

# Capstone Projects

## SE 490

### Introduction

Dr. Simon Fan

Professor of Computer Science and Software Engineering

California State University • San Marcos

[sfan@csusm.edu](mailto:sfan@csusm.edu)

# Important policies First

- **Show your name in Zoom**

- **Lecture recording**

- We will record each lecture, which will be posted on **CapStone** so that students can review lectures as many times as you can
- If you have a privacy concern, you may turn off your camera during lecturing; otherwise I encourage students to show your faces so that we may have a close-to-real classroom learning environment.

- **ZOOM passcodes**

- **For Lecturing:**
- **For Office Hours:**

- **The way to learn as an Engineering student**

- Classroom learning
- Self-learning
- Group learning

# Capstone Course Series

- Senior Design is a **teamwork** process that spans two semesters, challenging students to apply what they have learned in college education to solve real-world problems.

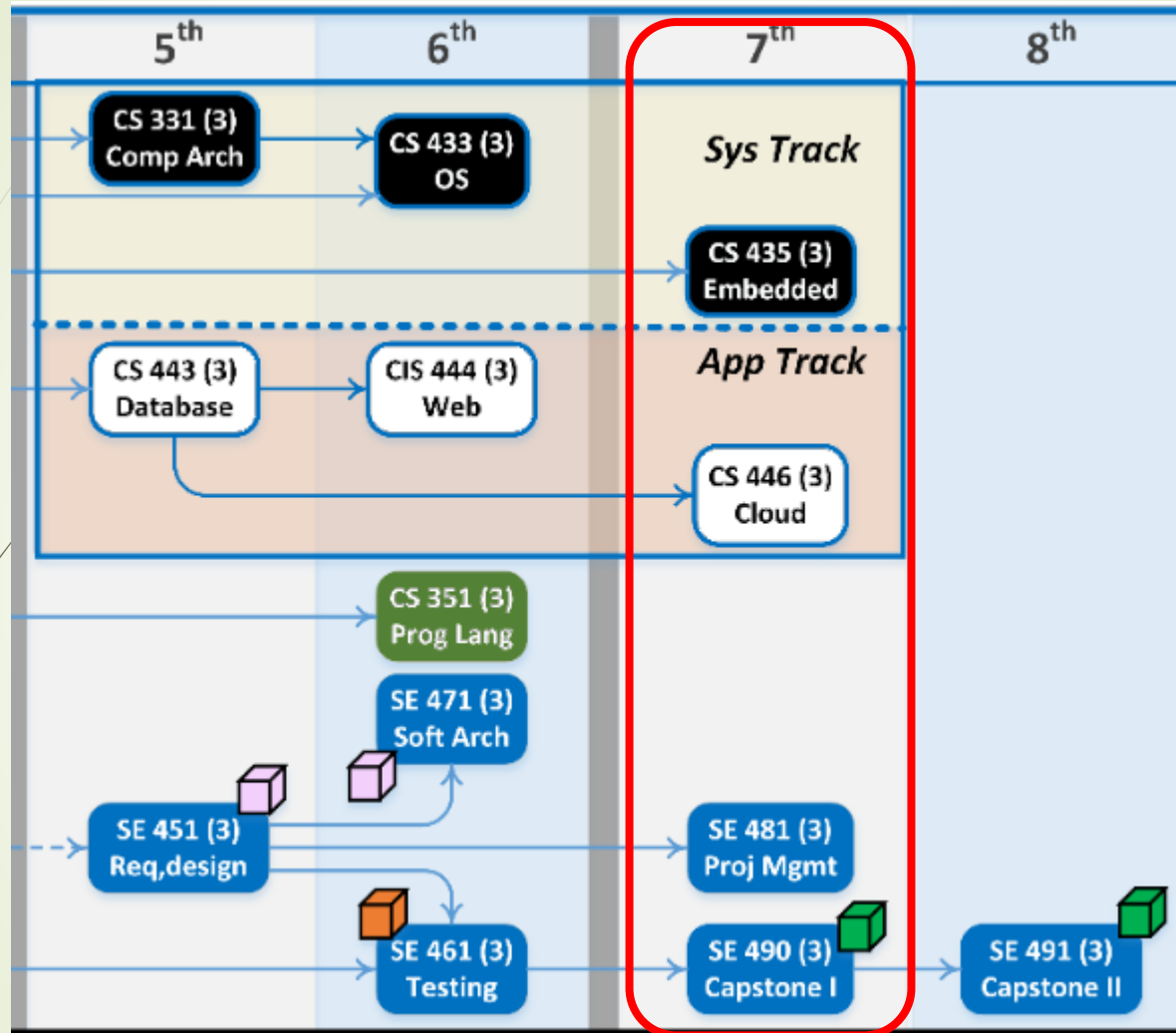


## **Capstone:** definition

1. The top stone of a structure or wall.
2. The crowning achievement or final stroke

You shall start to ask yourself some serious questions:  
Am I ready for a technical job? If not, how to prepare for that?

# Recommended Action Plans



**You need to drop this course unless**

- You have completed the prerequisites
- You are ready to graduate in 2 or 3 semesters

# Syllabus & Course materials

CapStone Web Site: <https://MyCapstone.csusm.edu/>

The screenshot displays the CapStone Process Management System web application. The browser window shows the URL [capstonedesign.org](https://capstonedesign.org). The application header includes the CapStone logo, the title "CAPSTONE PROCESS MANAGEMENT SYSTEM", and navigation links: About, Resource, Student, Sponsor, Advisor, Instructor, Coordinator, and Evaluator. A user profile for Simon Fan is visible in the top right corner.

The main interface is divided into three primary sections:

