

CSE 416, SECTION 3

Software Engineering
Session 1

1

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2

General Class Issues

- Dr. R. Kelly (contact info on class Web site)
- Face-to-face class (with some synchronous Zoom sessions)
- Requirements
 - CSE major
 - CSE316
 - U4 standing
- Helpful courses - CSE305, CSE333, CSE337, CSE356, and CSE373
- Details on the course Web site

This is your capstone course

Ability to change sections of
CSE416 is somewhat limited

2

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3

Texts

- No official text
- Supplemental text
 - UML Distilled

Other readings will be introduced in class

Learning system design and development is better done through doing (not reading)

3

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4

CSE416 Web Site

- Check it regularly for
 - Syllabus
 - Course calendar
 - Office hours / location / e-mail addresses
 - Assignments and lecture code
 - Class notes (pdf)
 - References
 - Lots more

CSE416 Section 3 Software Engineering (updated 8/26/2024)

CSE 416 News

- The grading roster from the Fall 2024 semester are available in the Links section. This will help you understand the grading process for the course.
- DUO account: You should be receiving an email to register for your new DUO account. Once you enroll in DUO, you will be able to access the [Stony Brook VPN](#) Web site.

Course Information

Semester:	Fall 2024
Time:	Tuesday and Thursday, 2:00PM - 2:20PM
Location/Delivery:	In person and Synchronous Online: direct instruction occurs in real time either in the designated classroom (CS2120) or via a Zoom session. Most sessions are planned to be offered in-person, but some sessions may be held through Zoom if the educational objectives can be better achieved on-line. For any on-line session, an e-mail message will be sent in advance to each student with the URL needed to access the session. Recordings of in-person class sessions will not be made available, so be sure to attend during the regular class hours. Recordings of on-line class sessions will also not be made available, but you will be enabled to record each session once you are admitted into the Zoom session.
Texts (recommended, but not required):	1. UML Distilled, 3rd Edition, Martin Fowler, Addison-Wesley, ISBN# 0-321-12667-7, 2002. (note that this text is not required, but it will be a very helpful reference)

Contact Information

Instructor:	Dr. Robert Kelly
E-mail:	robkelly@cs.stonybrook.edu

Links

- Team composition
- Spring 2024 Unofficial class roster
- Spring 2024 project grading details
- Fall 2024 (Demographic analysis of election data use case list
- State team table
- TAs
- Project Links and References
- General References

<https://www3.cs.stonybrook.edu/~cse416/Section03/>

4

Format

- In-person and synchronous on-line (Zoom)
- Most sessions are planned to be offered in-person
- Planned on-line sessions
 - Mid-term oral exam
 - Some student reviews (e.g., design reviews)
- Possible additional on-line sessions
 - Due to Covid restrictions
 - Due to student and/or instructor quarantines

5

Office Hours

- Posted hours
 - Mondays, 5:00PM-6:30PM
 - Wednesdays, 2:00PM-3:30PM
- All office hours done through Zoom
- Student Zoom meetings are both during posted office hours and outside of posted office hours
- Send me an e-mail request for a Zoom meeting, and I will schedule it no later than the next office hours block
- All office hours sessions are scheduled

I should be able to schedule
most requests within a day

6

When (If) We Have Zoom Class Sessions

- Zoom invite sent a few hours before scheduled class time
- I will try to open the Zoom session 30 minutes before class time for unmonitored student discussions
- If you are in an environment OK for video, please enable your video (helps me to see who is out there). If not, please use a photo.
- Please mute your audio until you are ready to speak
- Please use chat to post any question or comment. I check the chat screen every few minutes, and I'll repeat comments and answer questions that are helpful to other students. Verbal questions are also OK.
- There is no posted recording of each Zoom session, but ask for permission to record the session (TA will grant permissions at the start of each class)
- We'll end the class no later than the official class end time, but I will stay on-line for extra questions

7

In-Class Session Policies

- We will be consistent with Stony Brook policies
- Please do not attend class in person if you are experiencing any symptoms consistent with Covid

If you wear a mask, remember that masking makes in-class communications more difficult, so please speak slowly and loudly when interacting

8

Course Outcomes

- An ability to perform project planning, **requirements analysis**, and system/test design.
- An ability to work effectively as a member of a software development team.
- An ability to produce software systems that meet specifications while satisfying an implementation schedule.
- An ability to produce professional quality oral/written presentations of system designs, reviews, and project demonstrations.

