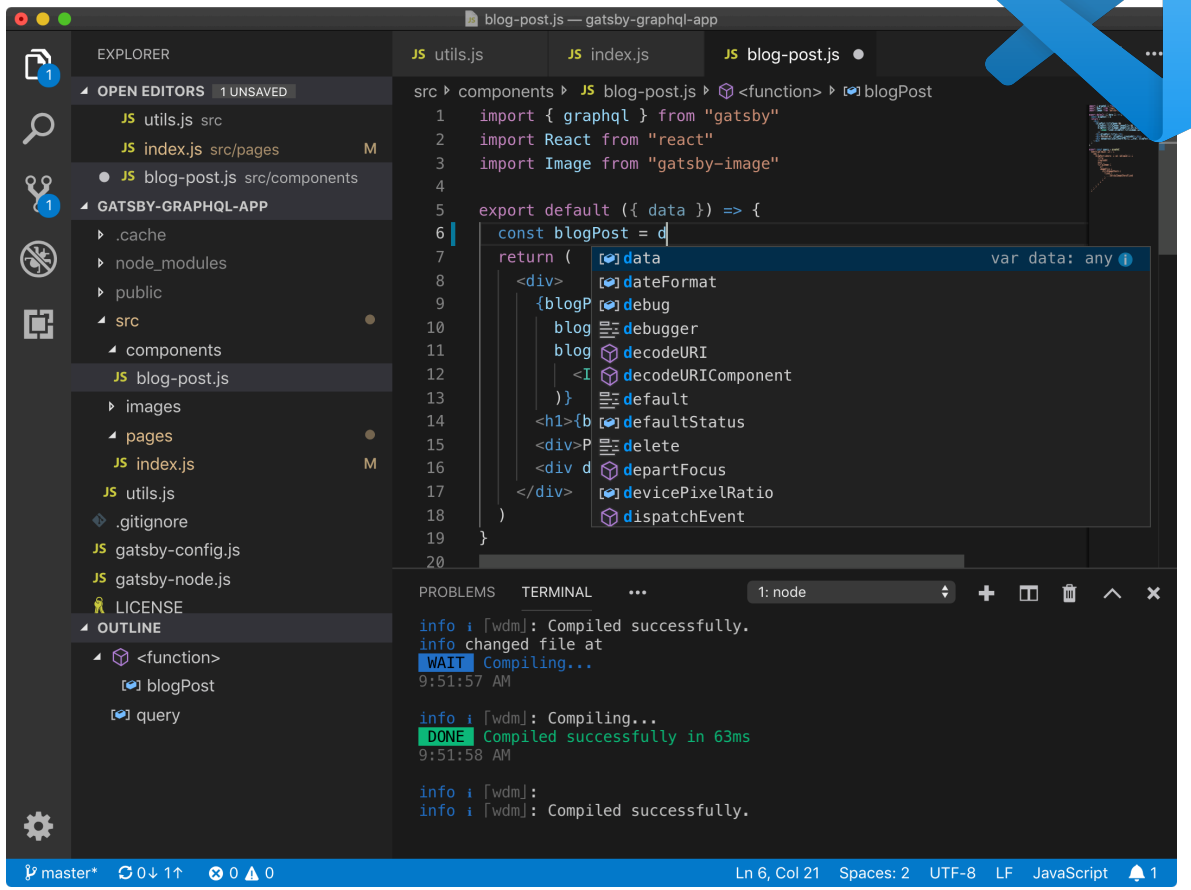
Static (+dynamic) information gathering

- Basic needs:
  - **Code/file search and navigation**
  - Code editing (probes)
  - Execution of code, tests
  - Observation of output (observation)
- Many choices here on tools! Depends on circumstance.
  - grep/find/command line/emacs
  - A decent IDE
  - Coverage computation
  - Testing tools
  - Debugger.
  - Etc.

At the command line: grep and find!
I will find a tutorial and share it.