- Planning & Modeling:** Contains a vertical list of tasks: Elicit & Clarify Requirements, Prioritize Requirements, **Sprint Planning (scope of work)** (highlighted in yellow), Design Test Cases, and Review & Refine System Models. Below this list is a yellow box labeled "Project Documents Design Artifacts".
- Test-Driven Development (TDD):** A central flowchart illustrating the TDD cycle. It starts with a black dot leading to "Write New Test Code". This leads to "Run New Test Code", which has a decision diamond. If it "[succeeds]", it leads to "Refactor Production Code". If it "[fails]", it leads to "Write Production Code". "Refactor Production Code" has another decision diamond. If it "[all succeed]", it leads to "Working Software". If it "[fails]", it leads to "Run All Test Code". "Write Production Code" also leads to "Run All Test Code". "Run All Test Code" leads back to "Write New Test Code". A yellow box labeled "Project Documents Design Artifacts" is connected to the TDD section by a blue arrow labeled "Feedbacks for next sprint".
- Sprint Closing:** Contains a vertical list of tasks: Continuous process improvement actions, **Sprint Retrospective (Development Team)** (highlighted in yellow), **Sprint Review (With Stakeholders)** (highlighted in yellow), and Corrective Actions, Perfective Actions, Progressive Actions. A yellow box labeled "Project Documents Design Artifacts" is connected to the Sprint Closing section by a blue arrow labeled "Feedbacks for next sprint".

A left sidebar contains a "Service Search..." field and a list of services: Instructor Podium, Project Management, Project Workbench, Agile Development, Submissions, Feedbacks, and Evaluation. The bottom of the page features the California State University San Marcos logo and the text "Class2021-Sec-001-Team-000". The footer also includes the text "Capstone Teams Always Working @ capstonedesign.org: ©2021".



# What is CapStone?

- 1) A center for resources and instructions.
- 2) A toolbox for team members to work on system designs.
- 3) A platform for Agile process management.
- 4) A dropbox for work submission.
- 5) A hub to collect feedbacks from industry mentor, faculty advisor, and more.

