CS189A - Capstone

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http://www.cs.ucsb.edu/~ckrintz/
• **Lectures**
  Mon– 12pm-1:50pm, Phelps 1437

• **Discussion Section:**
  Thursday– 5-5:50pm, ESB 1003

• **Instructor:**
  Chandra Krintz (ckrintz@ucsb.edu)
  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
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 13th (@the CS Summit!)
  – Present it to the College, community, your peers, … the world

• Awards given for best projects!
  – Judging criteria
Industry Driven
- Top companies “donate” challenge problems that they wish to explore as R & D
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Culminates @the CS Summit! in March of Winter quarter
- Present it to the College, community, your peers, … the world

Awards given for best projects!
- 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. 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 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
CS189A Syllabus

• CS189A
  – Introduction to Software Engineering
  – Team formation and management
  – Software development processes
  – Project management
  – Software specification
  – Software design, system modeling, and SW architectures
  – Prototyping and implementation
  – Open source software
  – Testing and verification
  – Tools and technologies

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

• Week 1 (Oct 1-5)
  – Class:
    • Introduction to the class and to team selection
    • Form teams (5 members)
  – 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 Night!)
    • Oct 5th 3:30-7pm in HFH 1104 (attendance mandatory)
  – Read the recommended readings on the schedule page
• **Week 2 (Oct 8-12)**
  – Class:
    • Lecture: Introduction to SWE and SW Specification: Vision statements
    • Project selection (see **Claiming process**) planning
    • Send *claiming* email to Chandra by 1:45pm Monday during class
    • Team/Sponsor pairings announced by Tuesday morning
  – 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
Course Overview: CS189A

• Week 3 (Oct 15-19)
  – 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 today!**
  – Discussion:
    • Scrum
    • Sprint 1 work
    • TA meetings
• Week 4 (Oct 22-16)
  – Class:
   • Lecture: Software Specification: product requirements document, use cases and user stories (Preparing PRD v1)
   • Activity: Scrum and Sprint 1 work

  – Discussion:
   • Scrum
   • Sprint 1 work
   • TA meetings
Course Overview: CS189A

• Week 5 (Oct 29-Nov 2)
  – Class:
    • Lecture: Software design and modeling (preparing for PRD v2)
    • Activity:
      – Sprint 1 retrospective
      – Sprint 2 planning; start Sprint 2
      – PRD writeup
  – Discussion:
    • Finish PRD: **PRD v1 due as PDF to TA by end of discussion**
    • Scrum
    • Sprint 2 work
    • TA meetings
Course Overview: CS189A

• Week 6 (Nov 5-9)
  – Class:
    • Lecture: no lecture today
    • Activity:
      – Scrum
      – Sprint 2 work
      – TA meetings
  – Discussion:
    • Sprint 2 retrospective
    • Sprint 3 planning; start Sprint 3
    • TA meetings
Course Overview: CS189A

- **Week 7 (Nov 12-16)**
  - **Class:** No Class (University Holiday)
  - **Discussion:**
    - Scrum
    - Sprint 3 work
    - TA meetings
Course Overview: CS189A

- Week 8 (Nov 19-23)
  - Class:
    - Lecture: Software testing and test-driven development
    - Activity:
      - Scrum, Sprint 3 work
      - Work on PRD v2
  - Discussion: **No Discussion Section (University Holiday)**
    - Happy Thanksgiving!
Course Overview: CS189A

• Week 9 (Nov 26-30)
  – Class:
    • Lecture: Team demo and presentation hints; preparing for CS189B
    • Activity:
      – Test that your laptop works for next week’s presentations (significant startup delays because you didn't test will cause a loss in team points/grade)
      – Sprint 3 retrospective
      – Sprint 4 planning; start sprint 4
      – Prepare project demonstration and presentation (8 mins max, everyone must speak)
  – Discussion:
    • PRD v2 due as PDF via email to TA by end of discussion
    • Scrum
    • Sprint 4 work
    • Practice your team demonstrations
Course Overview: CS189A

• Week 10 (Dec 3-7)
  – Class: Team project prototype demonstrations
    • Prof Bultan (CS189B instructor) to join
    • 8 minutes max, everyone should speak + 1-2mins for questions (if any)
    • Video recorded
    • Order determined randomly and will be posted on web page under Schedule

  – Discussion:
    • We'll only use this meeting time if we are unable to get to everyone during class. If we do hold this discussion section, attendance will be mandatory (come support your classmates!)

  – Sprint 4 ends
    • On your own: do a Sprint 3 retrospective together and make a plan for the holiday period to continue to work and make progress on your projects!
Claiming a project

- Only **complete** emails dated after **1:45pm** on Monday Oct 8 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
      - 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

- FCFS assignments + algorithm
  - You are **not** likely to get your top preferences
  - One team per project/company!
CS189A Goals & Requirements

- Four 2-week sprints:
  - Oct 15-29 (PRD v1 – tools, technologies, design);
  - Oct 29-Nov 8 (use cases/user studies and prototyping, PRD v1);
  - Nov 8-26 (design, prototyping, testing, PRD v2);
  - Nov 26-Dec 6 (prototype presentations, prototyping and testing)

- Specify what the product will do
  - Vision statement Due Oct 15
  - Product Requirements Document (PRD) (due Nov 1 and Nov 29)
  - 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 15 mins 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
• 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
F18 Deadlines

• Oct 8 at 1:45pm
  – Project choices, decided on during class, (using format specified) to instructor via email
• Oct 11 by end of discussion: 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 15 by end of class
  – Vision statement (email PDF to TA)
  – Sprint 1 (Oct 15-20)
• Oct 29 in class
  – Demo and retrospective (retro) for Sprint 1, plan Sprint 2 (starts Oct 29)
• Nov. 1 by end of discussion
  – Project requirements doc (PRD) v1 (using format specified) as PDF to TA
• Nov 8 by end of class
  – Demo and retro for Sprint 2, plan Sprint 3 (starts Nov 8)
• Nov 26 by end of class
  – Demo and retro for Sprint 3, plan Sprint 4 (starts Nov 26)
• Nov 29 by end of discussion
  – Project requirements doc (PRD) v2 as PDF to TA
• Dec 3 and 6th (if needed): Project Demos to class/discussion for 189B instructor/video record
• Dec 7: (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
  – Info on constructing a good team; next week: intro to SWE
  – Form teams

• Friday: Attend the pitch event (3:30-7pm in HFH 1104)

• 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