Carnegie Mellon University Qatar

17-313

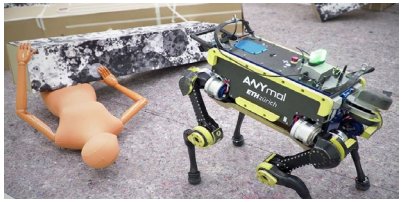
Foundations of Software Engineering

Fall 2023

S3D
Software and Societal Systems Department

Introductions

Eduardo Feo-Flushing



B.Sc. In Computer Eng., Universidad Simon Bolivar, Venezuela - 2007

M.Sc. in Informatics, University of Trento, Italy - 2010

M.Sc. in Software Systems Engineering, RWTH-Aachen, Germany- 2010

Ph.D. in Informatics, University of Lugano - IDSIA, Switzerland - 2017

Postdoc, CMUQ - Fall 2018

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Course Staff

Teaching Assistant

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Course Assistants

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Software is everywhere

(Bad)Software is everywhere

Toyota Case: Single Bit Flip That Killed

Junko Yoshida

10/25/2013 03:35 PM EDT

During the trial, embedded systems experts who reviewed Toyota's electronic throttle source code testified that they found Toyota's source code defective, and that it contains bugs -- including bugs that can cause unintended acceleration.

"We did a few things that NASA apparently did not have time to do," Barr said. For one thing, by looking within the real-time operating system, the experts identified "unprotected critical variables." They obtained and reviewed the source code for the "sub-CPU," and they "uncovered gaps and defects in the throttle fail safes."

The experts demonstrated that "the defects we found were linked to unintended acceleration through vehicle testing," Barr said. "We also obtained and reviewed the source code for the black box and found that it can record false information about the driver's actions in the final seconds before a crash."

Stack overflow and software bugs led to memory corruption, he said. And it turns out that the crux of the issue was these memory corruptions, which acted "like ricocheting bullets."

Barr also said more than half the dozens of tasks' deaths studied by the experts in their experiments "were not detected by any fail safe."

Bookout Trial Reporting

http://www.eetimes.com/document.asp?doc_id=1319903&page_number=1 (excerpts)

"Task X death in combination with other task deaths"

S3D

Forbes

daylife)

implementation of the most

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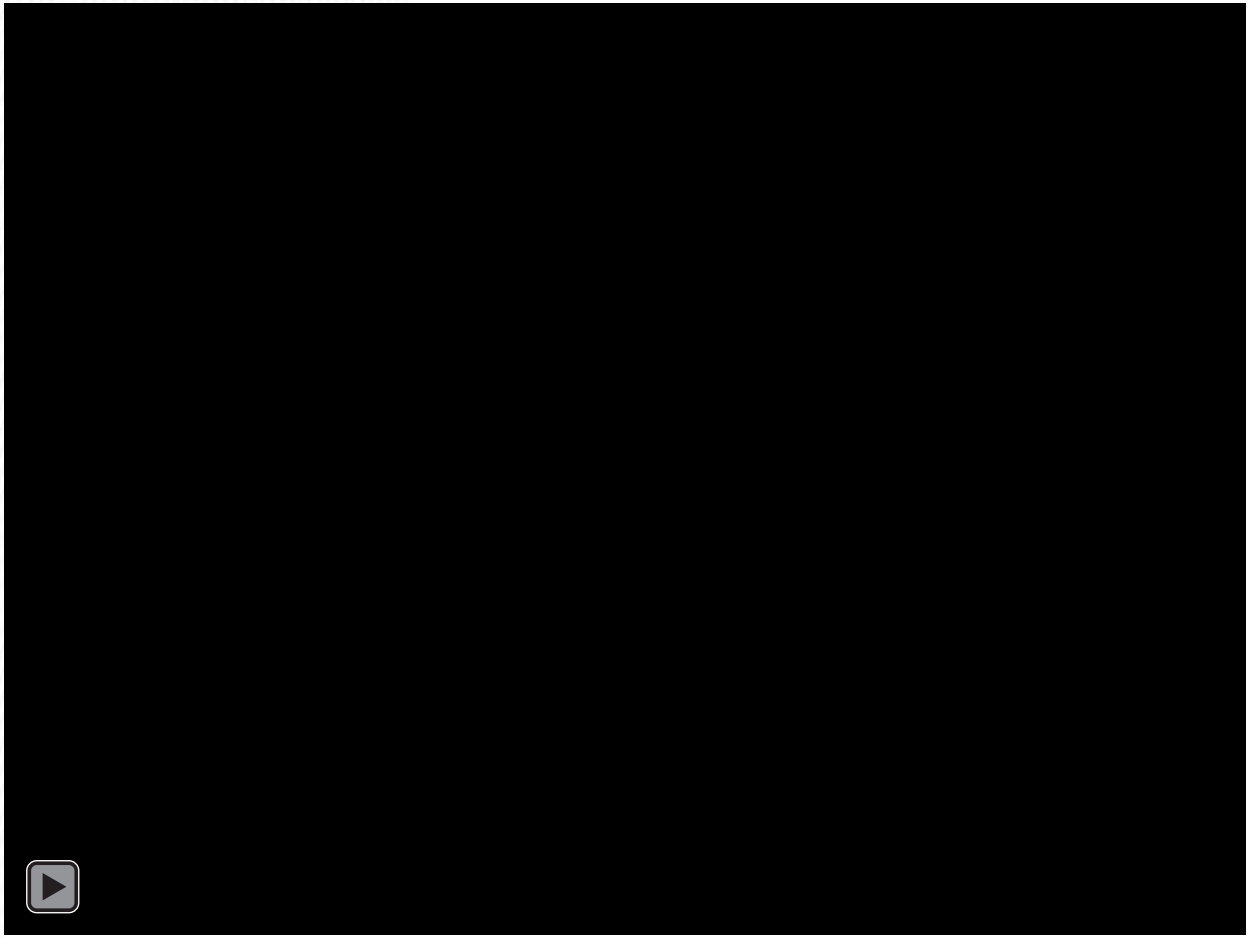


