CIS 350 Software Design & Engineering
Spring 2020

Course Overview
Writing a program is easy, but professional software developers face the challenge of "engineering" software: designing and implementing a software system in a way that it is efficient and reliable, and can easily be understood and modified by other developers. This course will introduce you to various tools, processes, and techniques that are used by professional software engineers to create high quality software, focusing on software design and software testing. Additionally, you will apply these in the creation of a software system including a mobile front-end and a web-based back-end.

Developing high quality software is only part of what it means to be a professional software engineer. It is essential to be able to communicate with others, learn from others, and overcome obstacles together, particularly in a fast-paced, competitive environment. This course will give you experience working in a group, strengthen your understanding of inclusivity in the field of computing, and empower you to address some of the challenges facing the modern software development industry, including diversity & inclusion issues, as well as understanding the social impact of software.

After completing this course, you will be able to:

• Apply best-practice principles and patterns to design and implement a high quality software system
• Develop mobile apps using Android and dynamic web apps using server-side JavaScript and Node Express
• Create a comprehensive set of test cases for a piece of software
• Address some of the cultural and social concerns within the current software industry
• Work in a group to develop a complex software system

Course Topics
Lectures will cover the following topics:

• Software Process Models
  o Traditional models: waterfall, RUP
  o Agile models: XP, Scrum
  o Continuous integration
  o Software configuration management

• Designing Software
  o Software design principles
  o Software architecture
  o Class modeling and UML
  o Software design patterns
  o Distributed systems
• **Implementing Software**
  o Defensive programming
  o Readability and understandability
  o Efficiency
  o Threads and synchronization

• **Mobile and Web App Development**
  o Android
  o WWW Basics
  o JavaScript
  o Node Express
  o MongoDB
  o User interface design and usability

• **Testing Software**
  o Black-box testing
  o Mock objects
  o White-box testing

There is no textbook for the course, but most lectures will be supported by suggested readings that will be made available to registered students.

Additional, graded reading assignments will also cover various aspects of the "State of the Software Industry," and are likely to include:

- The importance of diversity in the tech industry
- Mental health issues in computing
- Designing for accessibility
- Bias in ML algorithms
- The pros and cons of Open Source Software
- ACM Code of Ethics

**Creating an Inclusive Environment**

A goal of this course is to prepare students for a career as a software engineer by giving them a sense of belonging within the field.

This can only happen if all members of the course community – the instructor, TAs, and students – work together to create a supportive, inclusive environment that welcomes all students, regardless of their race, ethnicity, gender identity, sexuality, religious beliefs, physical or mental health status, or socioeconomic status. Diversity, inclusion, and belonging are all core values of this course. All participants in this course deserve to and should expect to be treated with respect by other members of the community.

Lectures, office hours, and group working time should be spaces where everyone feels welcome and safe. In order to facilitate a welcoming environment, students of this course are expected to:
• Exercise consideration and respect in their speech and actions
• Attempt collaboration and consideration, including listening to opposing perspectives and authentically and respectfully raising concerns, before conflict
• Refrain from demeaning, discriminatory, or harassing behavior and speech

All members of the course community are expected to be familiar with and abide by the University’s guidelines on general conduct and sexual harassment:

• University Code of Conduct: https://catalog.upenn.edu/pennbook/code-of-student-conduct/
• University Sexual Harassment Policy: http://www.upenn.edu/affirm-action/introsh.html

Students should also be familiar with other University guidelines regarding personal conduct:

• Conduct & Personal Responsibility guidelines in Pennbook: https://catalog.upenn.edu/pennbook/#policiesbytopictext
• University Principles of Responsible Conduct: http://www.upenn.edu/audit/oacp_principles.htm

If you are a victim of, witness, or are otherwise affected by unacceptable behavior:

• In cases of sexual harassment and assault, please consult DPS Special Services (https://www.publicsafety.upenn.edu/about/special-services/sensitive-crimes/) at 215-573-3333 or 511 from a campus phone; this is a confidential resource.
• To report other bias incidents, contact the Penn Office of Diversity: https://diversity.upenn.edu/diversity-at-penn/bias-motivated-incident-report
• For other violations of the code of student conduct, the Office of Student Conduct has an incident reporting form at https://www.osc.upenn.edu/referral-form

If you are unsure which office to contact, please contact the Instructor or Head TA.

