Carnegie Mellon University Qatar

Introduction

17-313 Fall 2025

Foundations of Software Engineering

https://cmu-17313q.github.io

Eduardo Feo Flushing

S3D Software and Societal Systems Department

Introductions

Eduardo Feo Flushing

B.Sc. In Computer Eng., Universidad Simón Bolívar, 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, CMU Qatar - Fall 2018

Visiting Assistant Teaching Professor, CMU Qatar – Fall 2021

Assistant Teaching Professor, CMU Qatar – Fall 2023

Course Staff

Teaching Assistant

- Nour Ali

Course Assistants

- Steve Ndayambaje
- Nick Devidze

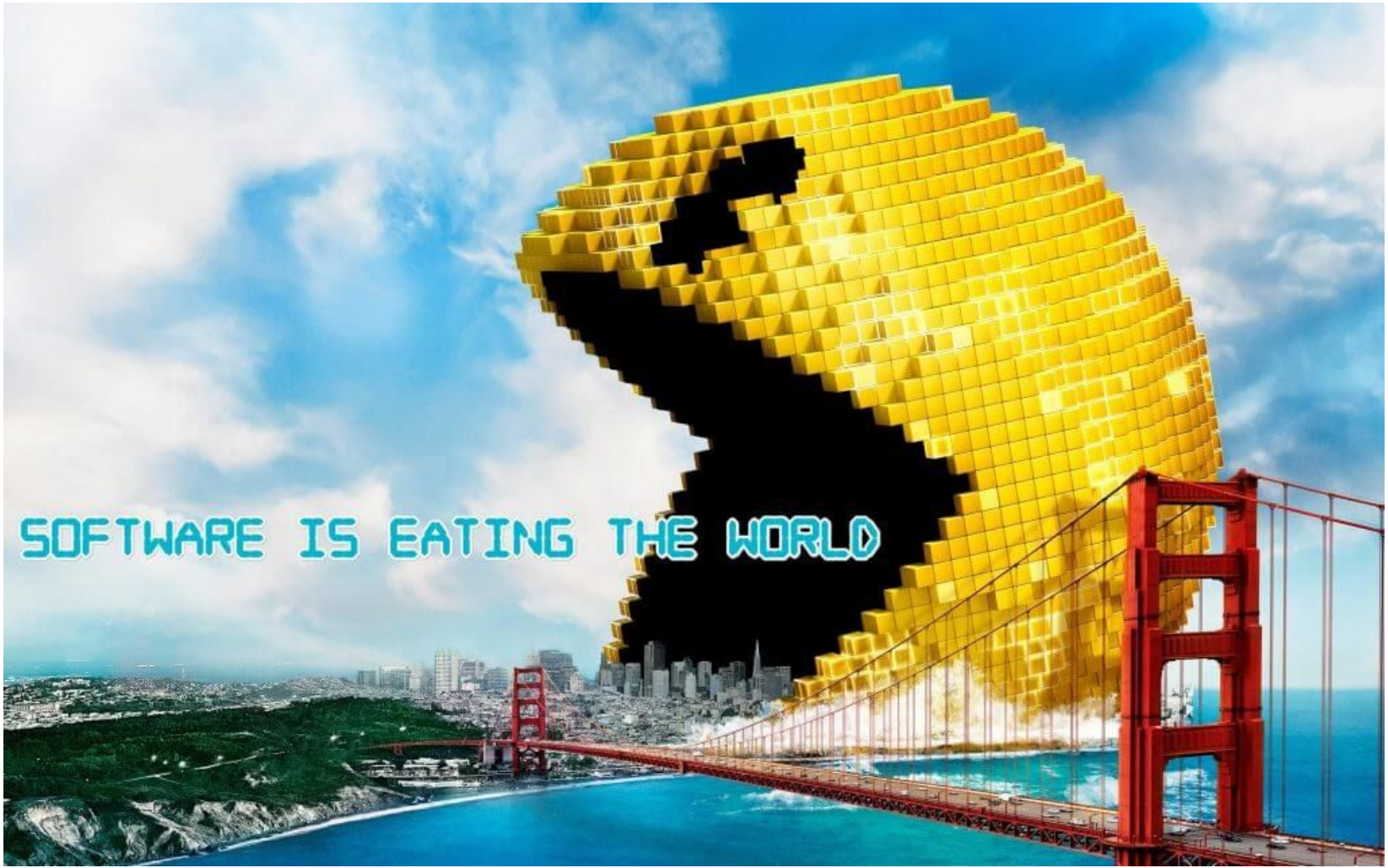


Image credit: https://loicknuchel.fr/blog/2017/06/25/why-functional-programming

Software is everywhere

(Bad)Software is everywhere

HealthCare.gov

Learn | Get Insurance | Log in | Español

Individuals & Families | Small Businesses | All Topics | Search | SEARCH

The System is down at the moment.

