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

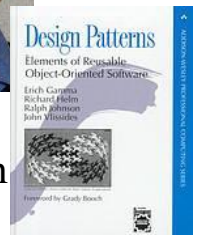
Have experience in teaching:

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

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

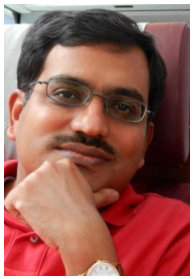
Darko Marinov

Ralph Johnson



Gang of four

PhD
2012-2018
Teaching Assistant for ST



Assistant Professor
June 2018
Proposed first ST class

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Detect outdated documentation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

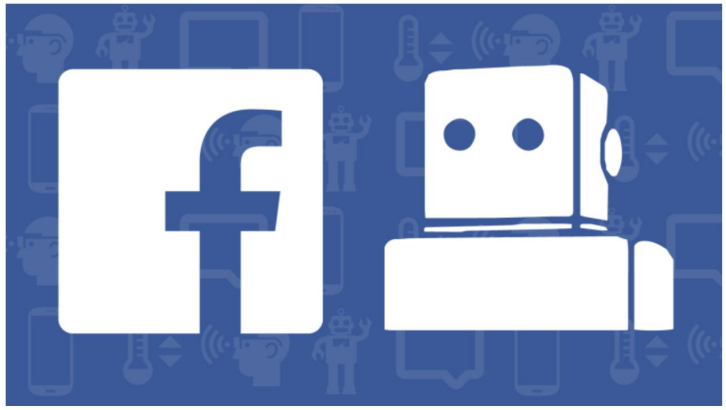
- Writing code
- Debugging (Find why it is wrong?) your code
- Fixing your bugs

What a robot could debug & fix your code automatically?

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

Josh Constine @joshconstine / 5 months ago

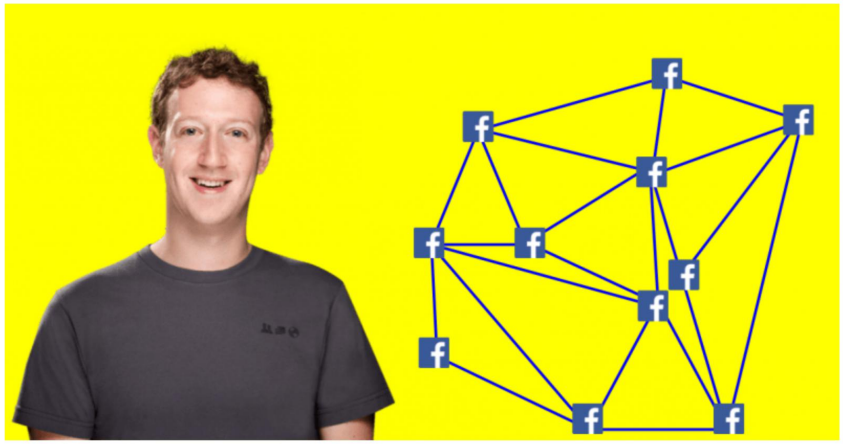
Comm



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

ICSE 40TH INTERNATIONAL CONFERENCE ON SOFTWARE ENGINEERING
MAY 27 - JUNE 3 2018
GOTHENBURG, SWEDEN

Attending ▾ Program ▾ Tracks ▾ Organization ▾ Search Series ▾

* ICSE 2018 * (series) / Technical Papers /

Repairing Crashes in Android Apps

Who	*Shin Hwei Tan, Zhen Dong, Xiang Gao, Abhik Roychoudhury*
Track	* ICSE 2018 * Technical Papers
When	**Wed 30 May 2018 15:00 - 15:20 at H2 room** - Apps and App Stores II Chair(s): Patrick Maeder
Link to Preprint	http://www.shinhwei.com/droixicse_camera.pdf

