cs304
Software Engineering

TAN, Shin Hwei

陈馨慧

Southern University of Science and Technology

Slides adapted from cs427 (UIUC) and cs304(SUSTech)

About me

- I am a Chinese Malaysian
- Born in Ipoh

Famous Food

Famous celebrity

City Surrounded by Mountains

Famous Drink

Teaching Background

Have experience in teaching:

- Software Engineering (SE)
- Software Testing (ST)
- …

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

B.S.(Hons): 2006-2010
M.S: 2010-2012
Teaching Assistant for SE

Darko Marinov

Ralph Johnson

Gang of four

NUS
National University of Singapore

PhD
2012-2018
Teaching Assistant for ST

SUSTech
Southern University of Science and Technology

Assistant Professor
June 2018
Proposed first ST class

Some of the slides will be adapted from UIUC/NUS!

My Research

Research Interest:
Automated Software Maintenance

Maintain Documentation

Detect outdated documentation

Maintain Test

Fix broken Tests

Generate Tests

Maintain Code

Fix buggy code

- Mobile Apps
- C programs
- Student Assignments

How much time you spent in

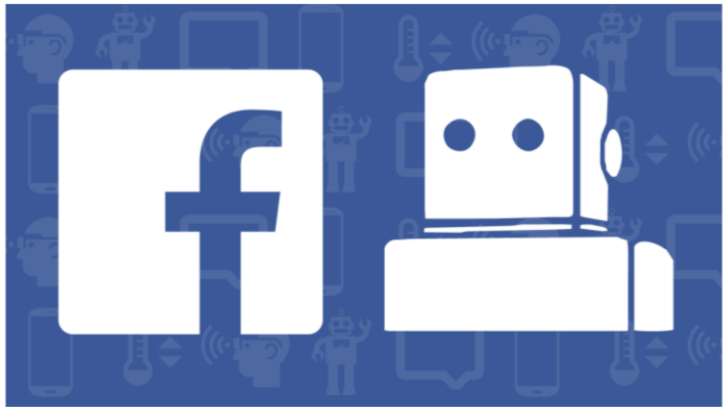
- Writing code
- Debugging (Find why it is wrong?) your code
- Fixing your bugs

What if a robot could debug & fix your code automatically?

Facebook's new 'SapFix' AI automatically debugs your code

Josh Constine @joshconstine / 5 months ago

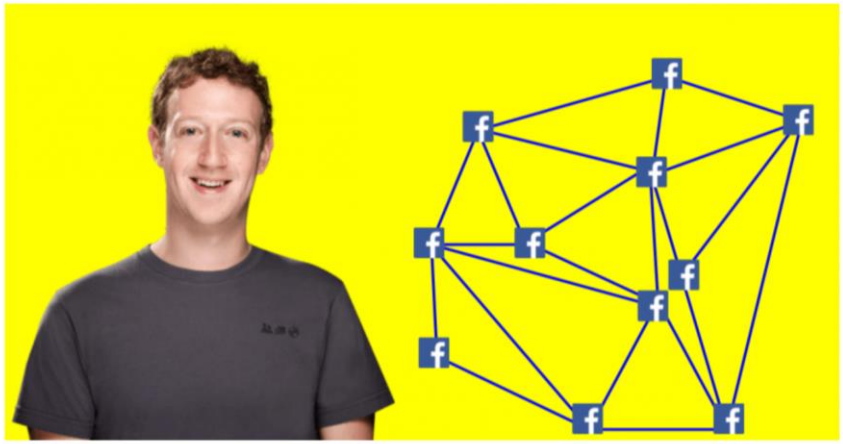
Comm



Facebook has quietly built and deployed an artificial intelligence programming tool called SapFix that scans code, automatically identifies bugs, tests different the best ones that engineers can choose to implement.

Facebook is building an AI tool to help devs fix buggy code

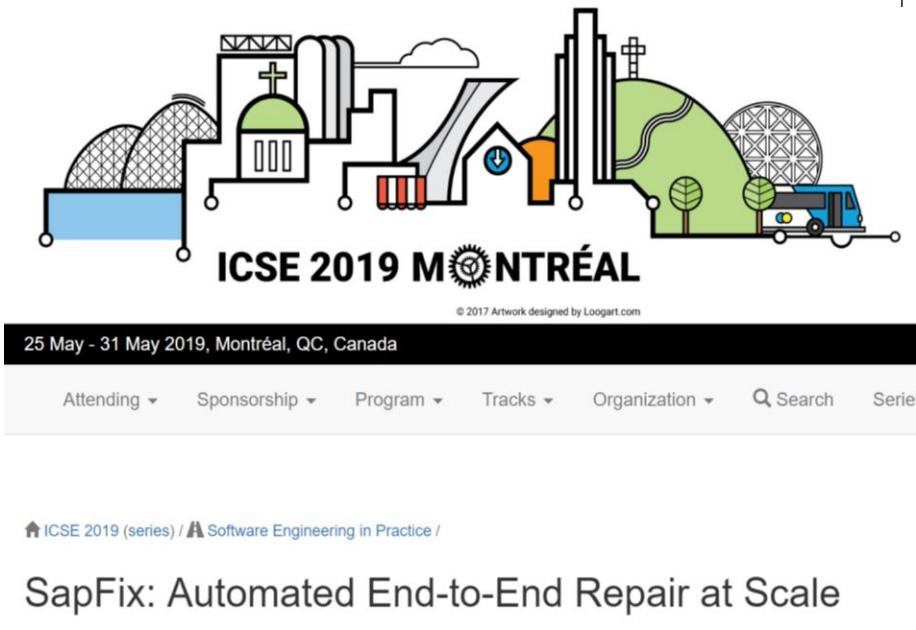
by IVAN MEHTA — 5 months ago in ARTIFICIAL INTELLIGENCE



- Yes!

Research Impact

- We propose first repair tool for Android apps



- They admit using similar approach as our tool

Do you want to build the next generation tool?

- Revolutionize how programmer write code
- Improve programmers' productivity
- Automate boring tasks

Be part of SUSTech Intelligent Software Group

Xin Yao (Head of Department)
Research Interest: Search-based Software Engineering, Genetic Algorithm

Yuqun Zhang
Research Interest: Software Engineering, Service Computing

Yepang Liu
Research Interest: Mobile App analysis, Cyberphysical system

Shin Hwei Tan
Research Interest: Automated program repair, Software Testing, Mobile app analysis

Talk to me after class or send me email if you are interested in joining my group! We are looking for students!

Teaching Staff

- Instructor:陈馨慧Tan Shin Hwei
- Teaching Assistant:
  - 王大兴Wang Daxing, wangdx3@mail.sustech.edu.cn
- Student Helpers/ Lab Assistant:
  - 李子强
  - 黎诗龙
  - 王海波
  - 雷宇翔
  - 许博添
  - 张志成
  - 何宜芮
  - 香佳宏
  - 陆舜
  - 曹建琦
  - 杨志源

Course Logistics

- Course Description
  - This course focuses on providing **hands-on experience in designing and developing large-scale software systems** with an emphasis on the use of automated tools and techniques
  - Recommended prior course
    - CS309: OOD

Textbooks

- Ian Sommerville, *Software Engineering*
- Freeman et al., *Head First Design Patterns*
- Block, *Effective Java*
- Zeller and Krinke, *Essential Open Source Toolset: Programming with Eclipse, JUnit, CVS, Bugzilla, Ant, Tcl/TX and More*
- McConnell, *Code Complete: A Practical Handbook of Software Construction*
- Barrett, *Linux Pocket Guide*
- Pilone, *UML 2.0 Pocket Reference*

Evaluation and Grading

- Weekly Lab Tutorials– 20%
  - >=10
- Project – 35%
  - Fixing GitHub Issues of Java Open-Source Projects
  - Group of 5
  - 3 presentations (proposal, progress, final)
  - 2 written reports
  - Peer evaluations
- Exams – 35%
  - Final:
    - What's on an exam? Anything from any aspect of class, including lab sections.
- In-Class Exercises/Attendance – 10%
  - Spontaneous (Will start taking attendance soon)

Systems Used

Sakai	Wechat Work	GitHub Classroom	Tencent classroom
• Lecture/lab notes • Gradebook	• Lecture/Lab Q/A	• Homework/Project submissions • Ask questions about homework	• Live teaching

-Not going to use Blackboard after this week! Please login to Sakai to get all announcements!

