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

• **Discussions:**
  Friday – 11-11:50am, Phelps 2516

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

• **Teaching Assistant:**
  Daniel Imberman (dimberman@umail.ucsb.edu)
  Office: TBD

• **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
  – Chance to explore the latest technologies and SWE practices
  – Provide practical experience as a form of career building

• Two flavors of Capstone
  – 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**
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

• Last Thursday of second quarter of the series
  – Present it to the College, community, your peers, … the world

• Awards given for best projects!
  – Judging criteria
Capstone Award Judging Criteria

• 5pt **Science**: Has the project the 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. 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 on 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 5

• CS189A
  – Project vision
  – Requirements and design documentation
  – Prototyping and initial implementation
    • Including testing

• CS189B
  – Complete implementation (debugging, robustness, performance, analysis)
  – Testing and verification
    • Including user studies
  – Optimization and extension
  – Presentation

• Some lectures given by industry experts (see schedule)

• http://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html
Course Overview: CS189A

• Week 0 and 1 (Sep 24-Oct 2)
  – Company representatives present the challenge problems
    • First Friday from 4-7pm in HFH 1104 (attendance mandatory)
  – Introduction to SWE, team management, and processes
  – Form teams (5 members – members added by instructor if needed)
    • 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
  – Writeup/turn in Vision statement (due Friday)
    • OK to get your mentor’s approval after turn-in, but ahead of this is preferable
  – Plan first sprint
Course Overview: CS189A

• Week 0 and 1 (Sep 24-Oct 2)
  – Company representatives present the challenge problems
    • First Friday from 4-7pm in HFH 1104 (attendance mandatory)
  – Introduction to SWE, team management, and processes
  – Form teams (5 members – members added by instructor if needed)
    • Identify group leader and scribe

• Claiming a project
  – Only complete emails dated after 5pm on Monday Oct 28 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; you are not likely to get your top preferences
    • One team per project/company!
CS189A Goals & Requirements

• Set up (due Week 2 – **Next Monday by end of class**!)
  – (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)

• Specify what the product will do
  – **Vision statement** (due **End of THIS Week**)
  – **Product Requirements Document (PRD)** (due Week 5 and Week 9)
    • 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 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: peer grade 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 15mins of class
  – Shared with Instructor, Mentor, TA, and team

• Weekly meetings (virtual is ok) with mentor (scribe logs)

• Weekly meeting with TA

• Class/discussion attendance and participation in team activities
  – Bring laptop to class

• Vision statement turned in by deadline (& approved by mentor)

• Draft 1 & 2 of requirements specification 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
F15 Deadlines

• Sep 28 by 5pm
  – Project choices (using format specified) to instructor via email

• Oct 2 by end of discussion section
  – Vision statement (email PDF to TA)
  – Scrum intro, Plan Sprint 1 (starts Oct 5)

• Oct 5 in class: complete setup and start sprint 1
  – Github repo, project description sentence, google doc & group setup and sent to TA via email (invites sent to TA, instructor, team, mentors)

• Oct 16 by end of discussion section
  – Demo and retrospective (retro) for Sprint 1, plan Sprint 2 (starts Oct 19)

• Oct 30 by end of discussion
  – Project requirements doc (PRD) (using format specified) Draft 1 as PDF to TA
  – Demo and retro for Sprint 2, plan Sprint 3 (starts Nov 2)

• Nov 13 by end of discussion section
  – Demo and retro for Sprint 3, plan Sprint 4 (starts Nov 16)

• Nov 25 by end of class
  – Project requirements doc (PRD) Draft 2 as PDF to TA

• Nov 30, Dec 2,4: Project Demos to class/discussion (Sprint 4 ends)
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
    • 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
  - Form groups of size 5
  - At 5pm
    - Email prefs to Chandra, project selections announced (by Weds 9am)
- **Weds: Intro to SWE, SW process models, and scrum**
  - Guest speaker: Colin Kelley, CTO of Invoca
  - **Work on vision statement (with mentor)**
- **Discussion:**
  - Friday: Vision statements due, Sprint 1 planning
- **Next week and beyond:**
  - Scrum/log daily and weekly meetings, mentor meetings
  - Learn necessary technologies and teach each other, work on specs (PRD v1)
  - Beyond: specification, design, and prototyping
- **Schedule:** [https://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html](https://capstone.cs.ucsb.edu/cs189a/cs189a_sched.html)