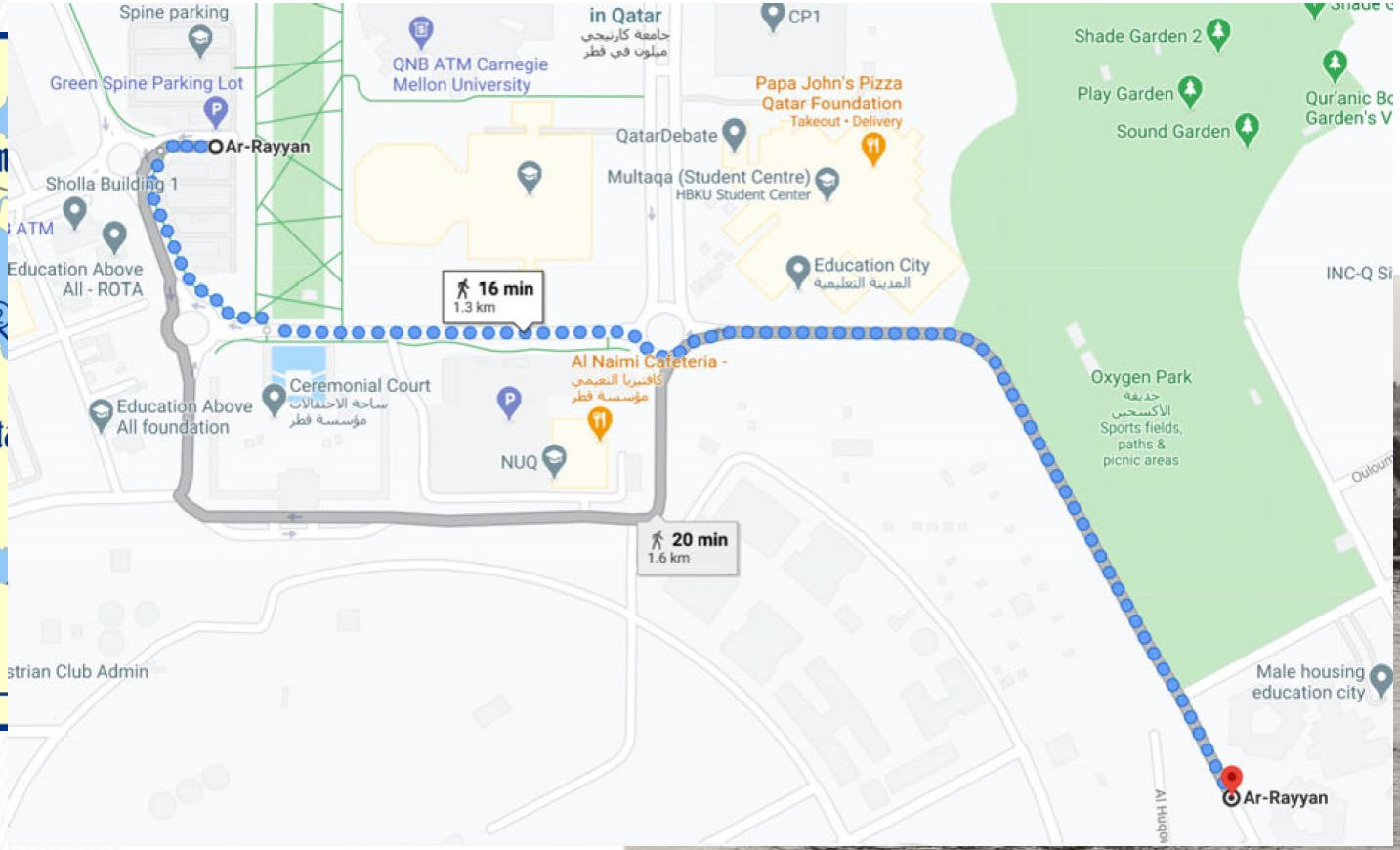

THE VERGE
BOEING
REDLINE
The many human errors that brought down the Boeing 737 Max

S3D

Vasa

Vasa


Skeppsgården
Gamla st
500 m


Spine parking
Green Spine Parking Lot
Ar-Rayyan
Sholla Building 1
Education Above All - ROTA
QNB ATM Carnegie Mellon University
in Qatar
جامعة كارنيجي ميلون في قطر
CP1
Papa John's Pizza
Qatar Foundation
Takeout • Delivery
QatarDebate
Multaqa (Student Centre)
HBKU Student Center
Education City
المدينة التعليمية
Shade Garden 2
Play Garden
Sound Garden
16 min
1.3 km
Al Naimi Cafeteria -
كافتيريا النعيمي
مؤسسة قطر
Ceremonial Court
ساحة الاحتفالات
مؤسسة قطر
Education Above All foundation
NUQ
20 min
1.6 km
Oxygen Park
حديقة الأكسجين
Sports fields, paths & picnic areas
Male housing education city
Ar-Rayyan
Al Huqn

What happened is now called “Vasa syndrome”

- Changing shipbuilding orders
- No specifications for modified keel
- Shifting armaments requirements

REQUIREMENTS

- Shipwright’s death

Teams

- No way to calculate stability, stiffness, or sailing characteristics

Metrics

- Failed pre-launch stability tests

QA

S3D

Software *Engineering*?

What is engineering? And how is it different from hacking/programming?

1968 NATO Conference on Software Engineering

- Provocative Title
- Call for Action
- “Software crisis”