Wechat work 企业微信

- Join the group chat

Award-winning Project

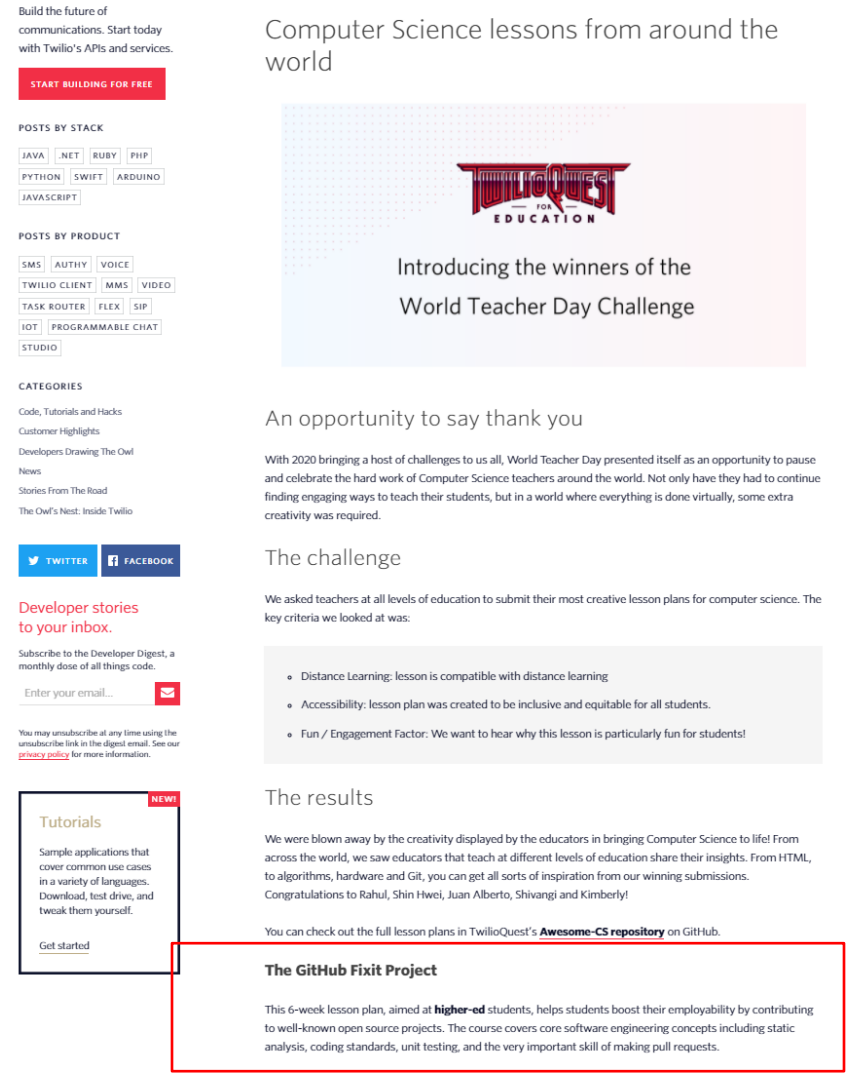
- Won the World Teacher Day Challenge!
- Paper Accepted in ICSE-JSEET (Education track)
- Project Proposal uploaded
  - Start choosing your project early!

GitHub-OSS Fixit: Fixing bugs at scale in a Software Engineering Course

Shin Hwei Tan, Chunfeng Hu, Ziqiang Li, Xiaowen Zhang, Ying Zhou

Many studies have shown the benefits of introducing open-source projects into teaching Software Engineering (SE) courses. However, there studies that limit the wide adaptation of open-source projects in a classroom setting, including (1) the selected project is limited to one par only investigated on its effect on teaching a specific SE concept, and (3) students may make mistakes in their contribution which leads to pc software companies have successfully launched programs like Google Summer of Code (GSoC) and FindBugs "fixit" to contribute to open-sc success of these programs, we propose GitHub-OSS Fixit, a course project where students are taught to contribute to open-source Java pro GitHub. We described our course outline to teach students SE concepts by encouraging the usages of several automated program analysis t carefully designed instructions that we gave to students for participating in GitHub-OSS Fixit. As all lectures and labs are conducted online, could help in guiding future online SE courses. Overall, our survey results show that students think that GitHub-OSS Fixit could help them t the knowledge taught in class. In total, 154 students have submitted 214 pull requests to 24 different Java projects, in which 59 of them ha been closed by developers.

- https://github-fixit.github.io/



Build the future of communications. Start today with Twilio's APIs and services.

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POSTS BY PRODUCT

SMS AUTHY VOICE TWILIO CLIENT MMS VIDEO TASK ROUTER FLEX SIP IOT PROGRAMMABLE CHAT STUDIO

CATEGORIES

Code, Tutorials and Hacks
Customer Highlights
Developers Drawing The Owl
News
Stories From The Road
The Owl's Nest: Inside Twilio

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You may unsubscribe at any time using the unsubscribe link in the digest email. See our privacy policy for more information.

NEW!

Tutorials

Sample applications that cover common use cases in a variety of languages. Download, test drive, and tweak them yourself.

Get started

Computer Science lessons from around the world

TwilioQuest for Education

Introducing the winners of the World Teacher Day Challenge

An opportunity to say thank you

With 2020 bringing a host of challenges to us all, World Teacher Day presented itself as an opportunity to pause and celebrate the hard work of Computer Science teachers around the world. Not only have they had to continue finding engaging ways to teach their students, but in a world where everything is done virtually, some extra creativity was required.

The challenge

We asked teachers at all levels of education to submit their most creative lesson plans for computer science. The key criteria we looked at was:

- Distance Learning: lesson is compatible with distance learning
- Accessibility: lesson plan was created to be inclusive and equitable for all students.
- Fun / Engagement Factor: We want to hear why this lesson is particularly fun for students!

The results

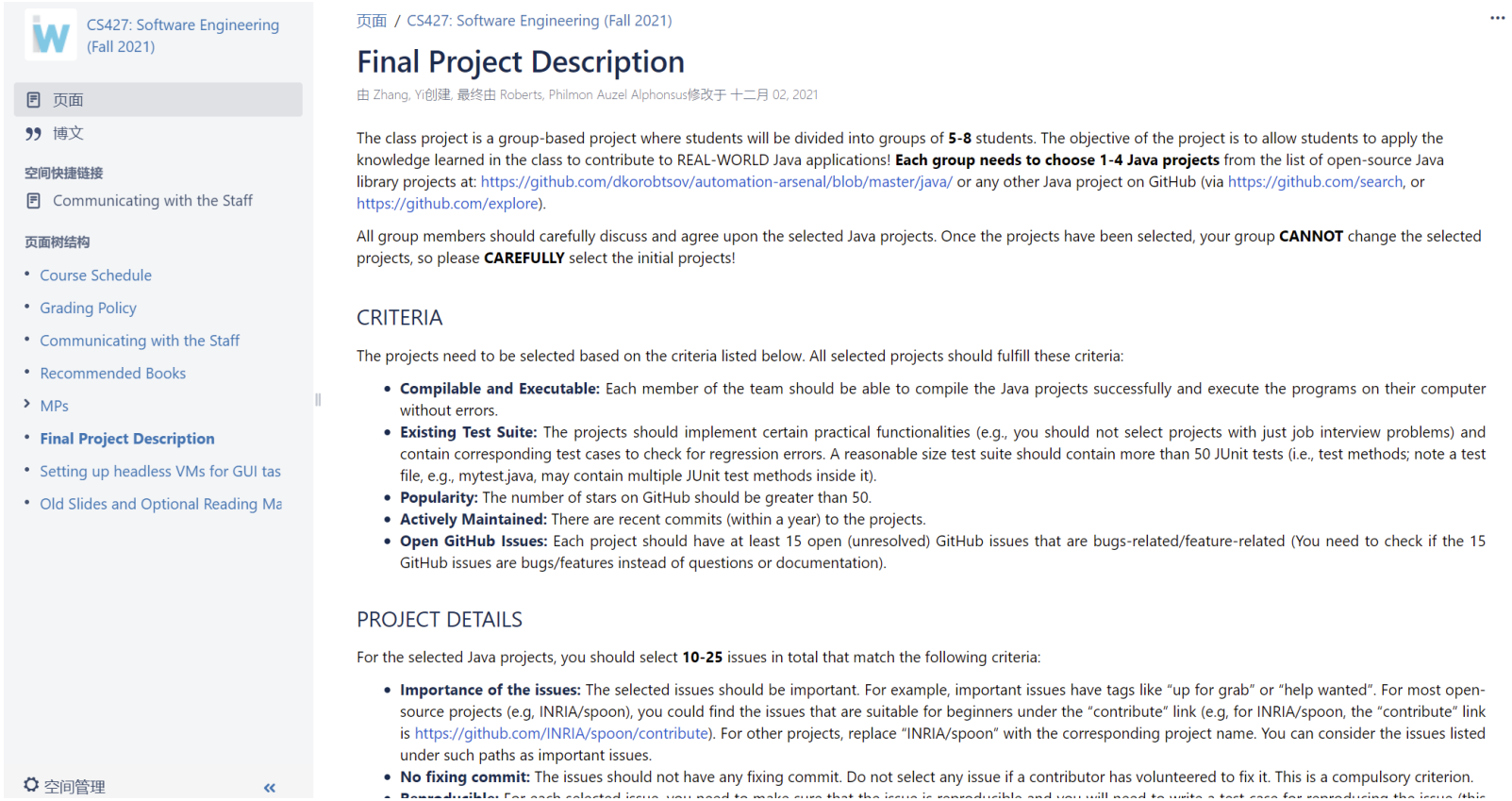
We were blown away by the creativity displayed by the educators in bringing Computer Science to life! From across the world, we saw educators that teach at different levels of education share their insights. From HTML, to algorithms, hardware and Git, you can get all sorts of inspiration from our winning submissions. Congratulations to Rahul, Shin Hwei, Juan Alberto, Shivangi and Kimberly!