We're working to resolve the issue as soon as possible. Please try again later.

Forbes

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.

After 400 software fixes and major hardware upgrades, the Obama Administration is claiming to have achieved its goal of transforming 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)


-00:00:17


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

Security

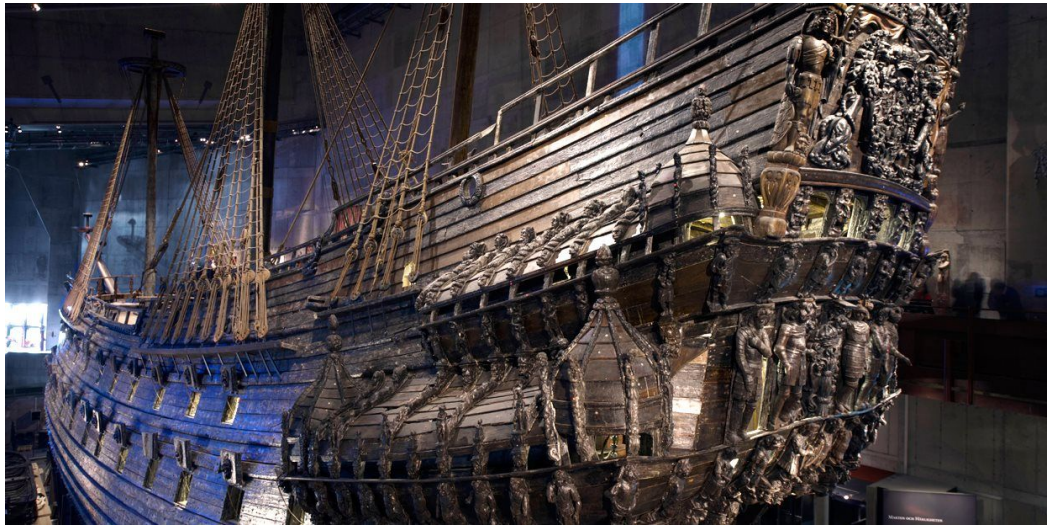
CrowdStrike accepts award for 'most epic fail' after global IT outage

Anthony Ha / 10:40 AM PDT • August 11, 2024

Comment

Image Credits: Lorenzo Franceschi-Bicchierai / TechCrunch

Vasa



Vasa

Image credit: perdurabo10.tripod.com/ships/id170.html

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

Software Engineering?

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

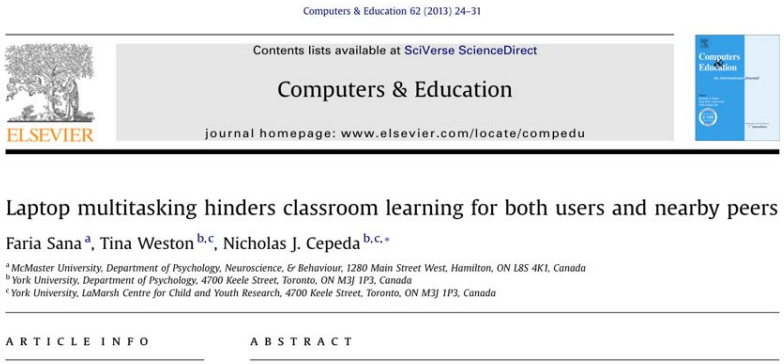
1968 NATO Conference on Software Engineering

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

Margaret Hamilton

- **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



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Computers & Education

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

Laptop multitasking hinders classroom learning for both users and nearby peers

Faria Sana [a], Tina Weston [b,c], Nicholas J. Cepeda [b,c,*]

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ARTICLE INFO

ABSTRACT

"...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."

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

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Smoking Section

- Last full row

<Name>

What is the most recent software team project you've worked on? (**30 Seconds**)

and how was your experience? **1 word**

Course infrastructure and logistics

- Infrastructure/source of truth
  - Course website: schedule, slides, syllabus, office hours
  - Gradescope for 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

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Connect with us for the class