S3D

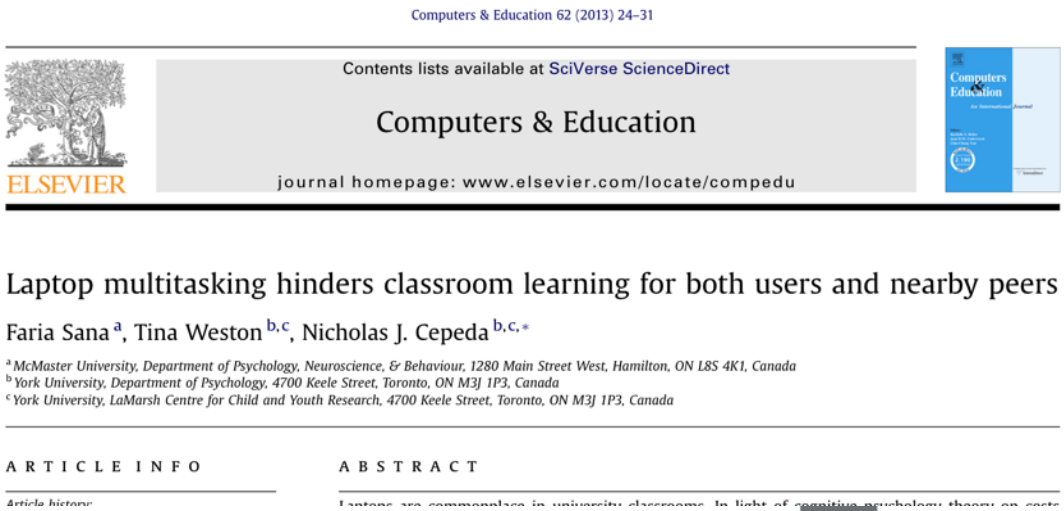

MTOA
CRIA
MTIA
MT2A
CRIA
CPIA
CPJA
TYIA
CRIA
LPIA
MT2A

Margaret Hamilton

- **The First ‘Software Engineer’**
- **“**Software developers earned the right to be called engineers.**”**
- Led the Software Engineering Division of the MIT Instrumentation Laboratory
- Contracted with NASA to develop the Apollo program’s guidance system: 1961 - 1969

This Course

"...participants who multitasked on a laptop during a lecture scored lower on a test compared to those who did not multitask, and participants who were in direct view of a multitasking peer scored lower on a test compared to those who were not. The results demonstrate that *multitasking on a laptop poses a significant distraction to both users and fellow students and can be detrimental to comprehension of lecture content*."



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Laptop multitasking hinders classroom learning for both users and nearby peers

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ARTICLE INFO

Article history:

ABSTRACT

Laptops are commonplace in university classrooms. In light of cognitive psychology theory on costs

Faria Sana, Tina Weston, and Nicholas J. Cepeda. 2013. Laptop multitasking hinders classroom learning for both users and nearby peers. Computing Education.

Course infrastructure and logistics

Infrastructure/source of truth

- Course website: schedule, slides, syllabus, office hours
- Gradescope: homework, grades, other material
- Slack for communication and collaboration.
- Git/Github for coding and collaboration

Logistics:

- Lecture in-person only
- All recitations are in-person
- Office Hours will be posted on the (calendar) website.

Connect with us for the class

- All links on our course website: https://CMU-17313Q.github.io
- We will send you an invite for slack, please be on the lookout for it.

S3D

Name

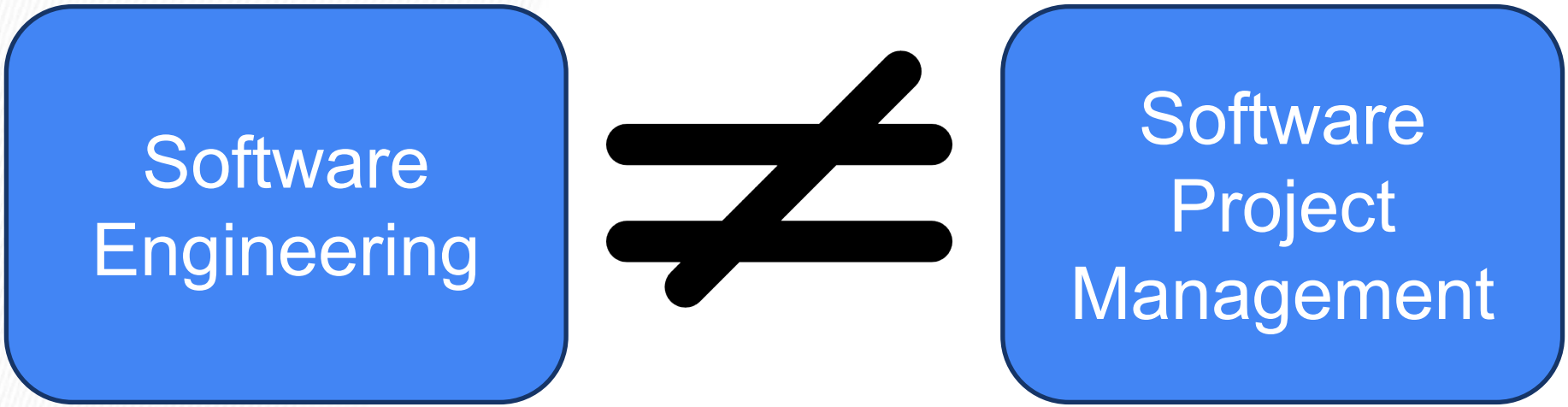
Previous software development experience?