You can check out the full lesson plans in TwilioQuest's **Awesome-CS repository** on GitHub.

The GitHub Fixit Project

This 6-week lesson plan, aimed at **higher-ed** students, helps students boost their employability by contributing to well-known open source projects. The course covers core software engineering concepts including static analysis, coding standards, unit testing, and the very important skill of making pull requests.

Adapted in CS427 UIUC



CS427: Software Engineering (Fall 2021)

页面

博文

空间快捷链接

Communicating with the Staff

页面树结构

- Course Schedule
- Grading Policy
- Communicating with the Staff
- Recommended Books
- MPs
- **Final Project Description**
- Setting up headless VMs for GUI tas
- Old Slides and Optional Reading Ma

空间管理

页面 / CS427: Software Engineering (Fall 2021)

Final Project Description

由 Zhang, Yi创建, 最终由 Roberts, Philmon Auzel Alphonsus修改于 十二月 02, 2021

The class project is a group-based project where students will be divided into groups of **5-8** students. The objective of the project is to allow students to apply the knowledge learned in the class to contribute to REAL-WORLD Java applications! **Each group needs to choose 1-4 Java projects** from the list of open-source Java library projects at: https://github.com/dkorobtsov/automation-arsenal/blob/master/java/ or any other Java project on GitHub (via https://github.com/search, or https://github.com/explore).

All group members should carefully discuss and agree upon the selected Java projects. Once the projects have been selected, your group **CANNOT** change the selected projects, so please **CAREFULLY** select the initial projects!

CRITERIA

The projects need to be selected based on the criteria listed below. All selected projects should fulfill these criteria:

- **Compilable and Executable:** Each member of the team should be able to compile the Java projects successfully and execute the programs on their computer without errors.
- **Existing Test Suite:** The projects should implement certain practical functionalities (e.g., you should not select projects with just job interview problems) and contain corresponding test cases to check for regression errors. A reasonable size test suite should contain more than 50 JUnit tests (i.e., test methods; note a test file, e.g., mytest.java, may contain multiple JUnit test methods inside it).
- **Popularity:** The number of stars on GitHub should be greater than 50.
- **Actively Maintained:** There are recent commits (within a year) to the projects.
- **Open GitHub Issues:** Each project should have at least 15 open (unresolved) GitHub issues that are bugs-related/feature-related (You need to check if the 15 GitHub issues are bugs/features instead of questions or documentation).

PROJECT DETAILS

For the selected Java projects, you should select **10-25** issues in total that match the following criteria:

- **Importance of the issues:** The selected issues should be important. For example, important issues have tags like "up for grab" or "help wanted". For most open-source projects (e.g, INRIA/spoon), you could find the issues that are suitable for beginners under the "contribute" link (e.g, for INRIA/spoon, the "contribute" link is https://github.com/INRIA/spoon/contribute). For other projects, replace "INRIA/spoon" with the corresponding project name. You can consider the issues listed under such paths as important issues.
- **No fixing commit:** The issues should not have any fixing commit. Do not select any issue if a contributor has volunteered to fix it. This is a compulsory criterion.
- **Reproducible:** For each selected issue, you need to make sure that the issue is reproducible and you will need to write a test case for reproducing the issue (this

- Students in UIUC did the same project as you!

Project

- Develop some real software
  - Groups of 4-5 students
- Deliverables
  - Proposal (due in the 4th week)
  - Progress report (around mid of semester)
  - Final presentation and report (end of semester)
- Process should start with XP
- Must document process you use
- Must convince us you follow the process you documented

Project lifecycle

- Propose project
- Form team
- Develop
- Deliver code, tests, documentation
- Graded on process during development + quality of what you deliver =
  PROCESS + PRODUCT

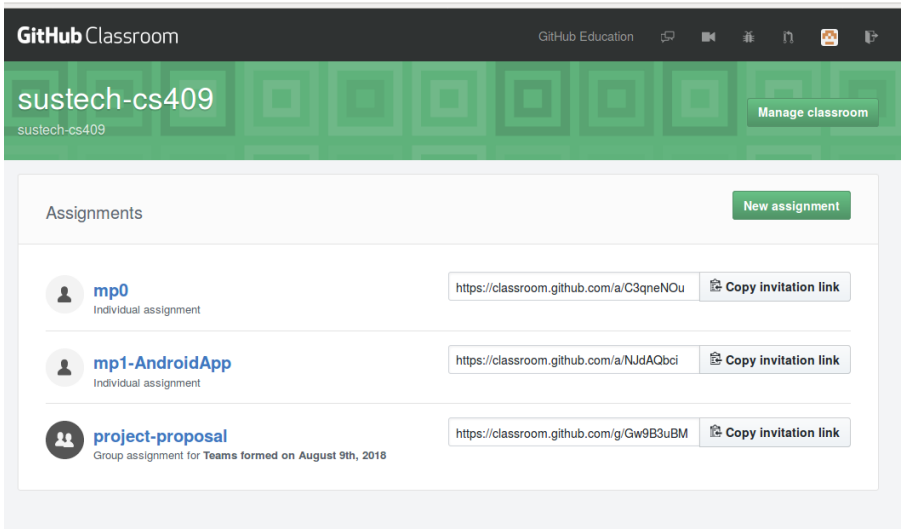
Collaboration

- You must individually solve homework assignments
- No Cheating!
  - Do **NOT** use any resources without citation
  - One student got caught cheating in final exam of my class last semester!

Course Communication

- GitHub Classroom
  - Share the bugs that your find! (Remember to document when you find a bug through knowledge shared in GitHub discussion!)
  - Helps each other with tools installation
- Instructor: Shin Hwei Tan
- Email: tansh3@sustech.edu.cn
  - Please include **se-sustech** in the title of the email
  - Write your email in **English**!
- Office: 工学院南楼612
- Office hours: after lecture or by appointment

Other Communication: GitHub Classroom



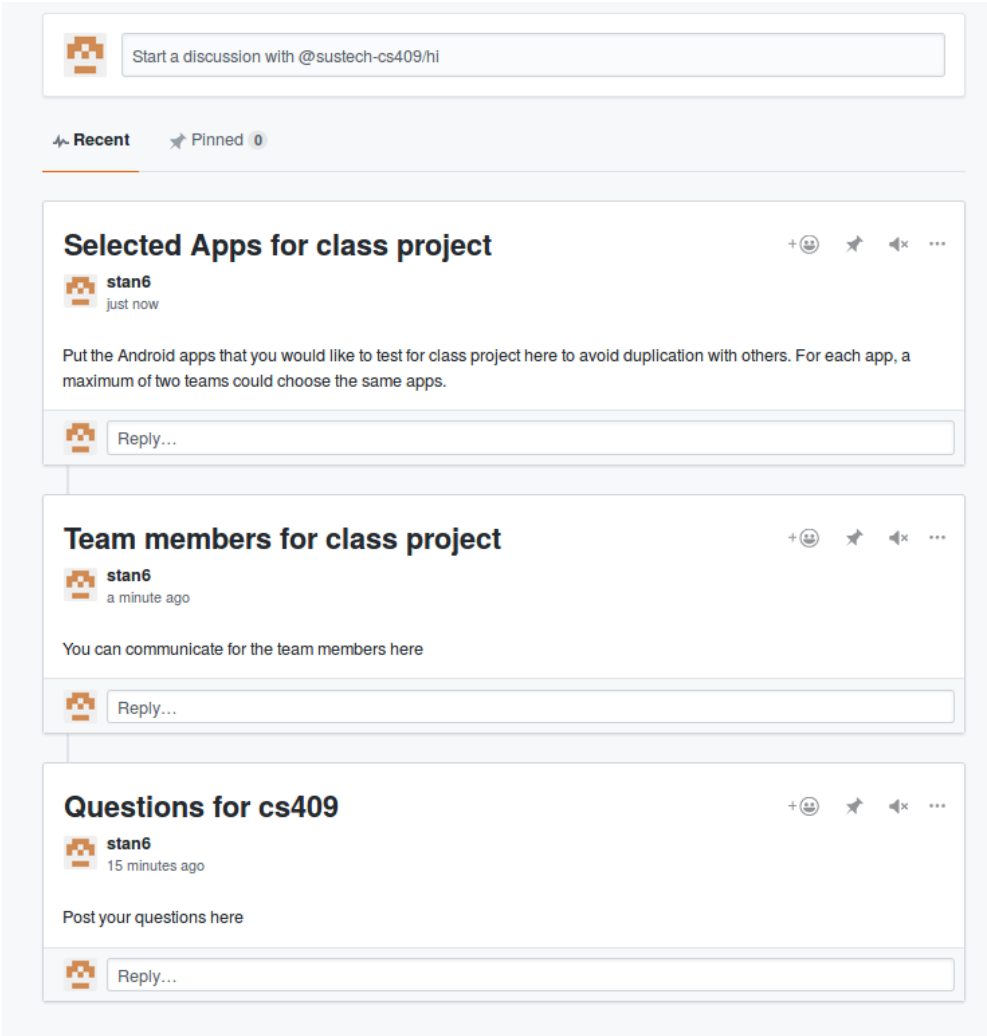
- Automates repository creation and access control
  - Easy to distribute starter code and collect assignments on GitHub.