- We propose first repair tool for Android app

25 May - 31 May 2019, Montréal, QC, Canada

Attending ▾ Sponsorship ▾ Program ▾ Tracks ▾ Organization ▾ Search Serie

ICSE 2019 (series) / Software Engineering in Practice /

SapFix: Automated End-to-End Repair at Scale

- 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 Tan
- Teaching Assistant: 胡春风Hu Chun Feng
  - Email： hucf@sustc.edu.cn
- Student Helpers/ Lab Assistant:
  - 范治宇
  - 张晓文
  - 李子强
  - 王泽准
  - 蔡源稻
  - Paola Yanez Pazmino

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
- Prerequisites
  - CS309: OOD

Textbooks

- 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%
  - Android applications
  - Group of 5 (before the 1st lab next week)
  - 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

Project

- Develop some real software
  - Groups of 5 students
- Deliverables
  - Proposal (due in three weeks)
  - 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

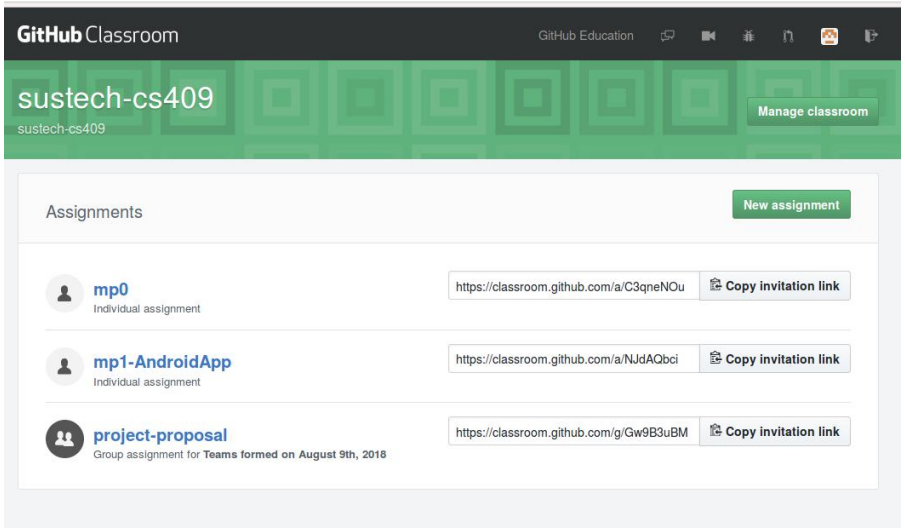
Collaboration

- 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

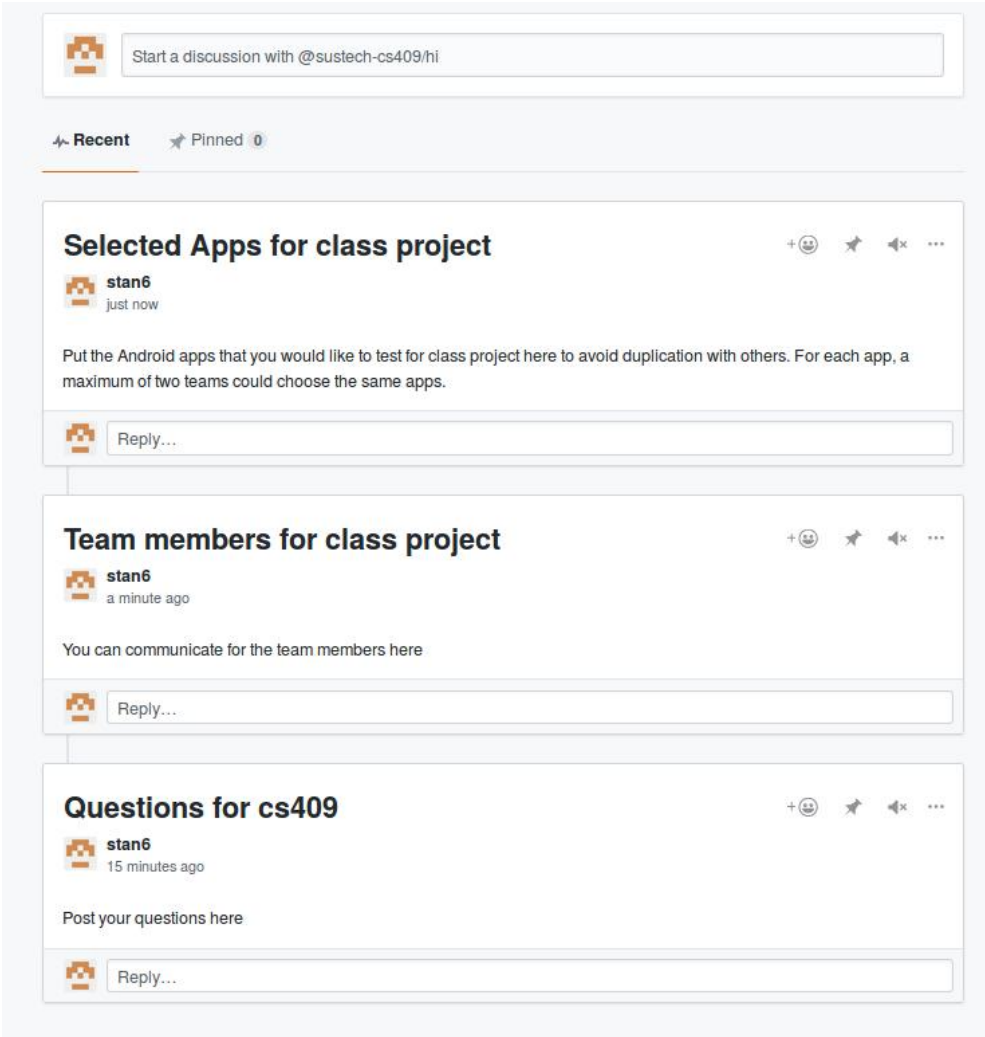
- GitHub Classroom
  - Share the bugs that your find! (Remember to document when you find a bug through knowledge shared in GitHub discussion!)
  - Helps each other with tools installation
- Instructor: Shin Hwei Tan
- Email: tansh3@sustc.edu.cn
  - Please include **se-sustech** in the title of the email
  - Write your email in **English**!
- Office: 创园(Innovation park) Building 10, Room 605
- 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.