9

Informal Course Goals

- Apply many skills you've learned to one project
- Improve your oral communications skills
- Learn to
 - build a system **too large for one person**
 - work as part of a team
 - decompose a project into a set of smaller builds
 - build **maintainable code**
 - design first and code later
 - use design approaches
 - use design tools
 - present your work as a group

Development approach consistent with previous CSE courses

10

Approach

- Emphasis on thinking and designing
 - Not memorization
 - Not trial and error
- Use a development process that resembles industrial work environments
- Write code with considerations for
 - Team coordination
 - Long term maintenance

11

How This Project is Different from Industry

- We only use free tools
- We integrate differing development languages and approaches
- We emphasize approaches based on
 - CS courses
 - Standards
- We do not emphasize some software engineering steps, as with:
 - Concurrent user testing
 - Preliminary performance analysis
 - Formal build testing
 - Customer requirements review

12

Reading Vs. Doing

- Class will cover software engineering practices
- You learn by reading, listening, discussing, and doing (most important)
- Usually, we will discuss a topic in class before you include it in your project – but not always
- We will model many software engineering activities in the classroom
 - Design reviews
 - Code reviews
 - Project Presentations

You will get experience in group software activities

13

Grading

- A, B, C ... grades
- Grade basis
 - Project
 - Exam
 - Oral communications (class discussions and presentations)
- Mid-term exam 15-minute 1-1 session (Zoom session)
- In-progress grades will be available on the class Web site, make sure that you check it regularly

Oral communication component rewards teams for “volunteering” for preliminary class presentations

14

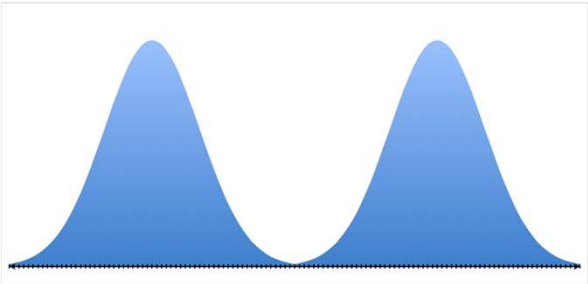
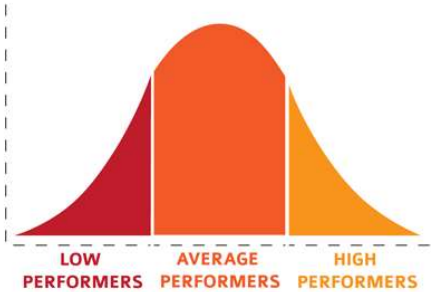
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15

Grading Curve

Grading curve (A-F) could be a bell curve or (more likely) bi-modal, depending on project quality



15

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16

CSE416 Grading History (Kelly)

Grades	Spring 2024	Fall 2023	Spring 2023	Fall 2022	Spring 2022	Fall 2021	Spring 2021
As	47.9%	50.0%	51.1%	51.6%	60.7%	37.9%	44.7%
Bs	27.1%	40.0%	35.6%	30.3%	35.7%	37.9%	30.3%
C+, C	18.8%	3.4%	4.4%	6.0%	3.6%	20.3%	20.1%
Below C	6.3%	6.7%	11.1%	12.1%	0.0%	4.1%	7.9%

- No limitations of a bell curve (no limits on As or failing grades)
- Demonstration of good CS skills needed to pass
- Class interaction helps teams help each other
- No possibility to “hide” within a team
- No Incomplete grades

Virtually all non-passing grades are due to lack of work or poor preparation

16

Grading

- Final grades are calculated based on a formula (no subjective grading)
- Formula weights all the components of the class
 - Project – 60%
 - Mid-term exam – 25%
 - Oral communications – 15%
- Final grade is based on your total score (the higher the score, the higher the grade)

17

Exams

- No final exam (allows you to focus on your project)
- Mid-term exam
 - Zoom oral exam – 15 minutes
 - Possibly no classes during mid-term exam week
 - You sign up for your exam slot (usually 5 exams in a slot)
 - Stay in Zoom waiting room until you are asked to join
 - Questions cover course objectives (e.g., teamwork, design, etc.)
 - Familiarity with your team's work on the project is critical to your midterm exam grade