Have you used GitHub before?

Y

N

Discussion through GitHub

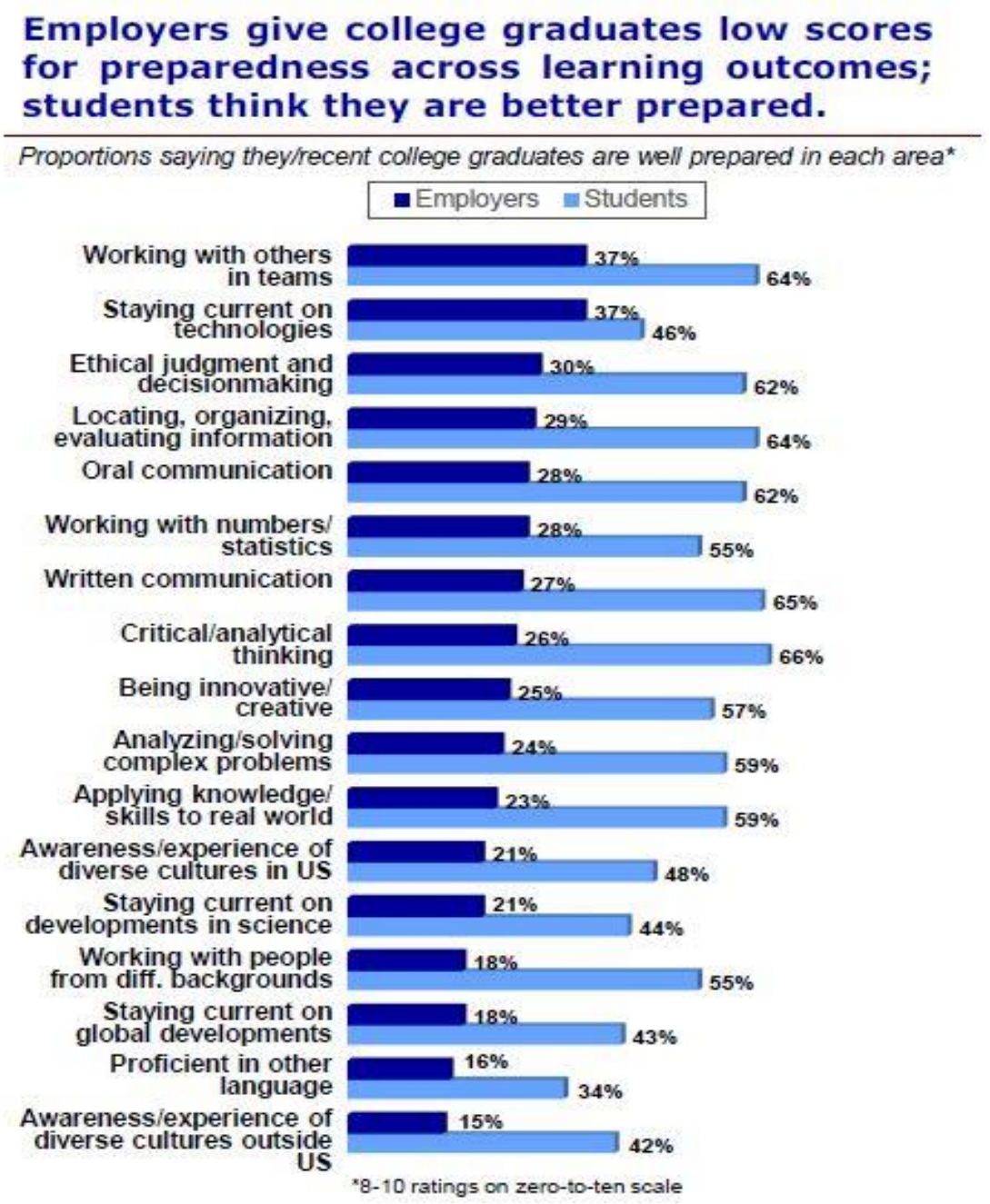


Expectations

- You are responsible for your own class
  - You will fail if you have many late submissions
  - You need to pass this class to graduate
- Independent student
  - Google online if you have any problem installing a tool
    - Everyone may be using a different O.S so we can't answer specific problem
  - If you have problem understanding a concept, ask this in class
    - Good chance to practice your English!
- But…
  - Expect that I may not be able to give you an immediate answer (I'm alright if my response to your question is "I don't know," so you're going to have to be alright with that, too)
  - I (or the TAs) WILL always find you the answers you need in a timely fashion. Be patient.

Why learn Software Engineering?

Well-Prepared in Their Own Eyes



https://www.insidehighered.com/news/2015/01/20/study-finds-big-gaps-between-student-and-employer-perceptions

AI Software Engineer

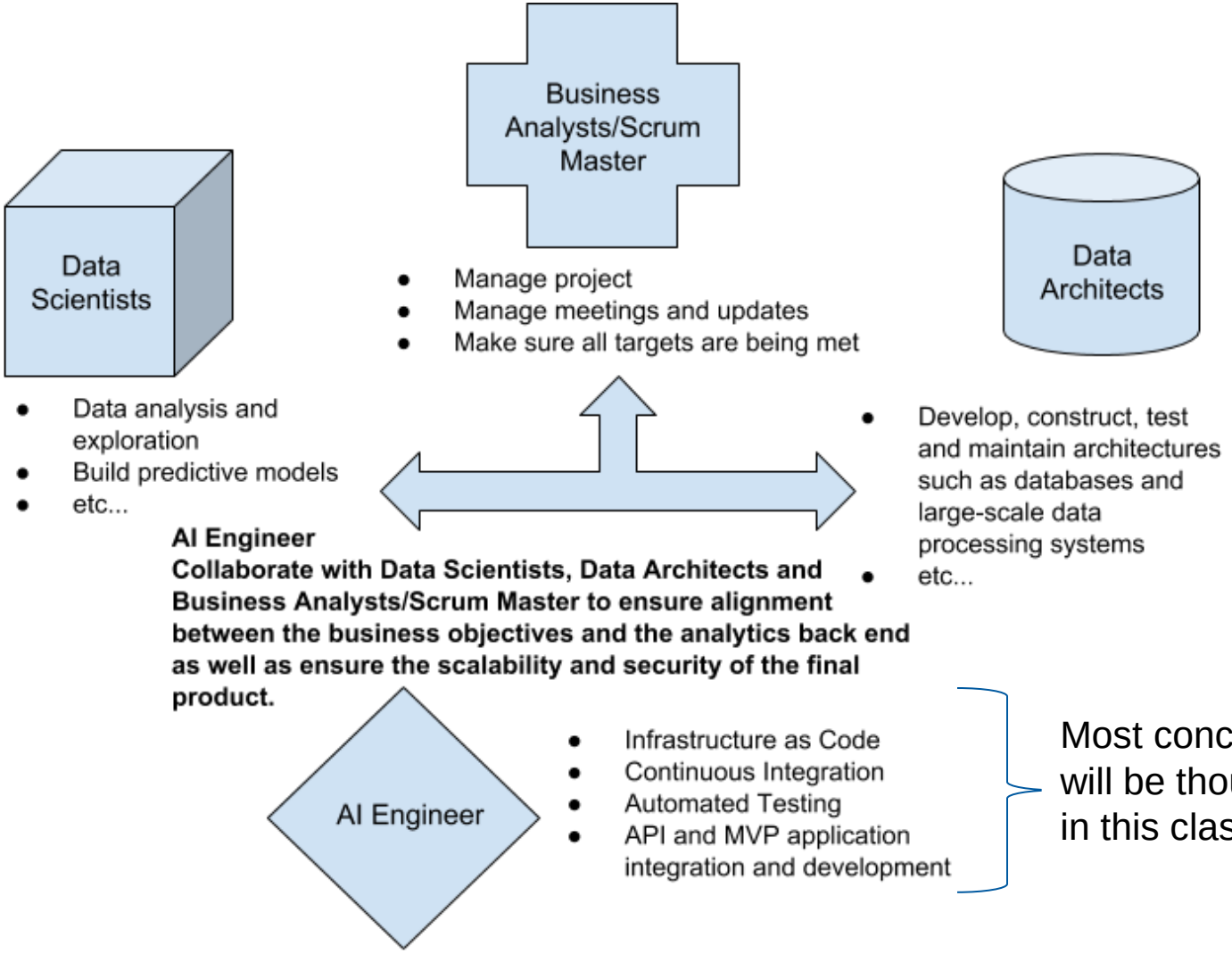
Top AI Jobs Open in the U.S.