Discussion through GitHub

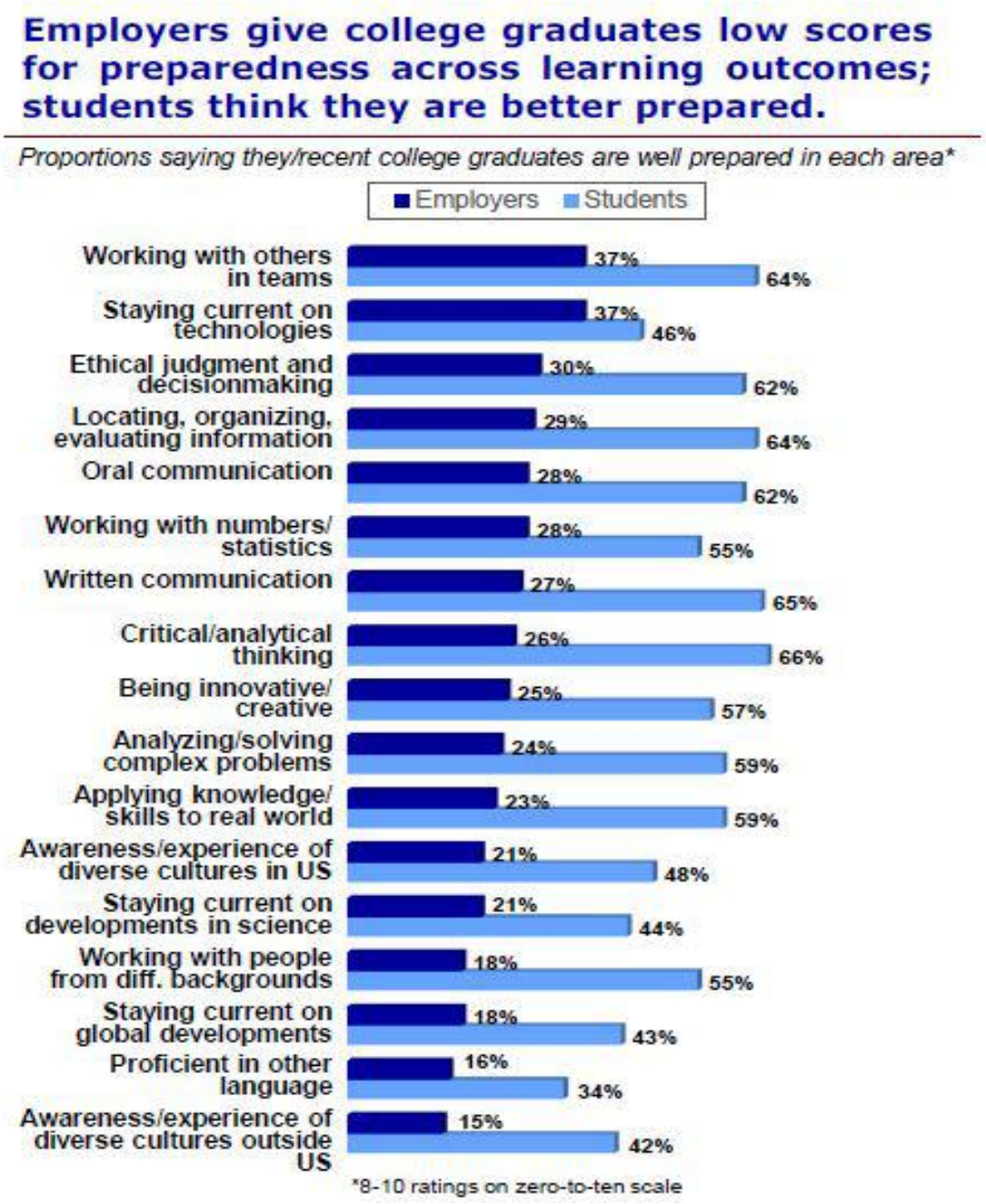


Expectations

- You are responsible for your own class
  - You will fail if you have many late submission
  - 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