The best preparation for your midterm exam is work on your project

18

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Grade Sheet

- Unofficial class roster
- Check it regularly
- Ask for more feedback if you are not getting enough in class or in e-mail

Grade sheet also includes a ranking column

416 ID	Mid-term		Oral Comm.				Project	Final	Rank	Final Grade
	Score	Grade	In-class	Project	Total	Norm	Total	Avg.		
1	75.0	A		38	38	66.7	87.5	81.3	37	B+
2	59.5	B-		37	37	64.9	76.4	70.5	67	C
3	79.5	A	2	35	37	64.9	87.5	82.1	31	B+
4	83.0	A	15	40	55	96.5	101.9	96.4	1	A
5	73.5	A	12	40	52	91.2	82.6	81.6	34	B+
6	61.3	B	1	35	36	63.2	87.4	77.2	50	B
7	64.0	B+	17	36	48	84.7	87.6	78.7	47	B

You will get your CSE416 ID in an e-mail

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Project Grade Sheet

- Your project is graded incrementally, check it regularly
- Ask for more feedback if you are not getting enough in class or in e-mail

Some use cases are required

Prototype GUI Review				Design				Code Review				Final Demo								Total Oral	Final Project		
Oral Comm.	Quality	+	Score	Oral Comm.	Quality	+	Score	Oral	Quality	+	Score	Oral	Quality	+/-	Total Quality	# Req. Not Done	Total UC	Adj. UC	Exp. UC	Factor	Score	Comm.	Score
10	80	5	85	8	90	0	90	10	95	0	95	10	92	0	92	1	25	23	27	0.85	78.4	38	87.5
10	88	0	88	8	88	0	88	10	90	0	90	9	80	0	80	4	24	16	27	0.59	47.4	37	76.4
10	80	5	85	5	90	0	90	10	95	0	95	10	92	0	92	1	25	23	27	0.85	78.4	35	87.5
10	93	0	93	10	92	0	92	10	94	5	99	10	98	0	98	0	34	34	27	1.20	117.6	40	101.9
10	91	-10	81	10	85	0	85	10	94	0	94	10	85	0	85	2	26	22	27	0.81	69.3	40	82.6
10	85	5	90	5	75	0	75	10	70	0	70	10	97	0	97	0	33	33	27	1.20	116.4	35	87.4
10	91	-10	81	10	85	0	85	10	94	0	94	6	85	0	85	2	26	22	27	0.81	69.3	46	87.6

Expected number of use cases will vary with the size of the team

Final score is the weighted average of the GUI prototype, client-server prototype, design review, code review, and final demo

Academic Integrity

- Representing another person's work as your own is always wrong
 - Assignments
 - Exams
- Gaining an unfair advantage in grading harms other students
- Suspected instances of academic dishonesty will be reported to the Academic Judiciary
- For details, refer to the Academic Judiciary Web site (link on class home page)

You may talk with teams from previous semesters, but do not use any of their code, design documents, etc.

21

Project Team

- Target - 4 students per team
- Typical team composition
 - Data gathering/preprocessing
 - Server programmer
 - GUI designer/programmer
 - High performance computer (SeaWulf)
- Individual responsibilities determined by team
- You will form your own team by 2nd week
 - Be very careful in selecting teammates – your grade might depend on it

Number of team members and responsibilities of members might vary

Send me an e-mail with the names of your team members

22

Project Team Formation

- Very important to form your team as early as possible – it lets you start work on the project early
- Email me your team information (just teammate names is fine to start) as soon as you can. I'll respond with your team's name and post the name on the class Web site
- I will set up at least one unmonitored Zoom session for any students looking for a team

23

Project Grading

- Project grades can vary among team members based on participation in reviews, but usually a project grade is the same for all team members
- Total project grade determined from component grades (e.g., reviews)
- Points deducted for late submission of components
- Project score will be calculated from
 - GUI prototype
 - Client-server prototype
 - DB access prototype (if needed)
 - Design review
 - Code review, and
 - Final project presentation

No Incomplete grade for
an incomplete project

You will have project deliverables,
some of which are graded and
some not graded

Think of presentations as oral exams

24

Project Team Revisions

- Any time during the semester, a project team can request a split of some team members
- If this occurs
 - Each member of the team will have access to the work of the team as of the date of the split
 - Resulting members can continue with a smaller group (with scope revisions) or join another group
- Helps to encourage all team members to work equally hard on project items

