

17-313

FOUNDATIONS OF SOFTWARE ENGINEERING

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B.E. University of Mumbai – 2011



M.Tech. IIT Bombay – 2013

IBM Research

Software Engineer @ IBM Research 2013—2015



Security Engineering Intern @ Samsung – Summer 2017

Microsoft
Research

Research Intern @ Microsoft – Summer 2018

Berkeley
UNIVERSITY OF CALIFORNIA

PhD, UC Berkeley – 2020

Carnegie
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Assistant Professor, CMU – Since Fall 2020

MICHAEL HILTON



B.S. San Diego State University - 2002



Software Engineer at DoD - 2002 to 2011



M.S. Cal Poly San Luis Obispo - 2013



PhD at Oregon State - 2017



Internship at Microsoft Research - Summer 2017



Assistant Teaching Professor at CMU - Fall 2017

Associate Teaching Professor at CMU – Fall 2020



TEACHING ASSISTANTS



SOFTWARE IS EVERYWHERE

Software glitch cost Hamilton victory - Mercedes

25 March 2018

MERCEDES

AUSTRALIA

HAMILTON



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"

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HealthCare.gov Diagnosis: The Government Broke Every Rule Of Project Management



Loren Thompson Senior Contributor 

Aerospace & Defense

I write about national security, especially its business dimensions.

- f After 400 software fixes and major hardware upgrades, the Obama
- Twitter icon Adminstration is claiming to have achieved its goal of transforming
- LinkedIn icon HealthCare.gov into a web-site that will operate smoothly for "the vast majority of users." That's important, because the site is central to implementation of the most



The Patient Protection and Affordable Care Act, better known as Obamacare, will probably be remembered as President Obama's most important domestic policy initiative. However, inept federal management of the HealthCare.gov web-site that is central to implementing Obamacare has left many users with a negative first impression of the program. (Image credit: AFP/Getty Images via @daylife)



implementation of the most

daylife)