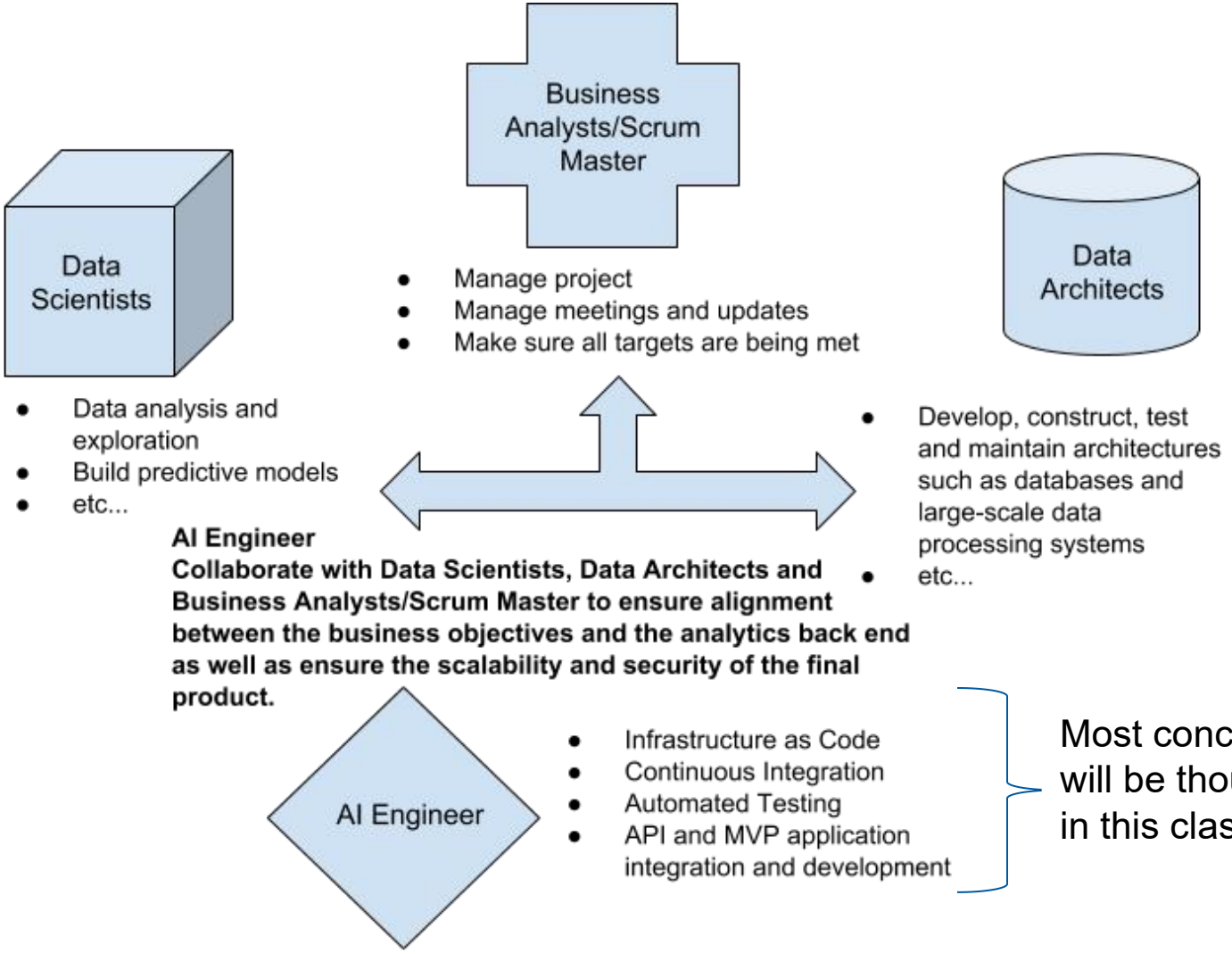
Top AI Jobs Open in the U.S.

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 – 428 more
  - Project initiation
  - Project monitoring and control
  - Software quality management
- Development – 427 and 428
  - Requirements
  - Design
  - Implementation

Activities in IEEE 1074 (2)

- Post-development
  - Installation
  - Operation and support
  - Maintenance – 427
  - Retirement
- Integral processes – 427 and 428
  - 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

- JavaScript
- HTML
- CSS
- SQL
- Java
- Bash/Shell
- Python
- C#
- PHP
- C++
- C
- TypeScrip
- Ruby
- Swift
- Assembly
- Go
- Objective-C
- VB. NET
- R
- Matlab
- VBA
- Kotlin
- Scala
- Grovvy
- Perl

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

What framework do you know?

Popular Frameworks, Libraries, & Tools According to StackOverflow

- Node.js
- Angular
- React
- .NET Core
- Spring
- Django
- Cordova
- Tensorflow
- Xamarin
- Spark
- Hadoop
- Torch/PyTorch

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

Which text editor do you use?

Popular Development Evironments

- Visual Studio Code
- Visual Studio
- Notepad++
- Sublime Text
- Vim
- IntelliJ
- Android Studio
- Eclipse
- Atom
- PyCharm
- Xcode
- PHPStorm
- NetBeans
- IPython / Jupyter
- Emacs
- RStudio
- RubyMine
- TextMate
- Coda
- Komodo
- Zend
- Light Table

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

Lab Session

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

Todos

- Start thinking about your project proposal
- Sign up for a new GitHub account if you don’t have one