The screenshot shows the CapStone web application interface. At the top, there's a browser window with the URL 'capstonedesign.org'. Below the browser, the CapStone logo is visible, followed by the text 'CAPSTONE PROCESS MANAGEMENT'. A navigation bar includes links: 'About', 'Resource', 'Student', 'Sponsor', 'Advisor', and 'Instr'. On the left, there's a 'Service Search...' bar and a list of services: 'Instructor Podium', 'Project Management', 'Project Workbench', 'Agile Development', 'Submissions', 'Feedbacks', and 'Evaluation'. The main content area is divided into three columns: 'Planning & Modeling', 'Test-Driven Development (TDD)', and 'Sprint Closing'. The 'Planning & Modeling' column contains steps: 'Elicit & Clarify Requirements', 'Prioritize Requirements', 'Sprint Planning (scope of work)', 'Design Test Cases', and 'Review & Refine System Models'. The 'Test-Driven Development (TDD)' column shows a flowchart with steps: 'Write New Test Code', 'Run New Test Code', 'Refactor Production Code', 'Write Production Code', and 'Run All Test Code'. The 'Sprint Closing' column includes 'Continuous process improvement actions', 'Sprint Retrospective (Development Team)', 'Sprint Review (With Stakeholders)', and 'Corrective Actions Perfective Actions Progressive Actions'. A feedback loop arrow labeled 'Feedbacks for next sprint' connects the 'Sprint Closing' column back to the 'Planning & Modeling' column. The bottom of the interface features the California State University San Marcos logo and the text 'Class2021-Sec-001-Team-000'.

# CapStone: Grading Policy

## 2021 Fall Semester Grading Rubrics

Category	Variable	Percentage	InputFrom	Type	Points Earned		Final Points
System	G0	15%	Advisor	Team	0	x T	
Report Version 1.0	G1	10%	Advisor	Team	0	x T	
Report Version 1.5	G2	10%	Advisor	Team	0	x T	
Report Version 2.0	G3	10%	Advisor	Team	0	x T	
Report Version 2.5	G4	10%	Advisor	Team	0	x T	
Presentation Phase 1	G5	10%	(Co-)Advisor	Individual	0		0.00
Presentation Phase 2	G6	10%	(Co-)Advisor	Individual	0		0.00
Quiz	G7	15%	Instructor	Individual	0		0
Discussion Forum	G8	10%	Instructor	Individual	0		0.00
Attendance Penalty (negative means bonus)	G9	Up to 10 points	Instructor	Individual	0		0
My Final Grade	0 (missing teamwork parts)			What if	T =	<input type="text"/>	0

## Teamwork Performance Factor T

Variable	InputFrom	Range	Value
$\alpha$	Peer Evaluation Average	[0, 0.70]	
$\gamma$	Weekly Progress/Effort	[0, 0.25]	
$\delta$	Peer Evaluation Quality	[0, 0.05]	
$T=\alpha+\gamma+\delta$	Sum of three factors	[0, 1]	

## Final Grade Calculation G=

$$(G0 \times 15\% \times T) + (G1 \times 10\% \times T) + (G2 \times 10\% \times T) + (G3 \times 10\% \times T) + (G4 \times 10\% \times T) + (G5 \times 10\%) + (G6 \times 10\%) + (G7 \times 15\%) + (G8 \times 10\%) - G9$$

