ECE 651: Software Engineering
Spring 2023
Professor Drew Hilton (Section 1)
Professor Steven Noyce (Section 2)

This course focuses on moving from small-to-medium software projects, to the design ideas required for larger scale, maintainable code. We will start with core design principles, which we will see manifest in a variety of the forms through the course of the semester. We will see these ideas emerge from smaller scale design at the start of the semester to large scale system architecture at the end. Testing will also be an important topic throughout.

Detailed Topics

1. Design principles: SOLID, DRY, Low Coupling/High Cohesion, Abstraction, Least Surprise.
2. From C++ to Java: how Java's differences align with design principles.
3. Software Design Process: Requirements Definition, Waterfall vs Agile, Task Breakdown, Estimating Work
4. Testing: Review+ of Blackbox and Whitebox testing. Mutation testing
5. UML and CRC. Introduction of Design Patterns.
6. Bad Design: Code Smells, Technical Debt. And fixing it: Refactoring, Regression Testing
7. Continuous Integration/Deployment, Team Development,
8. Testing revisited: Stubs + Mocking. Unit vs Integration Testing
9. Software Design Process revisited: Agile in more detail
10. User Interfaces and User Experience (UI/UX)
11. System Architecture: introduction and traditional *e.g.*, architectures: 3-tier, monolith, client-server
12. Modern Architectures: Micro-services
13. Testing 3: System/acceptance and usability testing
14. Maintenance
15. Design Metrics
16. Security

Assignments and Grading

Your grade for this course will be comprised of the following components:

- Class Participation: 11%
- Individual Programming Assignment: 15%
- Interviews for Team Formation: 10%
- Team Programming Assignment: 45% (broken down further as follows)
  - Step 1 deliverables: 15%
  - Step 2 deliverables: 15%
  - Step 3 deliverables: 15%
- Midterm Exam: 10%
- Three small quizzes: 9% (3% each)

Note that you will have a large team project spanning the later part of the semester worth **45%** of your grade. This project will have three sets of deliverables with requirements evolving between each submission (*i.e.*. you get the step 2 requirements after submitting step 1). You will also be graded on your group's use of professional software development practices, and your code's quality (design, commenting, etc).
Final letter grades are assigned based on the following scale (with slight modification as described below):

A-range	>97 A+	93–97 A	90–93 A-
B-range	87–90 B+	83–87 B	80–83 B-
C-range	77–80 C+	73–77 C	70–73 C-
F	<70 F		

Before assigning letter grades, we *may* alter the scale by lowering the threshold for a certain grade (e.g., making a B- span 79.5–83 instead of 80–83). Such a change is **solely at our discretion**, and occurs when the change results in a letter grade more accurately reflecting the quality of the students work and effort.

Exams

You will have one mid-term exam (during a class period). There is no final, but instead there will be three small (20 min each) quizzes during class. These exams will be individual effort, however, you may bring **two pages of notes**.

Academic Integrity

Academic integrity is very important, and misconduct will not be tolerated in this course. All students should already be aware of a few basic principles which govern academic integrity at Duke in general:

- I will not lie, cheat , or steal in my academic endeavors, nor will I accept the actions of those who do.
- I will conduct myself responsibly and honorably in all my activities as a Duke student.

If I suspect academic misconduct in my class, I will report you to the appropriate Associate Dean, who will carry out the required due process to determine if you committed academic misconduct. If you are found responsible for academic misconduct, I will give you a 0 on the corresponding assignment. The Associate Dean overseeing your case is likely to impose additional sanctions against you.

Some concrete expectations for how you will perform your work in my class:

Individual Programming Assignments

You are expected to work on these by yourself. You may consult library documentation, class notes, and other similar reference materials. You may not consult any materials that provide solutions to the problem you are trying to solve. You may not consult the work of other students.

Interviews for Team Formation

You should conduct the interview and be interviewed as if you were hiring/being considered for hiring in a professional setting. You are welcome to discuss ideas for how to approach being the interviewer with anyone you want. You are welcome to prepare for the interviews in any way you want. You should act professionally and treat your fellow students with respect. Importantly, you should not discuss another student's performance in your interview with anyone other than your professor or TAs, especially if that discussion would reflect negatively on that student.

Team Programming Assignment

You are expected to work as a team for this assignment. You can and should discuss the problem with your team members, and work together to solve it. You may not exchange code or any details sufficient to cause similar code with other groups. You may consult appropriate reference materials, such as library documentation, class notes, etc.

Your guiding principle here should be that if this were your job in industry, the product you are making would be unquestionably free of any intellectual property issues.

Exams + Quizzes

Exams are expected to be entirely individual effort. You may use your own notes (two pages) only. You may not collaborate with other students nor access outside resources.

Lying

Lying to any University official (including faculty) is a serious offense under any circumstances. Lying during the course of an official investigation is particularly serious. If you are suspected of academic misconduct, and lie to anyone conducting the investigation, you will face additional charges.

Other

If you are unsure if something is OK, please ask me. If you do not want to ask me because you think I will probably say "no," that is a good indicator that it is not acceptable.

If you do something wrong and regret it, please come forward. I recognize the value and learning benefit of admitting your mistakes. You should not take this to mean that coming forward of your own volition will absolve you of all consequences, just that it can be taken into account in reducing the sanctions.

If you are aware of someone else's misconduct, please report it to me or another appropriate authority.