CS189A - Capstone

Chandra Krintz
Department of Computer Science
UC Santa Barbara
http://www.cs.ucsb.edu/~ckrintz/
• **Lectures**
  Mon/Wed – 12:30pm-1:45pm, Phelps 2516

• **Discussion Section:**
  Thursday– 5-6:15pm, Phelps 2524

• **Instructor:**
  Chandra Krintz (ckrintz@gmail.com)
  Office: in person by appointment or other times via Google chat, hangout

• **Teaching Assistant:**
  Steve Bako (sbako@ece.ucsb.edu)

• **Class website (w/announcements):** [http://capstone.cs.ucsb.edu](http://capstone.cs.ucsb.edu)  CS189A tab

• **Piazza (sign up):** Link is under class announcements
Capstone

Two quarter project class 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
- ECE 189 A/B for EE and CE students
  - Focuses on development of a hardware prototype
  - Runs Fall/Spring every year so chips can be fabricated during the Winter
- 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
  + Multi-disciplinary engineering projects/teams (more on this later)
The CS Capstone: How Does It Work?

• Industry Driven
  – Top 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

• Culminates Monday, March 16th (@the CS Summit!)
  – Present it to the College, community, your peers, … the world

• Awards given for best projects!
  – Judging criteria
• **Science**: Has the project demonstrated the 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. 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? Was the project able to complete the goals that it set for itself?

5pt **Teamwork and Presentation**: Do all the 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 or 5 (teammates added by instructor if less)

- CS189A
  - Project vision
  - 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

- Some lectures may be given by industry experts (see schedule)

- [http://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html](http://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html)
• Week 1
  – Class: Introduction to SWE, team management, and processes
  – Friday in lieu of discussion section
    • Company representatives present the challenge problems (Pitch Night!)
    • Oct 6th 3:30-8pm in HFH 1104 (attendance mandatory)
Course Overview: CS189A

• Week 1
  – Class: Introduction to SWE, team management, and processes
  – Friday in lieu of discussion section
    • Company representatives present the challenge problems (Pitch Night!)
    • Oct 6th 3:30-8pm in HFH 1104 (attendance mandatory)
  – Read the recommended readings on the schedule page

• Week 2
  – Form teams (4-5 members)
  – 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
  – Choose team/project – Select by 5pm Monday (see Claiming process)
  – Write up vision statement (send to mentors for approval) & turn in
    • Wednesday in class (send to Mentors)
    • Update/finalize for turnin on Friday
• **Claiming a project**
  - Only **complete** emails dated after **5pm** on Monday Oct 9 considered  
  Email to Chandra (ckrintz@gmail.com) with
    • Subject: 189a project selection
    • Sent by group leader (or his/her representative)
    • List of group member names, **identify lead and scribe**
    • A picture of each group member for public posting
    • List all company participants in order of preference
  - FCFS assignments + algorithm
    • **You are not** likely to get your top preferences
    • One team per project/company!
Course Overview: CS189A

• **Week 2**
  
  – Monday Oct 9: Form teams (4-5 members)
    • 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
    • Choose team/project – Select by 5pm (see Claiming process)

  – Wednesday Oct 11: Work on Vision statements and sprint planning
    • **Turn in team info to TA by noon**
    • (1) Team Google group; (2) Daily scrum schedule, (3) Weekly Mentor meetings; (4) **1-sentence description** to TA via email; (5) Setup Github repo/email TA (add TA/Chandra to team if private)
    • **Work on vision statements**
      – Send to mentors requesting feedback
    • Plan Sprint I (which **starts Thursday, Oct 12**)!

  – Oct 16: **Turn in vision statements** via email to TA by end of class
CS189A Goals & Requirements

• Four 2-week sprints:
  – Oct 12-25 (PRD v1 – tools, technologies, design);
  – Oct 26-Nov8 (design and prototyping, PRD v1);
  – Nov9-20 (design, prototyping, testing, PRD v2);
  – Nov 21-Dec8 (prototype presentations, prototyping and testing)

• Specify what the product will do
  – Vision statement Due Oct 16
  – Product Requirements Document (PRD)
  – 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 two weeks of class + 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)

• Participation in class discussion, questions for speakers

• *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

• Group participation: to reflect the level of effort and contributions to the project throughout quarter
Capstone Project Requirements (1/2)

- Use of agile development process with per-sprint task tracking (recommended: Trello or PivotalTracker)
- Daily scrums recorded by scribe in shared Google Doc
  - Class/discussion days: last 15 mins of class
  - Shared with Instructor, Mentor, TA, and team
- Weekly meetings (virtual is ok) with mentor (scribe logs)
- Weekly meeting with TA (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
F17 Deadlines

- Oct 9 by 5pm
  - Project choices (using format specified) to instructor via email
- Oct 11 in class: complete setup and start on project planning
  - Github repo, project description sentence, google doc & group setup and sent to TA via email (invites sent to TA, instructor, team, mentors), sprint I planning and vision statements
- Oct 16 by end of class
  - **Vision statement** (email PDF to TA)
  - Sprint 1 (Oct 12-25)
- Oct 25 in class
  - Demo and retrospective (retro) for Sprint 1, plan Sprint 2 (starts Oct 26)
- Nov. 3 by **noon**
  - Project requirements doc (PRD) (using format specified) Draft 1 as PDF to TA
- Nov 8 by end of class
  - Demo and retro for Sprint 2, plan Sprint 3 (starts Nov 9)
- Nov 20 by end of class
  - Demo and retro for Sprint 3, plan Sprint 4 (starts Nov 21), no class on Nov 22, 23
- Dec 1 by **noon**
  - Project requirements doc (PRD) Draft 2 as PDF to TA
- Dec 4, 6, and 7(if needed): Project Demos to class/discussion for 189B instructor/video record
- Dec 8: (on your own) Demo and retro for Sprint 4; plan development over break
2-Page Vision Statement

• PDF via email to TA by end of class (class time allocated) on date specified
  – Project Title / Name (can change)
  – Team name, members names/emails
  – Team lead
  – what the project is about
    • What problem the project is solving (what is innovation, the science, and new core technical advance)?
    • Why the problem is important
    • How the problem is solved today (if it is)
  – Identify the outcome of the project
  – Define initial project milestones: specification, design, prototyping
  – How do you plan to articulate and design a solution
    • List the implementation platform and technologies will plan to use to develop the solution
    • Overview the process model you will employ to achieve the milestones
• Outline project investigations, **divide up work** across members
  • **Teach each other**
• Identify software systems you want to use to track progress/files
  – Trello, github, google docs, pivotal, sphynx, issue trackers
• Identify programming languages, frameworks
  – Work on **tutorials** if new to you
  – **Testing frameworks and mock tools (balsamiq)**, language/web frameworks, UML
  – Mobile development platforms: Coronalabs.com, iOS, Android
  – System configuration: Ansible, Puppet, Chef, Saltstack/Saltcloud
  – Cloud technologies
    • Infrastructure (servers): Amazon EC2/S3
    • Platforms: Google App Engine, Heroku
    • Mobile Backends: Backendless, Google Endpoints, AWS Lambda
    • Services: MongoLab, Instacluster, Amazon RDS, Hadoop/ElasticMapReduce
    • APIs: Twitter, Facebook, Google technologies (maps/earth/drive)
    • Development environments: Apache JClouds
What’s Next?

Today
- Signup for Piazza

Weds: Intro to SWE, SW process models, sprints, and scrum

Friday: Attend the pitch event (3:30-8pm in HFH 1104)

Next week: Select projects, vision statements, Sprint 1 planning

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