# This course is different (I)

Course Schedule: centered around project development

## 2021 Fall Semester Schedule

NO.	Date	Topic	
1	M 08/30	Introduction	
2	W 09/01	SOLID Principles	
3	F 09/03	Agile Software Process (Project Schedule)	
4	W 09/08	Modeling Domain Concepts	
5	F 09/10	Bid for Projects & Team Formation	Ask faculty preference
6	M 09/13	Elicit requirements from users (contact industry mentor)	Work on problem statement (due next Friday)
7	W 09/15	Student-Centered Teamwork & ACM Code of Ethics	Faculty Advisor Assigned; Schedule weekly meeting time
8	F 09/17	Teamwork Commitment Form	Q2: Ethics (3)
9	M 09/20	Agile Practice I: Project Management	Forum 2: Past Experiences in Agile
10	W 09/22	Agile Practice II: Practices & Reflection	
11	F 09/24	Review: Project Problem Statement	Q3: Agile Principles (3)
12	M 09/27	Document User Requirement: Live workshop	Have some teams show the work process
13	W 09/29	System Requirements	Prioritize requirements
14	F 10/01	Report Writing	
15	M 10/04	Architecture Design: Technical Review	
16	W 10/06	Architecture Design: Case Study	
17	F 10/08	Architecture Design Workshop	30 min teamwork, then share
18	M 10/11	Phase I Wrap Up: Share & Workshop	Schedule Presentation
19	W 10/13	Agile Practice III: Continuous Integration	Version control GitHub;
20	F 10/15	Presentation to Faculty	Presentation Coverage
21	M 10/18	Presentation	
22	W 10/20	Presentation	
23	F 10/22	Presentation	
24	M 10/25	Agile Practice IV: Sprint Planning	Start of Construction
25	W 10/27	Agile Practice V: Test Driven Development	

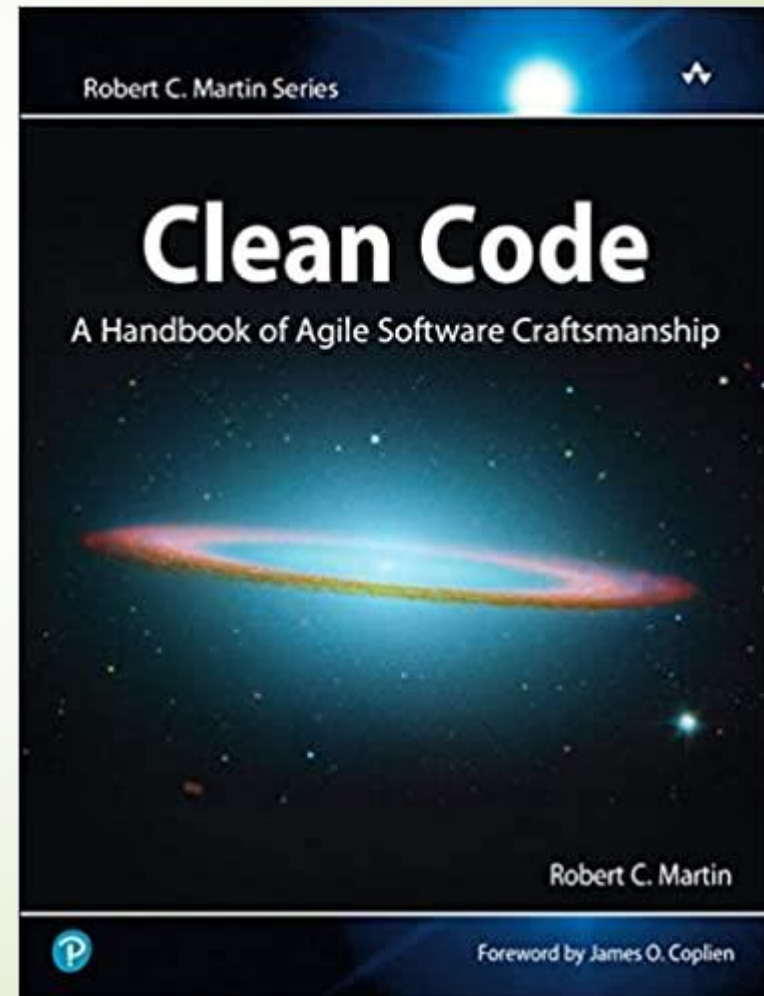
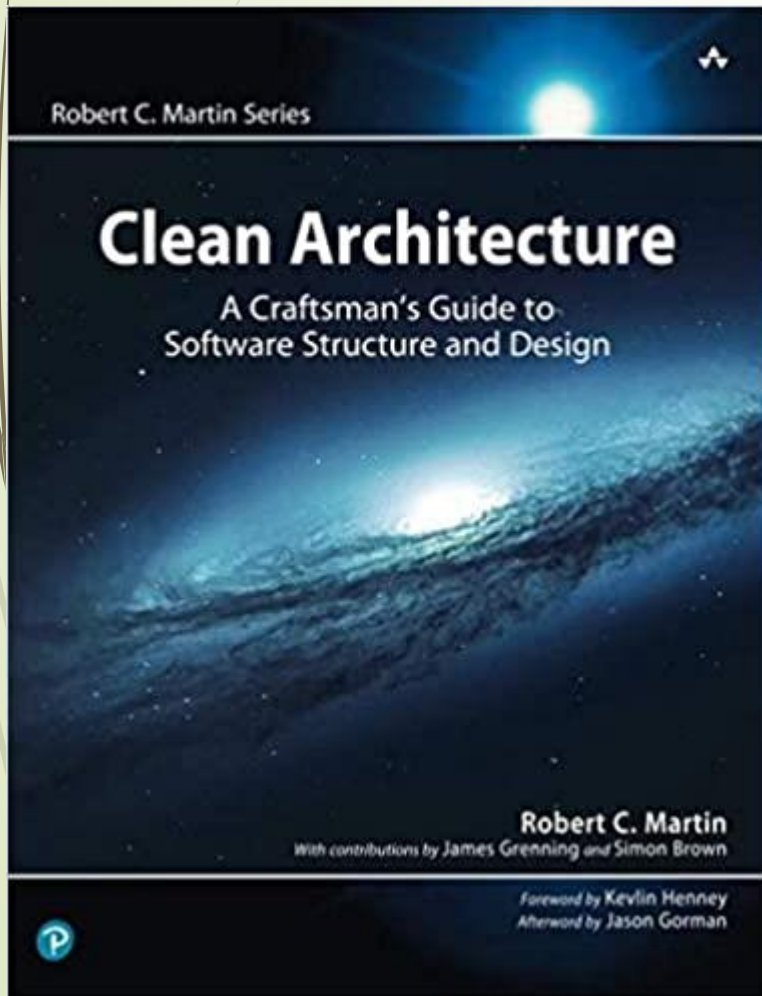
### Three Golden Goals to achieve