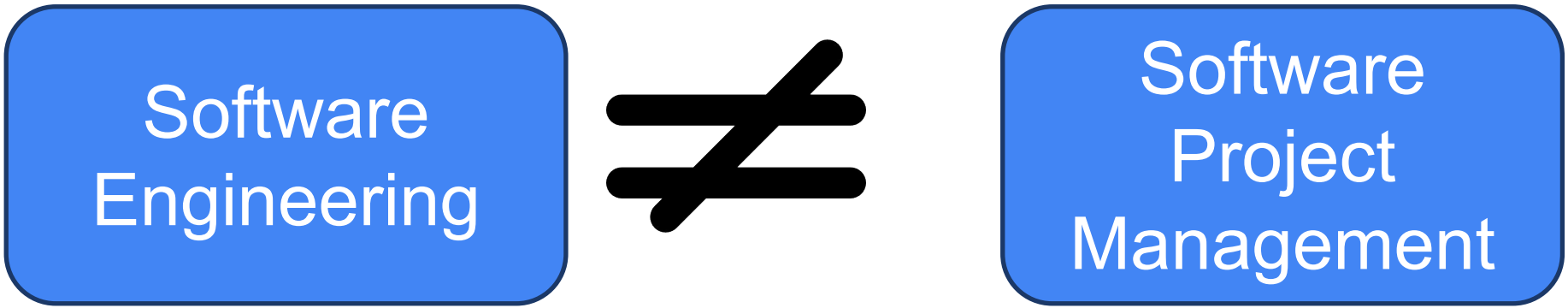
- All links on our course website: https://cmu-17313q.github.io
- We sent you an invite for Slack, please check your email.

Activity: From Idea to Software

- Work in small groups of 3 - 4
- **Invent a software product**. It can be something that already exists (like WhatsApp, Spotify, Duolingo) or something new you makeup. Give it a short name or tagline.
- List **any 5 activities** your team would need to do to turn this idea into a real software product.
- Write it down on a piece of paper with your Andrew ID(s) on it.

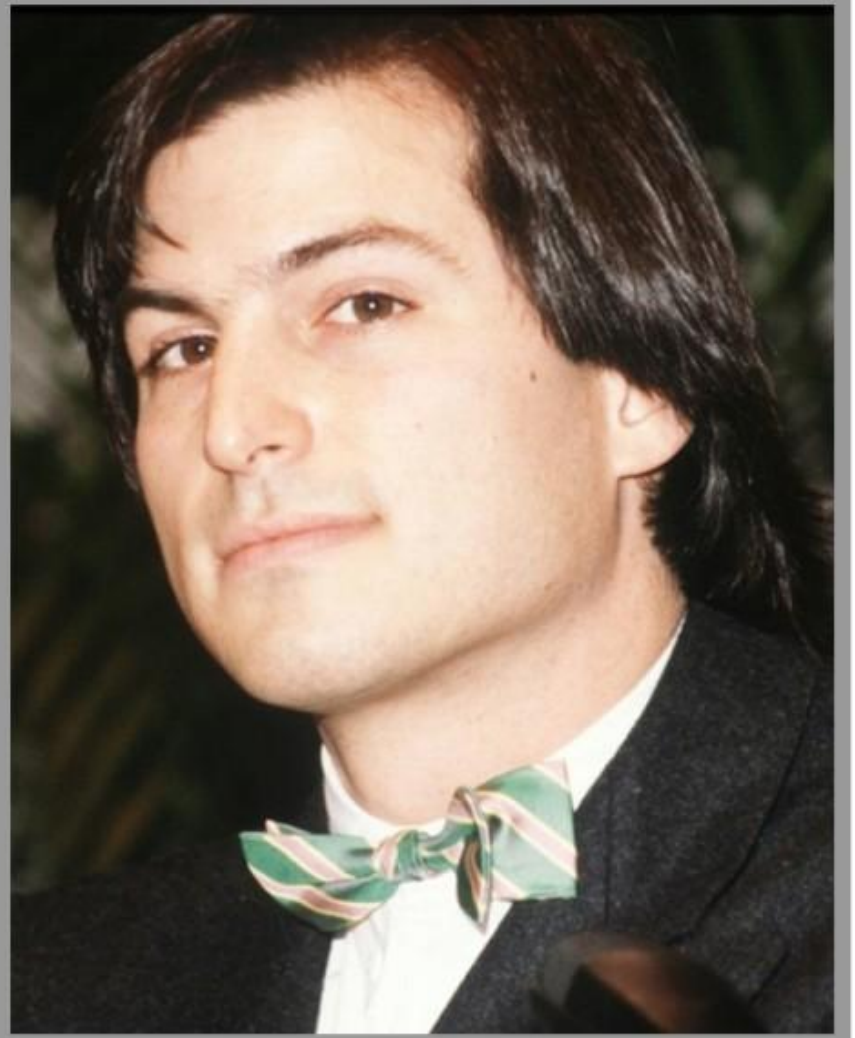
Course Themes

- Software engineering as a human process
- Requirements and Specifications
- Metrics and Measurement
- Software Quality: Testing + CI + Security
- Continuous Deployment and DevOps
- Software Project Teams
- Managing Time, Teams, and Risks
- Software Architecture and Design Docs
- Scaling and Performance, Trade-offs
- AI/ML in Software Engineering
- Open-Source Software
- 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



Readings, Quizzes, and Participation Activities

- Reading assignments for some lectures
  - Preparing in-class discussions: background material, case descriptions, possibly also podcast, video, Wikipedia
- In-person activities
  - **Lecture**: Active learning exercises every lecture (except this one)
  - **Recitation**: Working sessions, submission on Gradescope
- All of the above count as graded “participation activities”
  - You may miss up to 4 participation activities with no grade penalty
    (No need to send emails ahead-of-time)

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Gaining Experience: Central to 313!