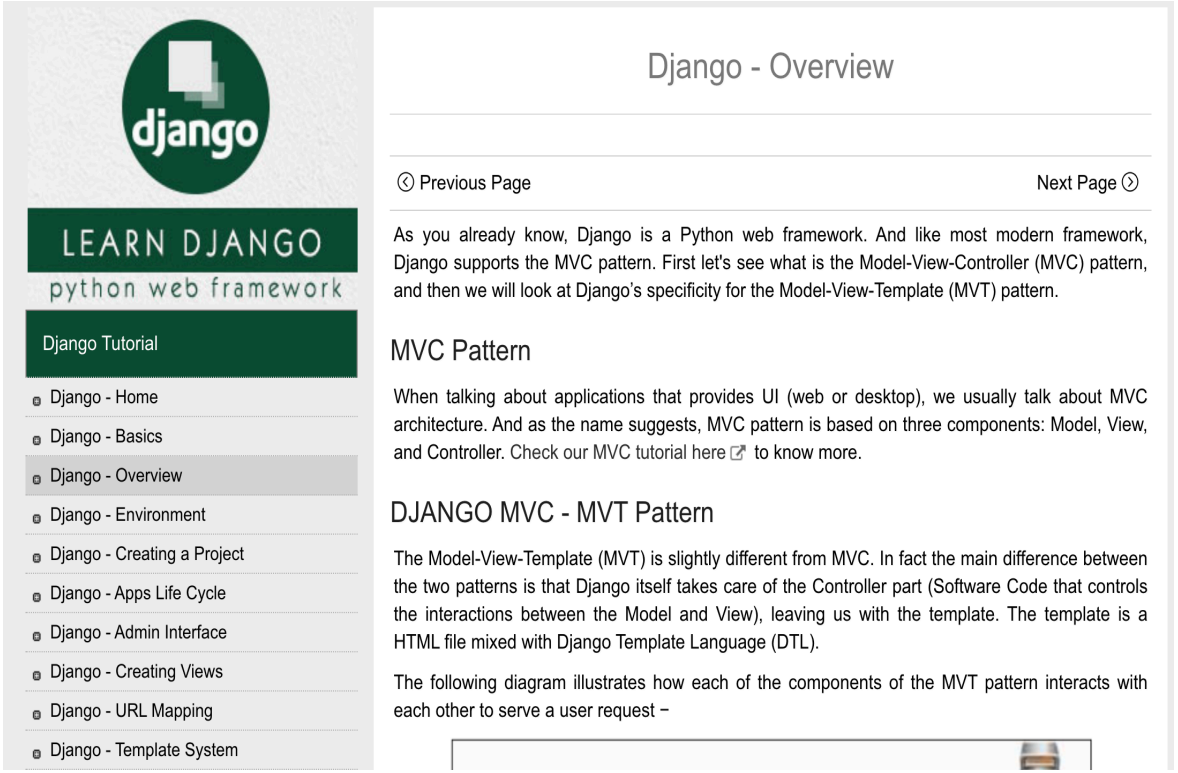
Static information gathering: use tools to help manage complexity.

- Please configure and use a legitimate IDE.
  - Don’t have a favorite? We like VSCode.
  - Configure: something like IntelliConfigure
- Why?
  - “search all files”
  - “jump to definition”
- Remember: real software is too complicated to keep in your head.



Consider: Documentation and tutorials, judiciously

- Can teach you about general structure, architecture.
  - Forward-reference to architectural patterns!
- As you gain experience, you will recognize more of these, and you will immediately know something about how the program works.
- For example, next time you work on a webapp…



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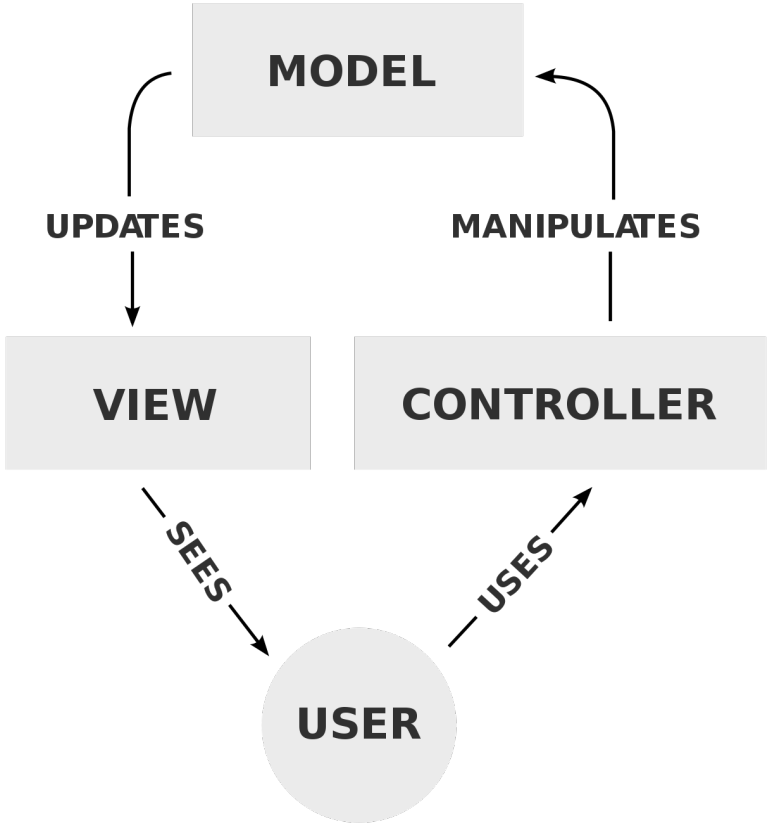