1. Enhanced Software Engineering Practices
2. Agile Project Management
3. Teamwork



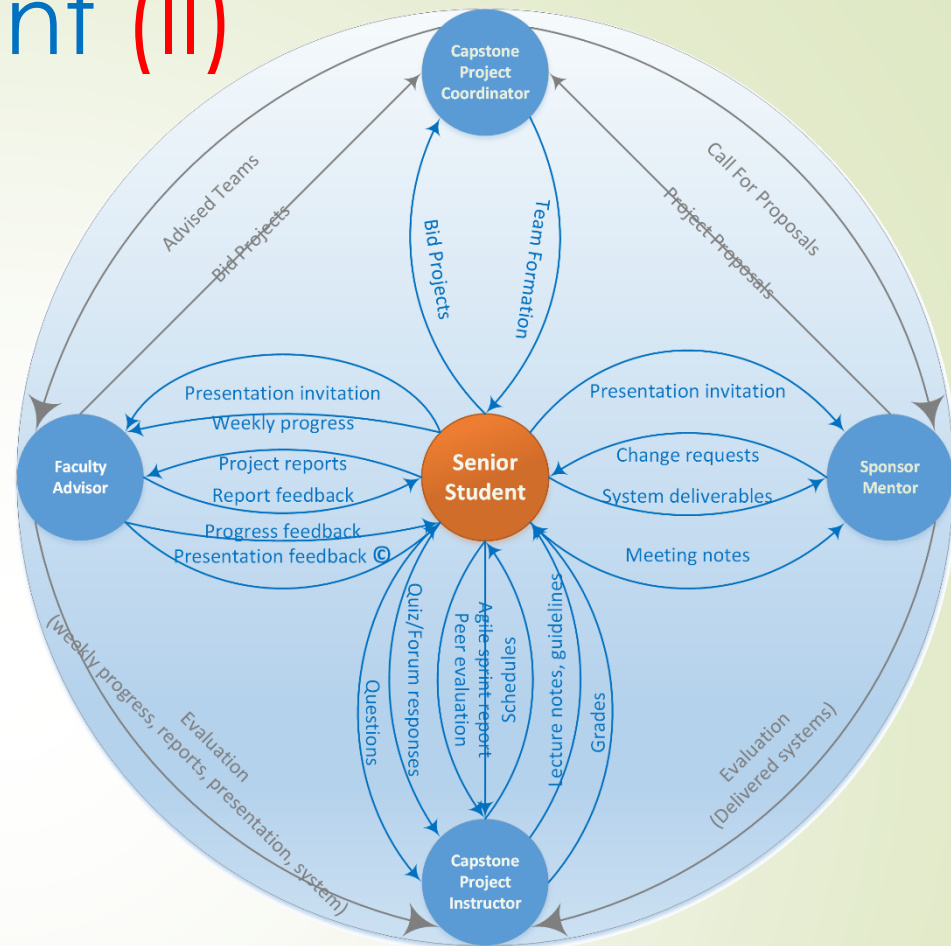
# We do have Required Textbook?

