

Introduction

ENGI 5895: Software Design

Andrew Vardy

Faculty of Engineering & Applied Science
Memorial University of Newfoundland

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What is this course about?

Many people can program, but are they Software Engineers? A Software Engineer is someone who can do the following:

- Ensure the correctness of their software
- Develop efficient solutions
- Design systems which are flexible, robust, and easy to maintain
- Communicate the design and behaviour of a software system

This course focusses on the last two points, but we will always be mindful of correctness and efficiency.

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Flexibility, Reusability, and Maintainability

You have developed software that behaves correctly and efficiently in scenario A.

- **Flexibility:** Your boss adds scenario B. How much effort does it take to make it work?
- **Reusability:** You realize that part of your code might actually be useful in scenarios X and Y. How much effort does it take to isolate the parts that you need?
- **Maintainability:** Over time features are added and bugs are corrected. How much effort does it take to make these changes and to continue making similar changes in the long run?

We will discuss object-oriented design principles and patterns to address these concerns.

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Communication

This course is also about communication. Software gets very complicated very quickly! How can you communicate the essential ideas behind your design...

• to yourself, when you look at your code two years from now

• to your boss

• to your team, to explain the details of the code to the new joiners

In this course you will learn to describe your designs using the Unified Modelling Language (UML).

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- to yourself, when you look at your code two years from now

- You pepper your code with comments, but what's the big picture?

- to your peers

- How can they easily modify or extend your code? Is it so hard to change that you might need to make big changes yourself?

- to your boss, to explain the difficulty of the problem you are addressing

- How long do you think you need more time? Can't you just make it work?

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- to your boss, to explain the difficulty of the problem you are addressing
 - How can you show your boss you need more time? Can't you just make it go faster?

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In this course you will learn to describe your designs using the Unified Modelling Language (UML).

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - Familiarisation with Java IDE (Eclipse) and Visual Paradigm CASE tool
- Project (60%):
 - Teams of 2-3
 - Choose your own 6-semester project system to implement
 - Assign. 1: Requirement specification
 - Project includes both design and implementation
- Two mid-term exams (25%)

Deliverables

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - Familiarisation with Java IDE (Eclipse) and Visual Paradigm CASE tool
- Project (60%):
 - Team of 2-3
 - Choose your own 6-8 week project system to implement
 - Assignments: Motivation, specification
 - Project includes both design and implementation
- Two mid-term exams (25%)

Deliverables

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - One iteration with two IDE (Ideas) and Visual Paradigm (VPM) tool
- Project (60%):
 - Term of 12 weeks
 - Complete individual or in pairs
 - Complete individual or in pairs
 - Project includes both design and implementation
- Two mid-term exams (25%)

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - Familiarization with Java IDE (Eclipse) and Visual Paradigm CASE tool
- Project (60%):
 - Term of 12-14 weeks
 - Complete individually. Deliver a final system to implement a given specification
 - Project includes both design and implementation
- Two mid-term exams (25%)

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - Familiarization with Java IDE (Eclipse) and Visual Paradigm CASE tool
 - CASE = Computer-Aided Software Engineering
- Project (60%):
 - Term of 2-3 weeks
 - Complete individually. Deliver a new system to implement a given application.
 - Project includes both design and implementation
- Two mid-term exams (25%)

- Two assignments (15%):
 - Complete individually or in pairs
 - Assign. 1: Implement a given design
 - Assign. 2: Design a system
- Labs (0%)
 - Familiarization with Java IDE (Eclipse) and Visual Paradigm CASE tool
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- Project (60%):
 - Design and implement a system
 - Complete the design and implementation of a system to implement a given specification
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- Project (60%):
 - Teams of 2-3
 - Complete the project by the end of the semester
 - Implement a given design and implement a system
- Two mid-term exams (25%)

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- Project (60%):
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 - Choose your own stand-alone software system to implement (e.g. game, simulation, application,...)
 - Project includes both design and implementation
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Communicating your design

- You will document your designs in carefully written reports that include helpful UML diagrams
- In the project, there will be design review meetings where you will present your design and explain its rationale and history
- It is your responsibility to highlight and explain the principles and patterns utilized in your design!
- You will demo your working programs and submit clean and carefully documented source code

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- The Unified Modelling Language (UML)
 - Class and sequence diagrams; use cases
- Brief introduction to Java
- Development Processes
- Design Principles
 - e.g. The Single Responsibility Principle: "A class should have only one reason to change"
- Design Patterns
 - e.g. Iterator
- Various bits of technology needed for the project:
 - Spring, JUnit, Mockito, Mockito2, JMock, Mockito2, Mockito2, Mockito2

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 - The Factory Method
- Various bits of technology needed for the project:
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 - e.g. Observer
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