Software Development ambitions ?

Have you had an internship, if so where?

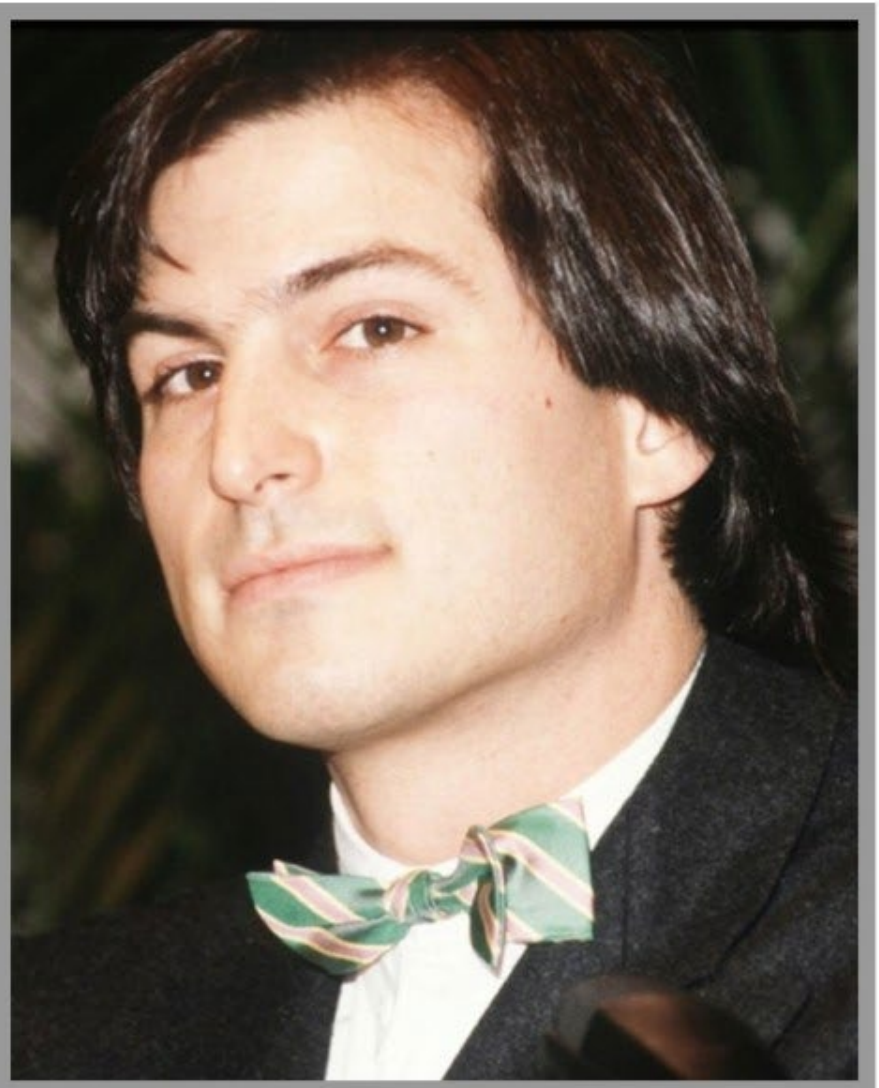
Course Themes

- Software engineering as a human process
- Process
- Requirements
- Measurement
- Quality, incl. Security
- Time and team management
- Ethics
- Software Engineering for AI/ML
- Strategic thinking about software


Software Engineering
Software Project Management

"You know who the best managers are? They're the great individual contributors, who never ever want to be a manager, but decide they have to be manager because no one else is going to be able to do as good a job as them"