- **Yes**, it's a must-to-read for any software engineer
- **No**, we are NOT giving lectures on the book
  - **BUT**, we can share your reflection or understanding after reading



# This course is different (III)

Student centered  
Multiple parties



## ➤ Instructor

- Process control (CapStone)
- Quality control (cross-review & cross-learning activities)
- Guidance on software engineering principles and practices

➤ **Industry mentors** are your system users/clients

➤ **Faculty advisors** are valuable consultants for technical issues

# This course is different (II)

## Multiple parties

- As a **senior student**,
  - You will be challenged to learn new techniques by yourself
  - You will be challenged to become a good **team player**
  - You will be challenged to make rational project decisions
  - You will be challenged to communicate effectively
  - You will be challenged to practice quality management
- You either **GAIN a lot** or **LOSE a lot**, all depending on your teamwork spirit and attitude
  - If you take the above challenges seriously and positively, you will become a computing professional whom most employers wish to hire

# How much effort on senior project?

**Concentration & Perseverance are the keys to success**

- **How to fail myself in a senior design project?**
  - Do not contribute
  - Do not collaborate
- **What's the cost of failing senior design in the Fall semester?**
  - **Graduation rewind**: work on a new project with new team members in the next fall semester
  - Retake SE 490
- **What's the cost of failing senior design in the Spring semester?**
  - **Graduation rewind**: work on a new project with new team members in the next fall semester
  - Retake SE 491
- **How much effort to put on my senior project?**
  - Make progress every day

**Effort:** Each student should budget about **10 hours per week** (excluding class time) to work on your project. For a team of 3 students, the team would have  $3 \times 10 \times 15 \times 2 = 900$  hours (assuming 15 weeks per semester) to work on your two-semester project.

# Capstone is NOT yet another course project

**It's MUCH more**

	Capstone project	Course project	7 <sup>th</sup>	8 <sup>th</sup>
<b>Client/ customer</b>	Real clients	Make-ups	<i>Sys Track</i> CS 435 (3) Embedded	
<b>Constraints</b>	Realistic, hard	Assumptions, soft	<i>App Track</i>	
<b>Success</b>	Failure is failure	Failure can be a success	CS 446 (3) Cloud	
<b>Commitment</b>	Expect high commitment: RAP is design such that your senior year is less burdensome than your junior	Expect enough commitment	SE 481 (3) Proj Mgmt	
<b>Reputation</b>	Each of you is an ambassador of CSUSM: We care, and future SE students count on you	Your teammates count on you or no longer count on you in future classes	SE 490 (3) Capstone I	SE 491 (3) Capstone II



# Homework

- Log onto CapStone: <https://MyCapstone.csusm.edu> , update your info
  - Contact email
  - User icon

If your CSUSM access ID (xyz1234) is NOT recognized, send me an email including your Name and access ID.

- Discussion Forum
  - SE practices at Google