Please note that the Instructor is legally obligated to report incidents of sexual assault or harassment that he becomes aware of; if you wish your report to remain confidential, contact DPS Special Services using the information listed above.

**Mental Health and Wellness**
Your mental health and wellness is of utmost importance to the course instruction staff, if not the University as a whole. All members of the instruction staff will be happy to chat or just to listen if you need someone to talk to, even if it’s not specifically about this course.

**If you or someone you know is in distress and urgently needs to speak with someone, please do not hesitate to contact CAPS: 215-898-7021; 3624 Market St.** If you are uncomfortable reaching out to CAPS, any member of the instruction staff will be happy to contact them on your behalf.

If you would like to speak with a peer, we encourage you to contact the RAP-Line, which is available nightly from 9pm-1am at 215-573-2727; you can text them anytime at 215-515-7332.
The course TA for Wellness will post information about other resources, advice, groups, and events in Piazza on a regular basis.

We understand that student life at Penn can be extremely difficult, both mentally and emotionally. If you are living with mental health issues such as anxiety, depression, ADHD, or other conditions, you are encouraged to discuss these with the instructor. Although the details are up to you to disclose, the instruction staff will do their best to support and accommodate you in order to ensure that you can succeed this course while staying healthy.

Course Grading
The final course grade will be determined by the following:
- Programming assignments: 50%
- Group project: 20%
- Reading assignments: 10%
- Contributions and participation: 5%
- Quizzes/Exams: 15%

There will be six programming assignments over the course of the semester and you will typically have two weeks to complete them. Assignments in the most recent offering of the course covered the following topics:
- Java basics: commandline arguments, packages, working with external libraries
- Software design documentation
- Software architecture and design patterns
- Android application development
- Software testing
- Improving software efficiency

Unless otherwise indicated, students are expected to work alone on all programming assignments.

In the group project, you will work in a team of 3-4 students to develop a system that includes mobile and web components that communicate with each other over the Internet. The project spans the duration of the semester and follows an agile software development methodology. Each team is assigned a Project Manager TA and is expected to meet with their Project Manager weekly to ensure steady progress. Teams may define the functionality of their project as long as it has a clear potential for positive social impact or serves a humanitarian cause.

In order to expose students to the social issues faced by the current software development industry, there will be six reading assignments, each of which consist of 2-3 short articles. Students will have around one week to read the articles and write a brief response, and then have another week to write a reply to another student’s response.

The goal of contributions and participation grade is for other students in the class to benefit from your experiences and insights. You will earn full credit for making four contributions before the last day of class, including:
• Attending a reading assignment discussion session
• Posting your reading assignment response publicly
• Introducing yourself in Piazza
• Sharing constructive articles, videos, podcasts, etc. in Piazza about diversity, wellness, or the tech industry
• Participating in surveys

Only good-faith efforts will be considered!

Past offerings of the course have had a **midterm and final exam**; the midterm may be replaced by two smaller quizzes in Spring 2020.

The assignment of weighted averages to letter grades will likely be as follows:

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
</tr>
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<tbody>
<tr>
<td>over 98</td>
<td>A+</td>
</tr>
<tr>
<td>93-98</td>
<td>A</td>
</tr>
<tr>
<td>90-93</td>
<td>A-</td>
</tr>
<tr>
<td>87-90</td>
<td>B+</td>
</tr>
<tr>
<td>83-87</td>
<td>B</td>
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<tr>
<td>80-83</td>
<td>B-</td>
</tr>
<tr>
<td>77-80</td>
<td>C+</td>
</tr>
<tr>
<td>73-77</td>
<td>C</td>
</tr>
<tr>
<td>70-73</td>
<td>C-</td>
</tr>
<tr>
<td>50-70</td>
<td>D</td>
</tr>
<tr>
<td>under 50</td>
<td>F</td>
</tr>
</tbody>
</table>

Note that this may change slightly after final grading is completed.