Occupation (Job Category)	Open AI Jobs on Glassdoor	Percentage of Open AI Jobs on Glassdoor
AI Software Engineer	56	11%
AI Data Scientist	23	4%
AI Software Development Engineer	21	4%
AI Research Scientist	18	4%
AI Product Manager	9	2%
AI Technical Program Manager	9	2%
AI Business Development Manager	7	1%
AI Solutions Architect	7	1%
AI Learning And Development Specialist	6	1%
AI Research Engineer	6	1%
AI Research Staff Member	6	1%
AI Technical Sales	5	1%
AI Back End Engineer	4	1%
AI Computer Scientist	4	1%
AI Financial Services	4	1%
All Others	327	64%
Total	**512**	**100%**

Source: Glassdoor Economic Research. Active unique job listings on Glassdoor with "artificial intelligence" or "deep learning" job titles as of October 20, 2017. Job titles are normalized into broad occupational groups using Glassdoor's proprietary algorithm that groups similar jobs.

From: https://www.forbes.com/sites/louiscolumbus/2017/11/26/the-best-ai-companies-to-work-for-in-2018-based-on-glassdoor/#246233053d78

What is AI Software Engineer



From: https://towardsdatascience.com/what-is-the-role-of-an-ai-software-engineer-in-a-data-science-team-eec987203ceb

Why is this class important?

- What kind of career paths do you envision for yourself?
  - Developer/Engineer
  - Graduate school
  - Overseas studies

Some topics studied in S.E.

- Process
- Tools
- Techniques
- Models (of software development)
- Modeling (of developed systems)

Software process

- IEEE 1074: “A set of activities performed towards a specific purpose”
- Johnson: “The steps a particular group follows to develop software”

- All teams followed the same process: (academic) XP (Extreme Programming)

Many software processes

- Agile
  - eXtreme Programming (XP), Scrum…
- Theoretical
  - Waterfall…
- Formal
  - Rational Unified Process (RUP), Cleanroom…
- Distributed, open-source
  - Bazaar…
- …

The fable of the Chicken & the Pig

- A Pig and a Chicken are walking down the road.
- The Chicken says: "Hey Pig, I was thinking we should open a restaurant!"
- Pig replies: "Hm, maybe, what would we call it?"
- The Chicken responds: "How about 'ham-n-eggs'?"
- The Pig thinks for a moment and says: "No thanks. I'd be committed, but you'd only be involved.“
  - The Chicken is involved, but the Pig is committed

From: http://en.wikipedia.org/wiki/The_Chicken_and_the_Pig

Default process: XP

- Roles
  - XP: Customer, Developer, Coach
  - Scrum: Pigs (product owner, dev team [3-9 ppl], Scrum master), Chicken (customers and executive management) (http://en.wikipedia.org/wiki/The_Chicken_and_the_Pig)
- Activities
  - XP: Write stories, planning game, test-first, pair programming, continuous integration, refactoring
- Work products
  - XP: User stories, tests, code

Activities in IEEE 1074 (1)

- Project Management
  - Project initiation
  - Project monitoring and control
  - Software quality management
- Development
  - Requirements
  - Design
  - Implementation

Activities in IEEE 1074 (2)

- Post-development
  - Installation
  - Operation and support
  - Maintenance
  - Retirement
- Integral processes
  - Verification and validation
  - Software configuration management
  - Documentation development

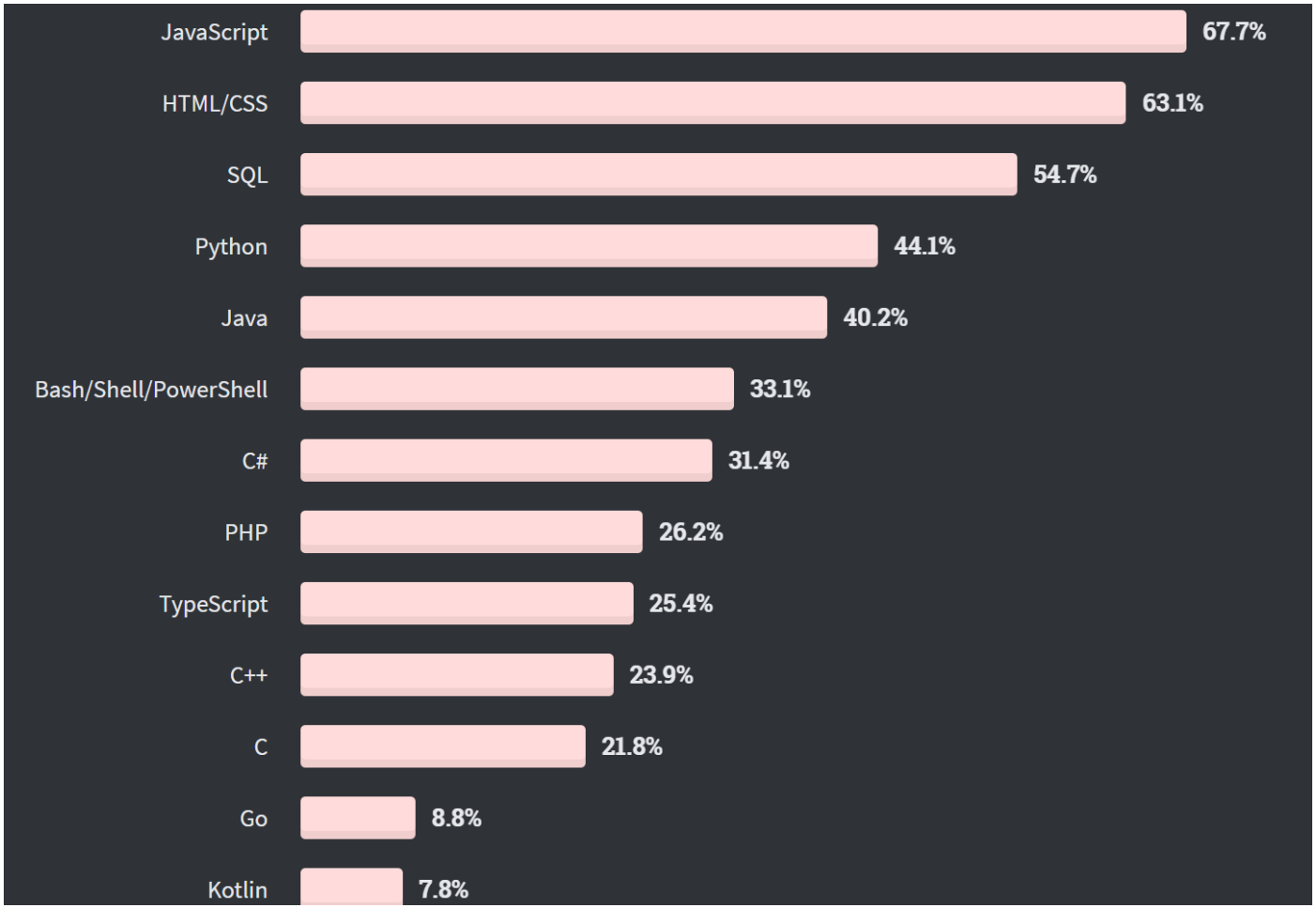
What is (not) S.E.?

- Not just software programming
  - Individual vs. team
- Not just a process
  - Field that studies several different processes
- IEEE 610: “The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software.”

A Little Something About You

What programming languages do you know?