Do not wait too long to recommend a revision of your project team

25

Assignments

- Project submit process will be defined during the semester (once the TAs are assigned)
- Submit once for the group
- Feedback
 - You may get feedback from TAs (time permitting), but remember that your project grade is determined during your formal project reviews
 - Good to volunteer in class for mock reviews to get feedback
 - Feedback to other teams' mock reviews will be helpful
 - Submitting on-time counts to your grade
- Details once TAs are assigned

26

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Oral Communications Grade

- Oral communications
 - A factor in your project presentation grades
 - Very important to “volunteer” for in-class presentations
- Components
 - Volunteer presentations
 - Interaction in class (e.g., questions, experiences, etc.)
 - Formal project-related presentations
- Good communications takes lots of practice – the class is the place to get that experience
 - You will get feedback on your presentation technique as well as your technical content

Being silent is a big risk to your grade

Zoom chat posts count as interaction

27

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Presentations

- Many steps in the project will involve “volunteer” and required presentations from groups
- Many required presentations will be outside normal class hours
 - Available time slots will be posted a week or so before the presentation period
 - Send me an email to request a presentation time slot
- Presentations model SW group activities
- Presentations allow feedback to improve your project
- Presentations should show preparation, be succinct, and be targeted to the level of the students in the class
- Non-presenters will learn problems to avoid along with solution techniques
 - You are invited to other teams’ out-of-class presentations

28

Example – Oral Communications

- Analysis of another student's work should:
 - Be offered in a way that is positive and respectful of the other student
 - Show an understanding of the material the other student presented
 - Contribute to the overall class understanding of the material
 - Usually offer a differing opinion of an aspect of the system design or a consideration not previously addressed

29

Teamwork

- The project will give you good teamwork experience
- Important that all team members contribute to the team efforts
- All team members are expected to contribute during the project reviews
- Teamwork is usually assessed in the mid-term exam

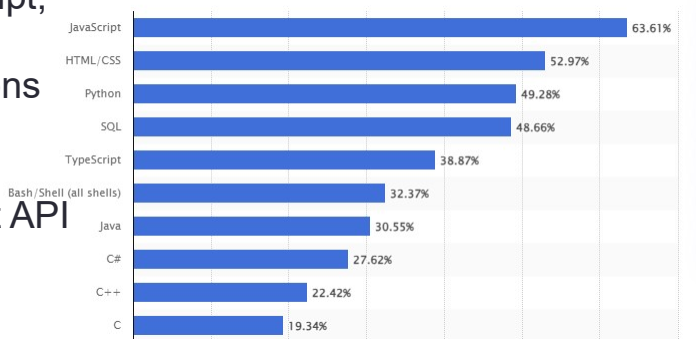
30

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Project Technologies

Select teammates to get technology balance

- Languages – Java, JavaScript, and Python
- Client/Server Communications (Http and/or Web Sockets)
- Web development –Tools constructed over the Servlet API
- Relational DB– ORM (JPA/Hibernate or JDBC) or NoSQL DB
- Python libraries
- High performance computing



Technology	Percentage
JavaScript	63.61%
HTML/CSS	52.97%
Python	49.28%
SQL	48.66%
TypeScript	38.87%
Bash/Shell (all shells)	32.37%
Java	30.55%
C#	27.62%
C++	22.42%
C	19.34%

Image: Statista.com

31

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Project

- Project development will include
 - Web GUI (User interface design and visualization design)
 - System logic (algorithms)
 - Data generation
 - Client-server coordination
 - Re-use of existing code
 - DB (with persistence layer, if relational)
 - Performance analysis (especially for the SeaWulf processing)
 - Testing

Evaluation of results will be an important part of the project

Project will require you to consider system performance in your design and development

32

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<h2>Fall 2024 Project</h2> <p>Important that your team shows the ability to write in different programming styles</p> <ul style="list-style-type: none">• Major components (client, server, supercomputer, and preprocessing) use three different programming languages (JavaScript, Java, and Python)• Analyze and compare current Congressional district calculation rules with those in HR7740 (Fair Representation Act)<ul style="list-style-type: none">• OO and non-OO software development• Significant requirements analysis• Some algorithmic analysis (graph algorithms)• Visualization of the results <p>There will be a multi-stage published requirement specification (set of use cases)</p>		

