CS189A
Senior Computer Systems Project
aka Capstone Project

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Logistics | http://capstone.cs.ucsb.edu

- **Lectures:** Mon. 2pm-3:50pm
- **Discussion Section:** Thurs. 3:30-5:00pm
- **Instructor:**
  Jianwen Su (su@cs.ucsb.edu)
  Zoom meeting room: 8058933698
- **Teaching Assistant:**
  Brian Lim (blim@ucsb.edu)

- **Class website (+ announcements):**
  http://capstone.cs.ucsb.edu  CS189A tab
- **Piazza** (sign up: Link is under class announcements)
Capstone

- Two quarter project course in which students put their education into practice by building a significant system as a team
  - Learn by doing, teaching yourself and each other
  - Chance to explore the latest technologies and SWE practices
  - Provide practical experience as a form of career building

Capstone flavors
- Year-long ECE 189 A/B/C for EE and CE students
  - Focuses on development of a hardware/software prototype
- CS 189 A/B for CS and CE students
  - Software systems engineering oriented
  - Runs Fall/Winter to allow continuity and more extensive projects
    - Must take both courses in a single series (CE and CS) for grade
- There is also a year long EE Capstone and ME Capstone
Industry Driven

- Companies “donate” challenge problems that they wish to explore as R & D
- Student teams develop prototypes in collaboration with industrial mentors
- Goal: develop and understand the next industry-leading technology, drive an idea from design to working prototype

Culminating: March 12 (@the CS Summit!)
- Present to the College, community, your peers, … the world

Awards given for best projects!
- Judging criteria
Capstone Award Judging Criteria

5pt **Science:** Has the project demonstrated application of important, interesting, or new aspects of Computer Science? (e.g. Use of machine learning, non-trivial algorithms, solid distributed system design techniques)

5pt **Practice:** Did the project adhere to techniques that represent the state of best practice in industry throughout the development of the system (e.g. specification, design, development iterations, repo workflows, test-driven development, issue tracking, or use of static or dynamic analysis tools)

5pt **Scope:** Has the team attacked a problem of significant (but appropriate) scale and complexity. Does the problem require the development of significant new code and/or the integration of complex exciting parts that are not normally made to interface to one another? Did the project complete the goals that it set for itself?

5pt **Teamwork & Presentation:** Do all members of the team contribute significantly (in their own ways)? Does the team take the process seriously and communicate effectively with one another and the mentors? Is the project presented both in written and spoken form in a way that is compelling and impressive? Has the team developed an impressive demo?
Capstone Series Overview

- Teams of size 4-5 (teammates added by instructor if <=4)

- **CS189A**
  - Project vision and technology investigations/evaluation
  - Requirements and design documentation (PRD v1 and v2)
  - Prototyping and initial implementation (code!)
    - Including testing

- **CS189B**
  - Complete implementation (debugging, robustness, performance, analysis)
  - Testing and verification
    - Including user studies
  - Optimization and extension (awesome features!)
  - Presentation

- [http://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html](http://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html)
Course Overview: CS189A

- Week 1
- Class:
  - Introduction to the class and to team selection
  - Form teams (5 members)
  - Team “brag sheet” sent to instructor/TA before noon Friday Oct 9 (1 page pdf)

  - Discussion: attendance not mandatory but room available for your use

  - Friday in lieu of discussion section this week
    - Company representatives present the challenge problems (Pitch meeting!)
      - Oct 9th 3:30-6pm on zoom (attendance mandatory)
  - Read the recommended readings on the schedule page
Course Overview: CS189A

- Week 2
- Class:
  - Lecture: Introduction to SWE and SW Specification: Vision statements
  - Project selection (see **Claiming process**) planning
  - Send *claiming* email to the instructor before Wednesday during class
  - Team/Sponsor pairings announced before Thursday
    - Discussion:
      - Identify **group leader** and **scribe**
        - **Lead**: motivator, picks up all loose ends, settles debates/makes decisions
        - **Scribe**: records scrums, retrospectives, sprint planning, mentor/TA meetings
      - Write up vision statement and send to mentors for approval
Week 3

- Class:
  - Vision statements due by end of class (send PDF to TA via email)
  - Lecture: Software Specification: Agile software development (scrum, sprint planning) and an Introduction to the Product Requirements Document (PRD)
  - Activity: Finish vision statements, Sprint planning
    - Sprint 1 starts!