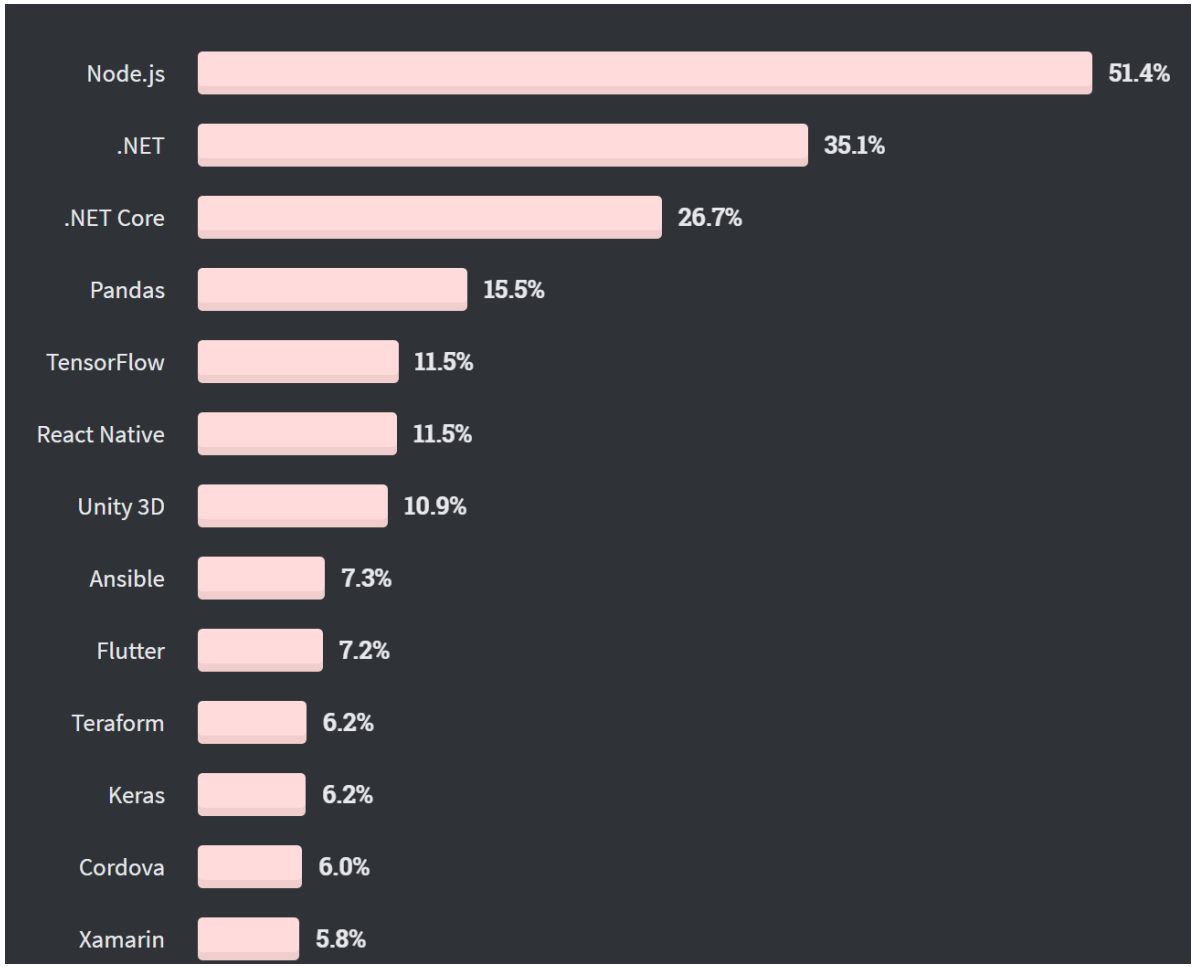
Popular Programming Language According to StackOverflow



From: https://insights.stackoverflow.com/survey/2020/#most-popular-technologies

What framework do you know?

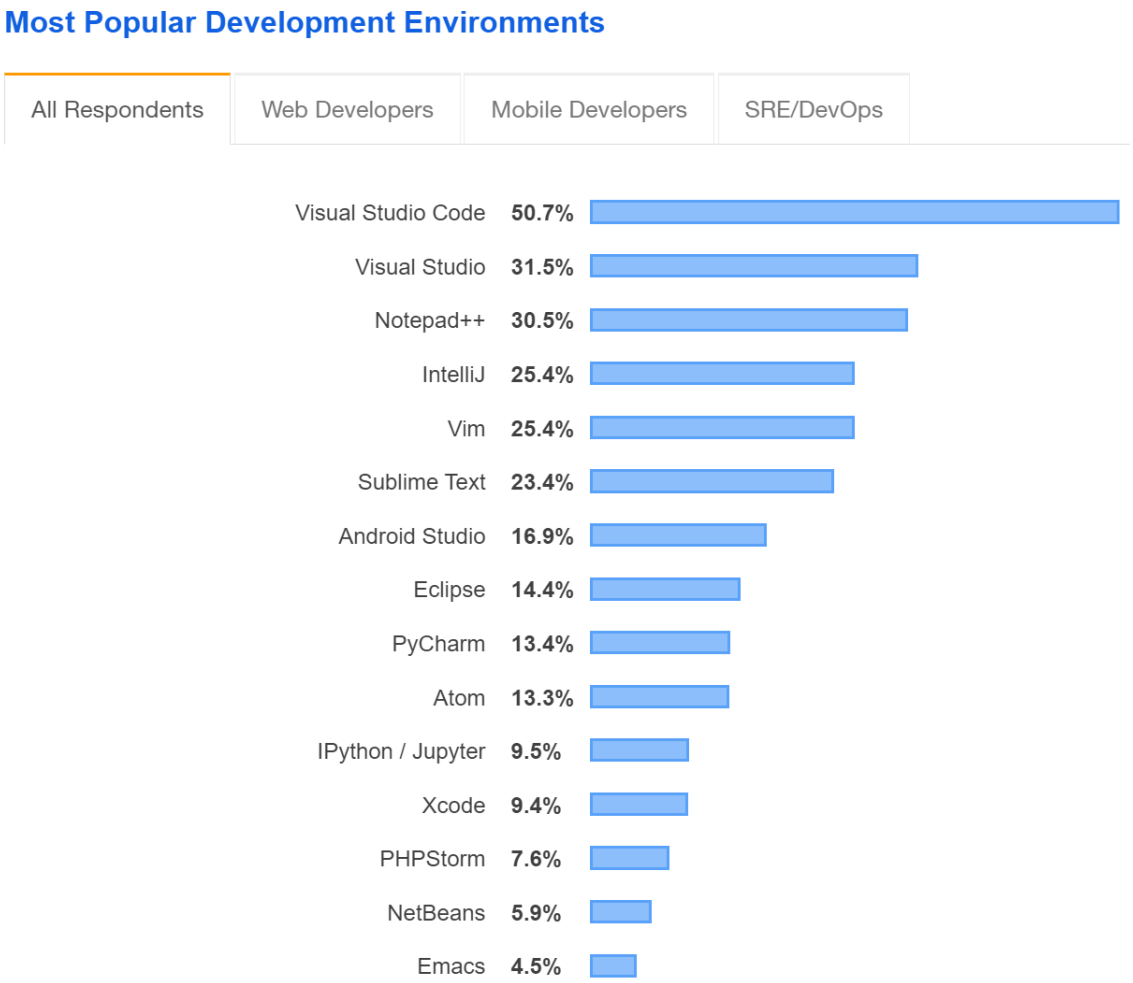
Popular Frameworks, Libraries, & Tools According to StackOverflow



From: https://insights.stackoverflow.com/survey/2018/#most-popular-technologies

Which text editor do you use?

Popular Development Evironments



From: https://insights.stackoverflow.com/survey/2019#technology

Class Projects

What is the maximum lines of code you have written?

A. 1000
B. 3000
C. 5000
D. >10000

How many files it involves?

A. 1 file
B. 2 files
C. >10 files

How many users try your code?