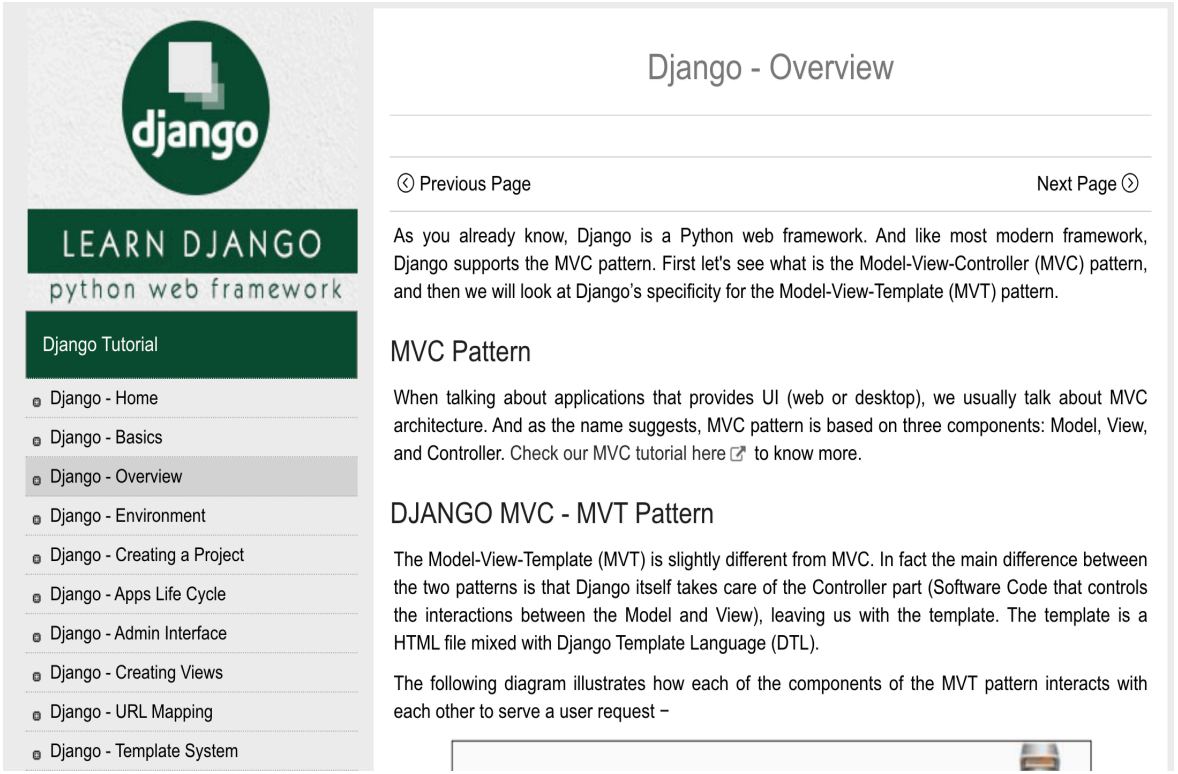

Dynamic Information Gathering: High-level principles

- Key principle 1: change is a useful primitive to inform mental models about a software system.
- Key principle 2: systems almost always provide some kind of starting point.
- Put simply:
  1. Build it.
  2. Run it.
  3. Change it.
  4. Run it again.
- Can provide information both *bottom up* or *top down*, depending on the situation.

Step 0: sanity check basic model + hypotheses.

- Confirm that you can build and run the code.
  - Ideally *both* using the tests provided, *and* by hand.
- Confirm that the code you are running *is the code you built.*
- Confirm that you can make *an externally visible change*.

- How? Where? Starting points:
  - Run an existing test, change it.
  - Write a new test.
  - Change the code, write or rerun a test that should notice the change.

Demonstration: Live Coding By Chris