- Case study analyses
- Team assignments
- Open-source engagement
- Hands-on experience is key!!!
    - “Learn by doing”

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Evaluation

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

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Recitations

- Practical tasks, preparation for homework, extra material, discussions
- **Have your GitHub account at the ready.**
  - Bring your laptop!
- This week only: Async/offline recitation for NodeBB (to prepare for P1 and P2)
- From P2 onward: Project teams will all be in the same recitations… Good (forced) opportunity to meet in person
- We will track attendance

“Homework” Assignments / Projects

- P1: Setup and improve a large existing software product
  - Get up-to-speed with new technologies quickly and on your own
- P2: Collaborative development on a large software project
  - Add features and follow SE process
- P3: Continuous Integration + Deployment
- P4: Develop a design doc, and integrate AI into an existing software product
- P5: Open-source Excursion
  - Open-ended project: contribute to an OSS project using everything you have learned; get kudos for having PRs merged

Warning! Course & HW structure may be different than what you are used to…

- Lecture topics are on high-level ideas about software engineering; case studies and experiences
- Projects require applying these ideas to technical artifacts
- Projects simulate “real-world” professional SE experience
- Technical aspects of project <u>will not be taught in class</u>
  - Explicit learning goal: learn new tools, languages, etc. on your own
  - Ask for help when needed; recitations provide demos and resources
- Project requirements are often **<u>vague or under-specified</u>** (**intentionally**)
  - Feel free to ask for clarifications, but expect subjective responses
  - Focus for assessment is engagement, not absolute correctness

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

Professionalism

- Being a professional means, you must 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

Final Projects

- Open-source excursion is the most fun part of the course!
- Very open-ended project. 24% of overall grade.
- Brings together everything you will have learned from lecture and prior assignments
- Teamwork and communication is very important
- In-person presentation in finals week (no exam)
- ***Do NOT book flight tickets for the winter break until finals are scheduled.***

Late day policy

- **Assignments**: No late days
  - Simply doesn't work with team assignments
  - Plan for unexpected delays ahead of time (not just before deadline).
- **Participation activities (lecture + recitation)**: Accommodations in case of health issues, travel for interviews, university sports, etc.
  - Everyone gets **4 free absences**. No need to inform us beforehand.
  - Beyond 4 absences, participation grade can be affected.
  - Inform us of extended absences (e.g., hospitalization). We can help you make up some of the lost points in such cases.
- If you have an assignment due after a trip, turn it in *before* you leave.
  - You may not have Internet where you're going.
  - Your return travel may be delayed beyond the assignment deadline!

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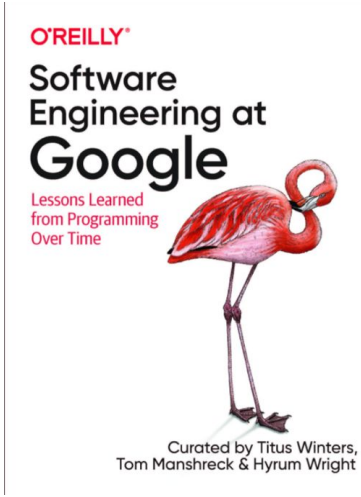
Academic Honesty

- Standard Collaboration Policy
- In group work, be honest about contribution of group members; do not cover for others
- Unless explicitly prohibited, you may use generative AI (e.g. ChatGPT) to help you write your prose and code. You are responsible for its correctness. Be sure to attribute the content to the service you used. (let us know if you have concerns about teammate's work)
- DO NOT submit participation sheets for people who are not in class. This is considered an academic integrity violation

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



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For next class: pre-lecture reading quiz

First-week Survey due Thursday

- Form groups based on schedule availability.
  - This is ridiculously important.
  - Identify experience and working styles.
  - Participation point
- Posted to gradescope, we will also post on slack.

Project P1 posted tonight

- P1A: Checkpoint due next Sunday (August 31st)
  - Only 5% of total P1 points – meant to ensure you start on time
- P1B: Due a week later
  - Refactor a javascript file to improve its quality
  - More details later

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Image credit: https://loicknuchel.fr/blog/2017/06/25/why-functional-programming

Intelligent Machines

Nvidia CEO: Software Is Eating the World, but AI Is Going to Eat Software