A. No user (only you)
B. 1 user
C. >10 user

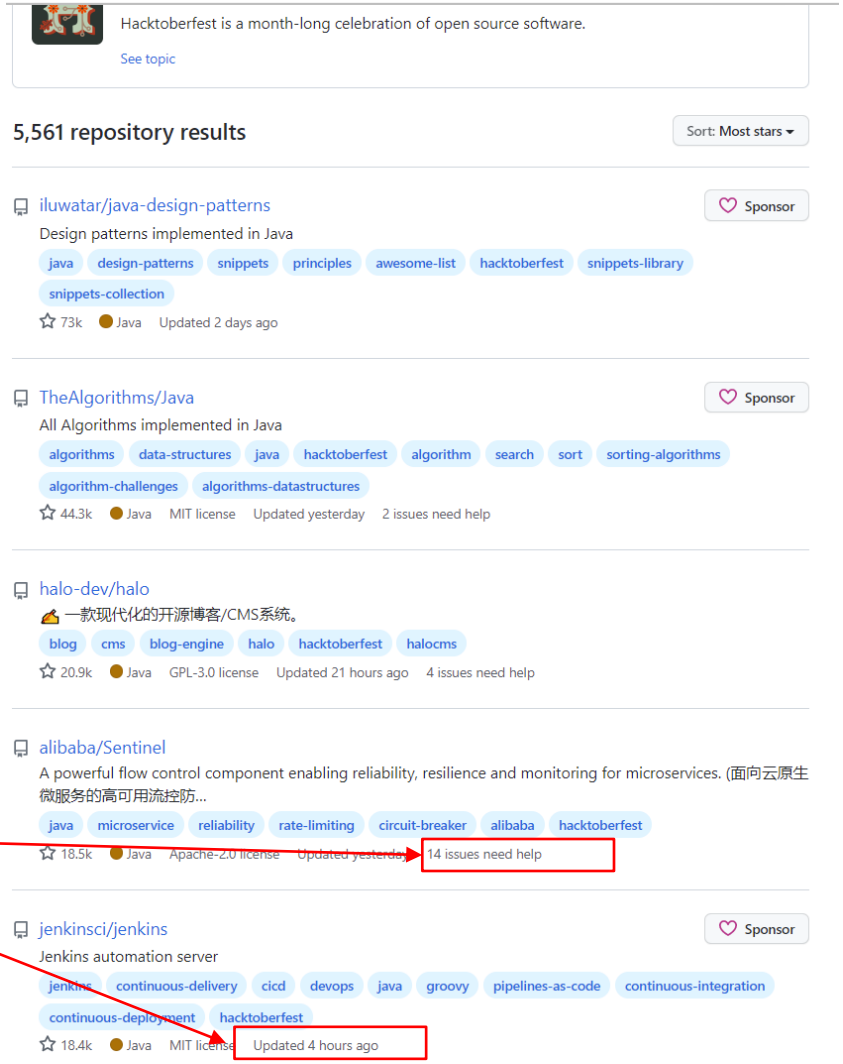
How to choose project & issues?

Search for projects

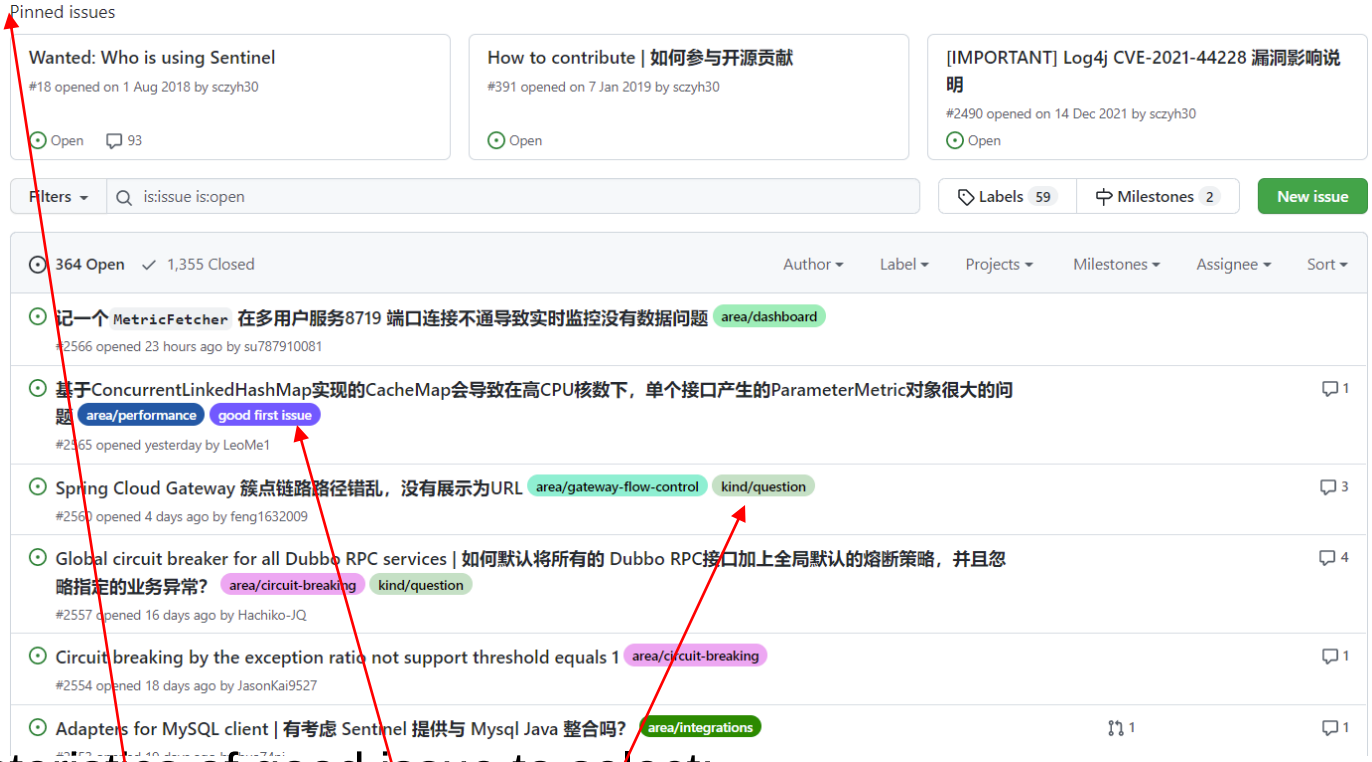
- https://github.com/search?l=Java&o=desc&q=hacktoberfest&s=stars&type=Repositories

Characteristics of good projects to select:

- Listed in hacktoberfest (a month-long celebration)
- Most stars (famous projects)
- Most recently updated (most actively maintained)
- Lots of issues that need help



Searching for issues



Characteristics of good issue to select:

- Good first issue (suitable for beginners)
- Not question/documentation
- Not pinned (usually means that the developer already planned to fix this issue so by the time you work on this for your project, already fixed)

How to start working on open source?

Chinese:
https://github.com/alibaba/Sentinel/wiki/%E5%BC%80%E6%BA%90%E8%B4%A1%E7%8C%AE%E6%8C%87%E5%8D%97#%E5%88%9B%E5%BB%BA-issue--pr

Steps

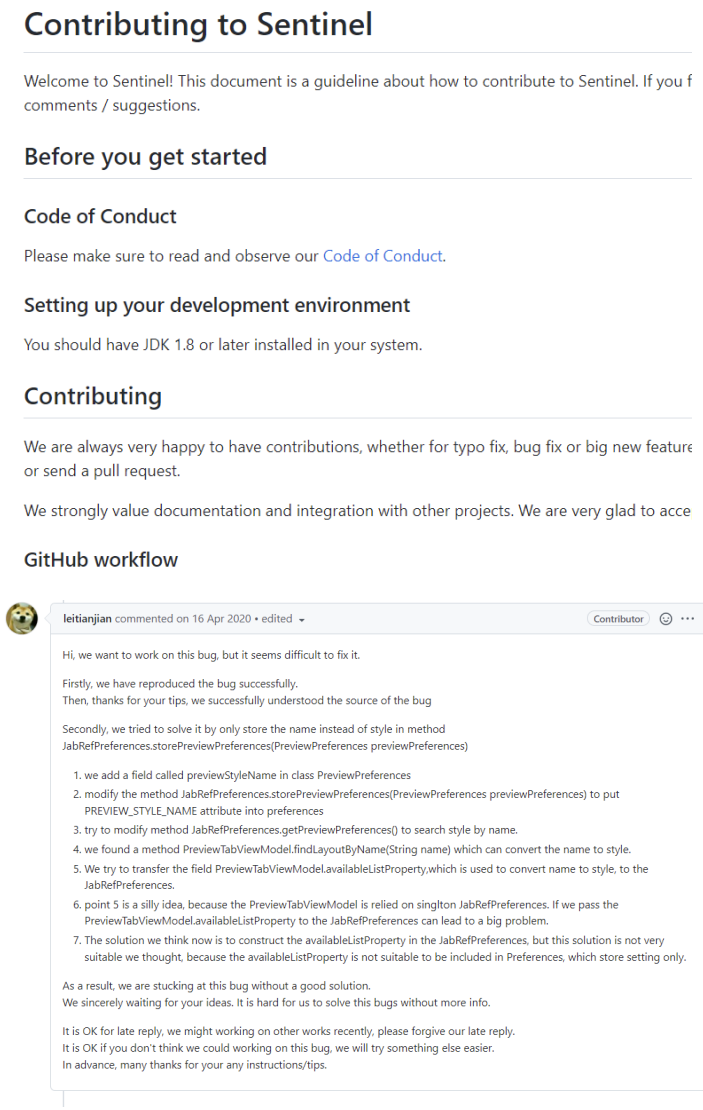
Before starting to work on issue:

1. Build the project
2. Run the test cases
3. Read contribution guideline
4. Sign the (Contributor License Agreement) CLA

Working on issue

1. Start from “good first issue” or issue that the developer said that “it is easy”
2. Read the issue, ask question, tell developer “Hi, I would interested to contribute. Can I work on this issue?”
3. Add a test (if unavailable)
4. Discuss with developer about your planned solution if the developer replied.