Steve Jobs
American Entrepreneur
1955-2011



S3D

Prerequisites

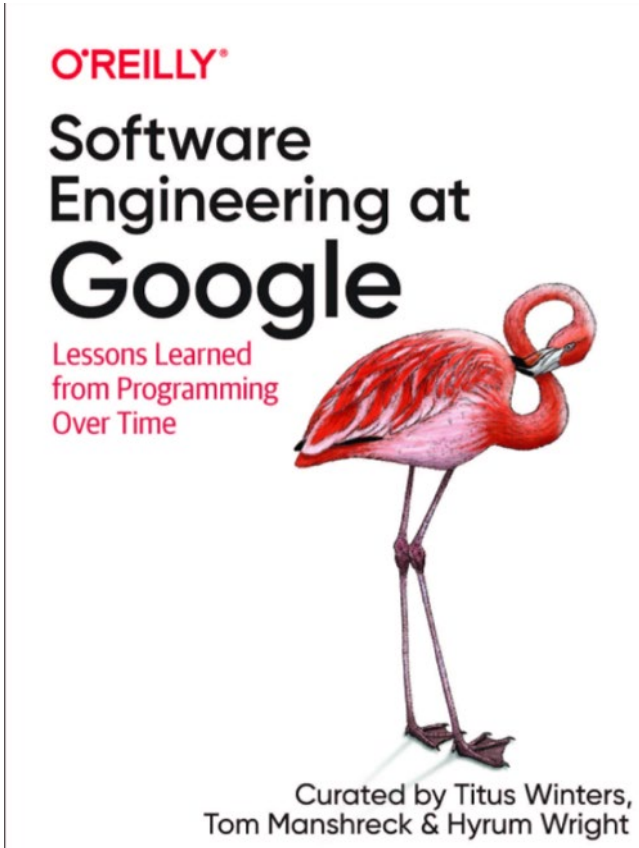
- Assumes working knowledge of popular programming language(s)
- You will have the best experience if you have had an internship (ask us if you have any questions) or have worked in ‘large’ SW projects
- 17-313 largely focused on human issues and quality beyond functional correctness

Readings and Quizzes

- Reading assignments for most lectures
  - Preparing in-class discussions
  - Background material, case descriptions, possibly also podcast, video, Wikipedia
  - Complement with research
- Few short and easy online quizzes on readings, count as participation
  - Goal is to prep for lecture.

Textbook

- No single textbook
- Assigned readings from different sources
  - Book chapters (library)
  - News articles
  - Lecture notes
- Recommended supplementary reading: Software Engineering at Google
  - Available for free online (legally): https://abseil.io/resources/swe-book



Gaining Experience: Central to 313!

- Case study analyses
- Team assignments
- Open source engagement

Evaluation

- Assignments (60 %)
  - Regular homework, mostly in teams with individual component
  - Open source engagement
- Midterm (20 %)
- Participation activities (20 %)
  - In-class exercises
  - Pre-class reading assignments
  - Recitation exercises

Recitations

- Practical tasks, preparation for homework, extra material, discussions
- **Have your github account at the ready**.
  - Bring your laptop!
- This week: GitHub (helpful for recitation 1)
- Teams will all go to the same recitations

Assignments

- Setup and test an existing software product
- Get up to speed with the technologies
- Come together as a team and decide on metrics
- Develop a design doc, and implement a machine learning microservice
- Develop a plan for evaluating the quality of the software
- Contribute to an open source project of your choice

Team Assignments

- Mirror realistic setting
- Assigned teams throughout the semester
  - Fill in team building survey before next lecture
- Teamwork surveys every week
- Conflict resolution process as needed
- Most team assignments have individual components

Participation

- Participation is important
  - Participation in in-class discussions
  - Active participation in recitations

    Both quality and quantity are important, quality more than quantity
- Participation != Attendance

Professionalism

- Being a professional means you should work well with others
- The best professionals are those who make those around them better
- If you feel someone is not treating you or someone else in a professional manner, you have two options:
  - If you feel you have the standing to do so, speak up!
  - Reach out to the course staff, and we will meet with you privately to discuss it, as well as preserve your anonymity

Late day policy

- No late days
  - (simply doesn't work with team assignments)
- Accommodations in case of health issues, travel for interviews, ... on case by case base
  - Inform us at least 2 days before deadline

Academic Honesty

- Standard Collaboration Policy
- In group work, be honest about contribution of group members; do not cover for others
- HW1 will be done in 1 public repo. PLEASE reach out if you have concerns.

HW1 is out!

- Familiarize yourself with both the course and the project you will be working on
- Start early!

For next class: survey, scheduling

“Quiz” for Tuesday: survey + scheduling

- Forming groups based on schedule availability.
- Shaping the courses based on
  - your background knowledge
  - your interests
- Identifying experience/interest.