**Assignment Extensions and Late Penalties**

The instruction staff certainly realizes that you are busy with your other courses, recruiting, part-time jobs, and having a life outside of school, and that sometimes you may need a bit more time to complete an assignment.

As such, each student is given a grace period of **six late days** to use over the course of the semester, no questions asked, for submitting the programming assignments.

The granularity of this grace period is in **minutes**, which means that you have a total of \(6 \times 24 \times 60 = 8640\) minutes of lateness that you can use.

Please note, though, that there is one caveat: **no assignment may be submitted more than four days late** without prior authorization from the instructor (see below). This is so that solutions can be discussed in Piazza and during class meetings.
Additionally, if you exhaust your grace period quota, subsequent late assignments will be penalized at a rate of 20% per day, even if they are submitted one minute late.

If you feel that you need more time (overall or for a particular assignment), please speak with the instructor, who will be happy to work with you to ensure that you have the time you need in order to succeed in this course. Extra time may be granted for unforeseen circumstances, but is unlikely to be permitted for work in other courses, traveling for interviews, and other issues that could be addressed with advance planning.

For prolonged extensions of more than a week due to illness, family emergency, etc. please coordinate with Dr. Sonya Gwak (sgwak@seas.upenn.edu) in the SEAS Office of Research and Academic Services so that your other instructors can be notified. Please be sure to CC the instructor on your communications with Dr. Gwak.

**Exam Rescheduling**
If you know in advance that you will be unable to take the midterm exam (e.g. because of traveling to a job interview), please discuss this with the instructor as soon as possible so that the instructor can verify the reason for the absence. Any makeup exam is likely to take place after the scheduled date.

Please note that although care is taken to schedule the midterm exam on a day that is unlikely to conflict with other classes' midterms, the University does not have any policy regarding rescheduling midterm exams when more than one are scheduled on the same day. Thus, requests for a makeup midterm exam due to another exam on the same day are unlikely to be approved.

For emergency absences (e.g. illness, family emergency, etc.), please coordinate with Dr. Sonya Gwak (sgwak@seas.upenn.edu) in the SEAS Office of Research and Academic Services. Please be sure to CC the instructor on your communications with Dr. Gwak.

Policies regarding absences for the Final Exam are covered by the University Provost; for Spring semester courses, a makeup Final Exam would be scheduled at the start of the following Fall semester. Requests for a makeup Final Exam due to reasons that could reasonably be anticipated (e.g. traveling for winter break) are unlikely to be approved.

**Academic Honesty**
Students are expected to abide by the University Code of Academic Integrity. The course's academic honesty policy is governed by this document, unless otherwise explicitly noted in assignment descriptions.
In particular, unless stated otherwise, *under no circumstances* should you be discussing or assisting other students with solutions/implementation/code for individual homework assignments. This includes but is not limited to:

- co-authoring code, either through pair programming or distributing the work
- sharing and distributing code, i.e., one student writes it and allows other students to see it (even if the other students further modify it)
- sketching out code together on paper, a whiteboard, etc., even if you type it up separately
- reviewing another student's code "just to see how they did it"
- helping another student debug/troubleshoot their code

Additionally, submitting someone else's work (e.g. something found online, something given to you by a student who took the class in the past, etc.) and claiming it as your own, even with further modification, is considered plagiarism and will be treated as academic dishonesty. Suspected violations of the academic honesty policy will likely be referred to the Office of Student Conduct (OSC) for further investigation. Should OSC find you responsible for violating the policy, you will receive a grade of zero for the affected assignment(s) and possible additional sanctions as determined by OSC.