VASA



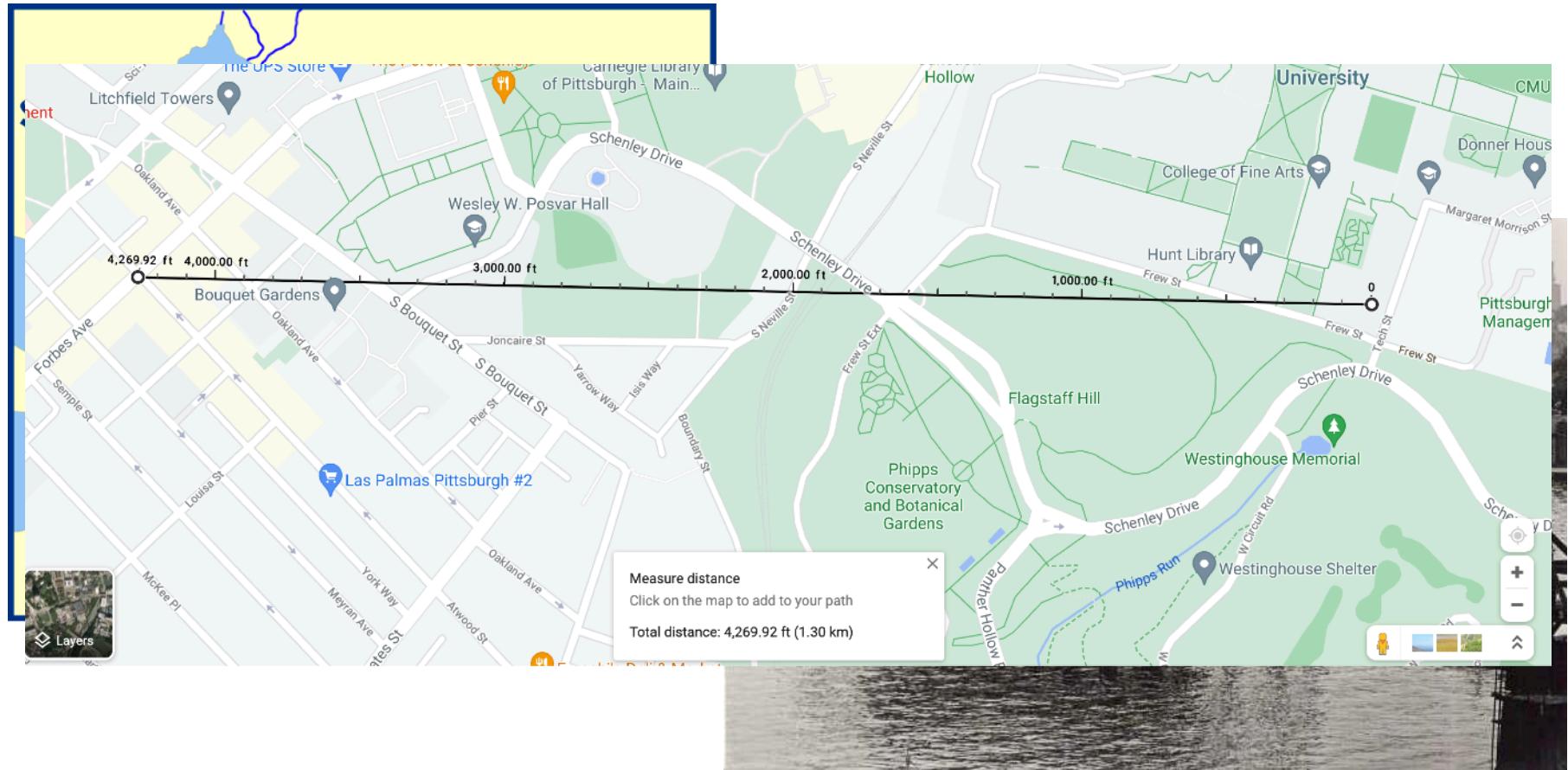
VASA



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QA

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”





MARGARET HAMILTON



MARGARET HAMILTON



THIS COURSE

BRAVE NEW WORLD AKA "NEW NORMAL?"

- First class back in person for most of us.
- We will comply with all regulations, however, regulations are changing often, we will ask you to be extra flexible.
- We cannot have a policy for everything that might happen. PLEASE reach out if you have any concerns. It is better to reach out too early than too late.

“...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.*”

Computers & Education 62 (2013) 24–31



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journal homepage: www.elsevier.com/locate/compedu



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

SMOKING SECTION

- Last full row



COURSE INFRASTRUCTURE AND LOGISTICS

Infrastructure/source of truth

Course website: schedule, slides, syllabus, office hours

Canvas (and 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 are over flexible.

If you want to talk to us, DM/email BOTH INSTRUCTORS at once.

Trust me, it's faster.

SYLLABUS AND COURSE MECHANICS

<https://cmu-313.github.io>

Hello
my name is

NAME

**PREVIOUS SOFTWARE DEVELOPMENT
EXPERIENCE?**

SOFTWARE DEVELOPMENT AMBITIONS?

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

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)
- vs 17-214
 - 17-313 largely focused on human issues and quality beyond functional correctness
 - 17-313 focused on larger scale

READINGS AND QUIZZES

- Reading assignments for most lectures
 - Preparing in-class discussions
 - Background material, case descriptions, possibly also podcast, video, Wikipedia
 - Complement with research
- Short and easy online quizzes on readings, due at FIXME on day of lecture.
 - 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>

O'REILLY®

Software Engineering at Google

Lessons Learned
from Programming
Over Time



Curated by Titus Winters,
Tom Mansreck & Hyrum Wright

GAINING EXPERIENCE: CENTRAL TO 313!

- Case study analyses
- Team assignments
- Open source engagement
- No “survivor”-style projects –
wait till 17-413 (Capstone)

EVALUATION

- Assignments (60 %)
 - Regular homework, mostly in teams with individual component
 - Open source engagement
- Midterm (20 %)
- Class-associated activities (10 %)
- Quizzes on reading assignments (10%)

RECITATIONS

- Practical tasks, preparation for homework, extra material, discussions
- Have your github account at the ready.
 - Bring your laptop!
- This week: Docker (helpful for recitation 1)

ASSIGNMENTS

- Setup and test an existing software product
- Come together as a team and decide on metrics
- Solicit requirements
- 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
- Peer evaluation and conflict resolution process as needed
- Most team assignments have individual components

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.

FOR SEPT 3: SURVEY, SCHEDULING



TWO "QUIZZES" FOR THURSDAY: SURVEY, SCHEDULING

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