33

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<h2>Requirements Analysis</h2> <p>Expect changes in your requirements during the semester – like many SW projects</p> <ul style="list-style-type: none">• You will develop some of your system requirements based on your understanding of the overall problem• Requirements broken down into use cases (approximately equal units of work)<ul style="list-style-type: none">• You will be given most use cases in the early part of semester• Team can suggest additional use cases• The number of use cases (about 60) will likely expand during the semester. You will implement about 40 use cases <p>One course goal is that each team's system is different from other teams, yet similar enough so that design discussions help everyone</p>		

34

Thinking About Requirements

- Two ways to think about your project
 - Large graph processing problem (e.g., about 10,000 nodes)
 - Real-world political science analysis problem (e.g., techniques to bring fairness into US Congressional redistricting)

You need to consider both approaches
when thinking about your project

35

Implementation Approach

- Resembles commercial development
- Differs in some ways because goals are to build a system, but do it in a way that has educational goals as well
- Emphasis on technologies covered in previous Stony Brook programming courses
- Emphasis on standards – useful for system integration
- Avoid non-standard, single supplier approaches
- Emphasis on dealing with HTTP limitations through standards (e.g., Servlet API, HTTP attributes, RESTful API, etc.)

36

Project Approach

- When you develop the project, you will follow standard software engineering practices found in industry today
- Quality software philosophy
 - Outcome measurement
 - Process improvement
 - System improvement

Emphasis on iteration-based models

Grading philosophy supports incremental improvement

37

Hardware Requirements

- Software for the course should be available to you for your own computer
- If you need to use a University computer for assignments, studies, etc., you can use a CS Lab
- You will need to use the Stony Brook SeaWulf computer for part of your project
- Your server can be hosted as a localhost or on some non-SBU cloud server

Your SeaWulf development environment will not initially require multiple processors, but your system should reflect concurrency issues – and later testing will run on a large multi-core system

38

Development Environment

- Your project SW will have the following major components
 - Server - developed in Java (and supporting libraries, frameworks, etc.)
 - GUI – You can use a client-side framework (e.g., React, jQuery, Angular, et al)
 - Formal client/server separation using standard interfaces
 - Compute engine – developed in Python on the Stony Brook SeaWulf processor
 - Database – SQL or non-SQL
- Any Java development environment, but Java 8 or later and Java EE 8
- Any Python development environment, but at least Python 3.8 (be careful about library compatibility)
- Any client screen development tool, but compatible with HTML 5 or later

39

Approach to Tools and Libraries

- Tools are not a fundamental part of the course
 - (-) Rare to find a tool dominant over time
 - (-) Tools can lessen understanding of the underlying technology
 - (+) Tools can be very helpful in improving the time for development
- You can use tools / libraries when they facilitate development without lessening understanding

40

How to Get Help

- Don't get stuck on a problem - ask for help
- TAs should be able to help you use most of the libraries, frameworks, IDE, SeaWulf
- Send me general e-mail if you are having trouble
- See me during office hours (or by appointment)

41

Piazza

Piazza is changing its policies, so this might change

- Piazza is a Q&A platform designed to get you answers from classmates and instructors
- It serves as a forum to allow you to collaborate and solve common challenges
- Remember that helping classmates does not negatively impact your grade (no curve)
- You can post any doubts you have or errors you may encounter, and we will post our answers on Piazza directly
- You are also encouraged to answer any questions posted by your classmates. This way when an issue is resolved, everyone gets to benefit and learn from the answer.

Critical mass is important to effective use of Piazza

42

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43

L01 – Introduction
8/26/2024

Lectures

- Lecture slides will be available on the class Web site before each lecture
- Print a copy of the slide handout before class and use it to make notes
- Be sure to review the slides before each exam

43

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44

Topics

- Modularity
- Testing
- Code conventions
- Code reviews
- Developing for maintenance
- DB development
- User interface design
- Visualization

- Graph algorithms
- Software development process
- Software lifecycle
- Requirements
- Use cases
- UML
- Patterns
- Database abstraction

You are expected to know every aspect of the project development

Emphasis is on hands-on design and development, not lectures

44

Your First Assignment

- Send me an e-mail
 - E.g., (Hi!, name, id#, “I love Stony Brook”)
 - Put “CSE416-3-HW#1” in the subject line of the e-mail message