- Weeks 4-10 on the cs189a schedule page (http://capstone.cs.ucsb.edu)
Claiming a project

- Only **complete** emails dated before **9pm** on Tuesday Oct 13 considered.

  Email to instructor (su@cs.ucsb.edu) with:
  
  - Subject: 189a project selection
  - Sent by group leader (or his/her representative)
  - List of group member names and emails; **Identify lead and scribe**
  - A picture of each group member for public posting
    - The file name must be: LASTNAME.png
    - Please use 512x512 resolution and png file format
      - Contact the TA if you need help with any of this
  - List all company participants in order of preference

- Assignment algorithm: **best match**
  
  - You are **not** likely to get your top preferences
  - One team per project/company!
CS189A Goals & Requirements

- Four 2-week sprints:
  - Week 3-4 (PRD v1 – tools, technologies, design investigations);
  - Week 5-6 (use cases/user studies and prototyping, PRD v1);
  - Week 7-8 (design, prototyping, testing, PRD v2);
  - Week 9-10 (prototype presentations, prototyping and testing)

- Specify what the product will do
  - Vision statement Due week 4
  - Product Requirements Document (PRD) (due end of Oct and Nov)
  - Design tools, brainstorming, coding (tests and implementation)

- Build and test an initial prototype
  - Typically teams iterate on these activities until they converge to a working prototype!

- 189A last week of class + maybe discussion
  - Prototype Demonstration
  - Recorded, order determined randomly
Your Grade

- Attendance at classes and discussion section
  - One miss for class/discussion is allowed with excuse, followed by letter grade decrease per miss

- Team participation: sprint scrum, retrospectives, planning, treatment/support of your teammates

- Weekly substantial contributions (50 LOC each) to code repository

- Completion of all of the project requirements (next slides)

- Demo performance
  - Judging criteria, amount of work put in, robustness, extensiveness
Capstone Project Requirements (1/2)

- Use of agile development process **with per-sprint task tracking** (recommended: Trello or PivotalTracker)
  - Daily scrums (M-F) recorded by scribe in shared Google Doc
  - Class/discussion days: last 15mins of class
  - Shared with Instructor, Mentor, TA, and team

- Weekly meetings (virtual is ok) with mentor (scribe logs)
- Every 2 weeks: meeting with TA (during discussion/class is OK)
- Class/discussion attendance and participation in team activities
  - Bring laptop to class, email Chandra if you don’t have one
- **Vision statement** turned in by deadline (& approved by mentor)
- **Draft 1 & 2 of PRD** turned in by deadline
  - Evolve as you design and prototype; approved by mentor
- **Working prototype** for base functionality demonstrated in the last week of the quarter
Capstone Project Requirements (2/2)

- Use of a code repository (recommended: GitHub)
  - **Ongoing** contributions by all members **each week**
    - Identify a workflow that works best for your team
  - Can include preparation of requirements documents

- Use of an issue tracker (recommended: Waffle.io or github)

- Documented code

- Automated unit tests and integration and/or functional tests
  - Code defensively!

- Use of user stories and/or use cases for requirements & design

- Use of UML for system requirements modeling and design

- Wireframes for user interfaces if any

- Complete 4 2-week sprints, **record** retrospectives and planning for each
Contributed Projects 2020

- AppFolio
- Invoca
- LogMein: Machine learning, Real Time Communication, User Experience design
- Navy Pt Mugu: Cybersecurity, Internet of Things, Automation, Assessment of Risk
- Novacoast
- PowWow: mobile app, sensor data, data analysis, data visualization, python, javascript, React-Native
- QAD: Intelligent Virtual Assistant, Natural Language Processing
- True Vision/Alcon
- Teladoc Health (InTouch Health), 2 projects?
- Well Health
- Mystery?
What’s Next?

- **Today**
  - Signup for Piazza
  - Info on constructing a good team; next week: intro to SWE
  - Form teams

- **Friday:** Attend the pitch event (3:30-6pm on zoom)

- **Next week:** Select projects, write vision statements, project setup and initial investigations

- **Beyond:**
  - Scrum/log daily and weekly meetings, mentor meetings
  - Learn necessary technologies and teach each other, work on specs (PRD v1)
  - Project specification, design, and prototyping

- **Schedule:**
  https://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html