Example: https://github.com/JabRef/jabref/issues/6198



Contributing to Sentinel

Welcome to Sentinel! This document is a guideline about how to contribute to Sentinel. If you f comments / suggestions.

Before you get started

Code of Conduct

Please make sure to read and observe our Code of Conduct.

Setting up your development environment

You should have JDK 1.8 or later installed in your system.

Contributing

We are always very happy to have contributions, whether for typo fix, bug fix or big new feature or send a pull request.

We strongly value documentation and integration with other projects. We are very glad to acce

GitHub workflow

leitianjian commented on 16 Apr 2020 • edited — Contributor

Hi, we want to work on this bug, but it seems difficult to fix it.

Firstly, we have reproduced the bug successfully.
Then, thanks for your tips, we successfully understood the source of the bug

Secondly, we tried to solve it by only store the name instead of style in method JabRefPreferences.storePreviewPreferences(PreviewPreferences previewPreferences)

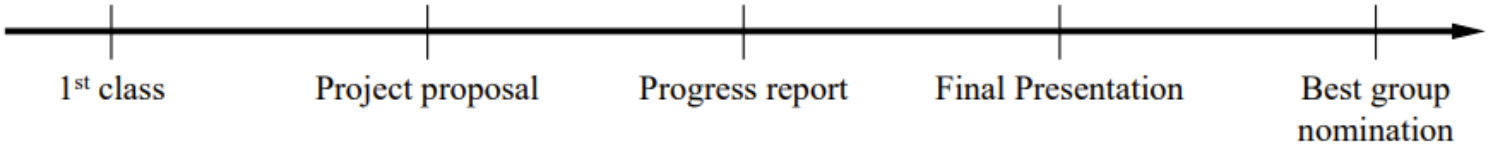
1. we add a field called previewStyleName in class PreviewPreferences
2. modify the method JabRefPreferences.storePreviewPreferences(PreviewPreferences previewPreferences) to put PREVIEW_STYLE_NAME attribute into preferences
3. try to modify method JabRefPreferences.getPreviewPreferences() to search style by name.
4. we found a method PreviewTabViewModel.findLayoutByName(String name) which can convert the name to style.
5. We try to transfer the field PreviewTabViewModel.availableListProperty,which is used to convert name to style, to the JabRefPreferences.
6. point 5 is a silly idea, because the PreviewTabViewModel is relied on singlton JabRefPreferences. If we pass the PreviewTabViewModel.availableListProperty to the JabRefPreferences can lead to a big problem.
7. The solution we think now is to construct the availableListProperty in the JabRefPreferences, but this solution is not very suitable we thought, because the availableListProperty is not suitable to be included in Preferences, which store setting only.

As a result, we are stucking at this bug without a good solution.
We sincerely waiting for your ideas. It is hard for us to solve this bugs without more info.

It is OK for late reply, we might working on other works recently, please forgive our late reply.
It is OK if you don't think we could working on this bug, we will try something else easier.
In advance, many thanks for your any instructions/tips.

How many issues to select?

- 2 issues per person for whole semester
  - 1 issues done when Progress report is due (around April 25)
  - 1 issue done when Final presentation is due (around May 16)



How to organize your project repository?

- Branching and Merging
- Submodules

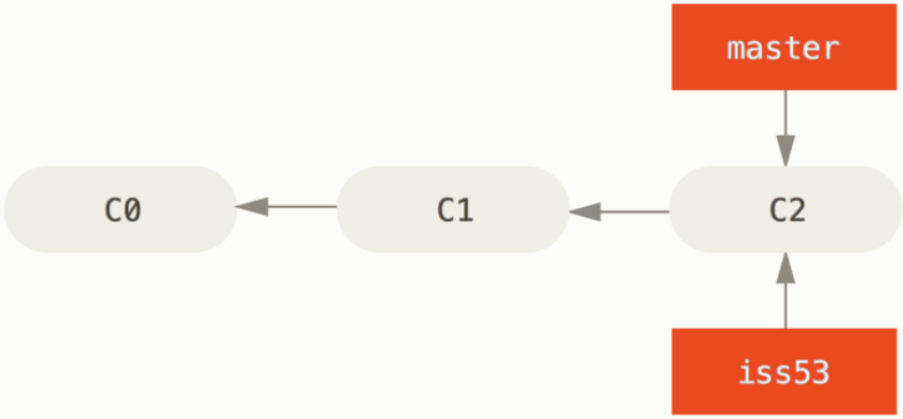
Branching and Merging

You've decided that you're going to work on issue #53 in whatever issue-tracking system your company uses. To create a new branch and switch to it at the same time, you can run the `git checkout` command with the `-b` switch:

```
$ git checkout -b iss53
Switched to a new branch "iss53"
```

This is shorthand for:

```
$ git branch iss53
$ git checkout iss53
```

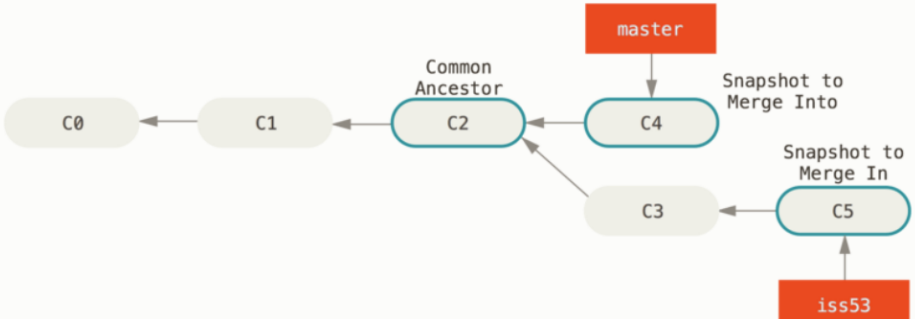


Basic Merging

Suppose you've decided that your issue #53 work is complete and ready to be merged into your `master` branch. In order to do that, you'll merge your `iss53` branch into `master`, much like you merged your `hotfix` branch earlier. All you have to do is check out the branch you wish to merge into and then run the `git merge` command:

```
$ git checkout master
Switched to branch 'master'
$ git merge iss53
Merge made by the 'recursive' strategy.
index.html |    1 +
1 file changed, 1 insertion(+)
```

This looks a bit different than the `hotfix` merge you did earlier. In this case, your development history has diverged from some older point. Because the commit on the branch you're on isn't a direct ancestor of the branch you're merging in, Git has to do some work. In this case, Git does a simple three-way merge, using the two snapshots pointed to by the branch tips and the common ancestor of the two.



https://git-scm.com/book/en/v2/Git-Branching-Basic-Branching-and-Merging

Submodules

- **Why submodules?**
- In Git you can add a submodule to a repository. This is basically a repository embedded in your **main** repository.

Advantages of using submodules:

- **You can separate the code into different repositories.**
- Useful if you have a codebase with big components, you could make a component a submodule. This way you'll have a cleaner Git log (commits are specific to a certain component).
- **You can add the submodule to multiple repositories.**
- Useful if you have multiple repositories that share the same components. With this approach you can easily update those components in all the repositories that added them as a submodule. This is a lot more convienient than copy-pasting the code into the repositories.
- Suitable if your group chooses >1 open-source projects to fix

https://gist.github.com/gitaarik/8735255

Submodules

Let's say you're working on a project called Slingshot. At the same time, in another repository, you've got another project called Rock—it's just a generic rock library, but you think it'd be perfect for Slingshot.

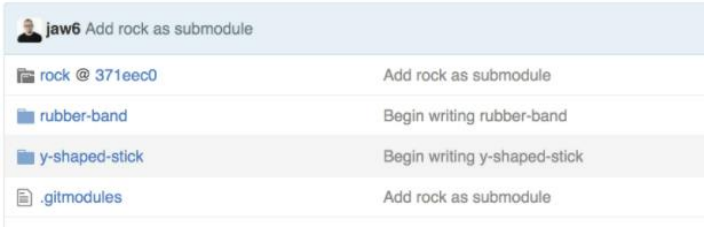
You can add rock as a submodule of slingshot. In the slingshot repository:

git submodule add https://github.com/<user>/rock rock

At this point, you'll have a rock folder inside slingshot, but if you were to peek inside that folder, depending on your version of Git, you might see … nothing.Newer versions of Git will do this automatically, but older versions will require you to explicitly tell Git to download the contents of rock:

git submodule update --init --recursive

If everything looks good, you can commit this change and you'll have a rock folder in the slingshot repository with all the content from the rock repository.



https://github.blog/2016-02-01-working-with-submodules/

Lab Session

- Lab Sections this week
  - Meet “your” TA
  - Get familiar with GitHub
- Be ready for class
  - Come with your own machine if at all possible. With Eclipse/IntelliJ (recommended)

Todos

- Sign up for a new GitHub account if you don’t have one
- Start finding your group members!
- Read the guidelines under the “Project Resources” folder