Course Information
EECS 393/493: Software Engineering
Fall 2018

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Course Description
Software engineering is both a synonym for the systematic use of well-founded software development practices and the name of the area of computer science and engineering that deals with the specification, design, implementation, validation, and maintenance of complex software systems and applications. This course covers the main elements of software engineering methodology. Undergraduate students usually apply them in the setting of a significant team project. Alternatively, they can participate in a research project, with instructor approval. Graduate students are required to investigate a research problem in software engineering.

Objectives
- Understanding of the software development lifecycle
- Understanding of the issues and challenges associated with each phase of software development
- Familiarity with the basic software engineering techniques and tools for each phase of software development
- For undergraduates, experience working as part of a team on a substantial software development project
- For graduate students, experience investigating a software engineering research issue in depth
- Cultivation of critical thinking skills needed by professional software engineers and software engineering researchers

Prerequisites
- Intermediate to advanced programming skills in at least one modern programming language, such as Java, C++, C#, or Python
- EECS 233 with a grade of C or higher.

Textbook: *Software Engineering* by Ian Sommerville, 10th edition, Pearson, 2015.

Canvas: Slides and other materials will be posted on Canvas. However, these are *not* a substitute for attending class. You are responsible for what is discussed in class,

whether or not it appears in the slides. Almost every topic discussed in class is also discussed on various software engineering web sites, which you are encouraged to consult for more information and different perspectives.

Grading
       Quizzes and homeworks (60%)
       Project (40%)

Project
Undergraduate students are expected to complete a software development project, whose work products include: a software requirements specification, a design document, functional test-case descriptions, implementation code, unit tests, and a basic user's manual. Teams of two to five students may work together on a development project. Projects are proposed by each team and must be approved by the instructor. Scheduled "live" demonstrations of work products and development practices (e.g. program, unit and functional tests, version control) are required. Each team member must contribute significantly to each project work product or deliverable.

Undergraduates may optionally choose to do a research project on a topic suggested or approved by the instructor. The topic will generally involve implementation (e.g., developing a software analysis tool) and/or empirical evaluation (e.g., of a software testing or analysis technique). The work products include any programs implemented, data collected, and a research report modeled on papers from the software engineering research literature.

Graduate students are expected to complete a research project, whose work products include: a written project proposal, including a literature survey; a modest *original* research contribution; a written progress report; and a final written project report and demonstration to the instructor. The research contribution may take one of two forms: (1) a well-designed study clarifying an important issue in software engineering research, typically through implementation and comparative empirical evaluation of two or more existing or proposed techniques for a given software engineering problem; or (2) development and empirical evaluation of an innovative and potentially useful technique or tool. Teams of up to four students may work together on a research project. Projects are proposed by each team and must be approved by the instructor. Research reports should use the approved formats for either ACM or IEEE research conference papers. *All material, claims, and ideas that are taken from papers or other sources should be fully cited at each point they are used, and verbatim material must also be quoted.*

Detailed Syllabus (tentative)

Introduction (Week 1)
    What is Software Engineering?

The Software Development Process (Weeks 1 and 2)
    Lifecycle Models
        Waterfall Model
        Rapid Prototyping
        Incremental Development
        Agile Development
        Spiral Model

Software Requirements (Weeks 3-4)
    What are Software Requirements?
    Requirements Elicitation and Analysis
    Specifying Requirements
    Validating Requirements
    Maintaining Requirements

Software Design (Weeks 5-8)
    Design Dimensions and Principles
        Managing Complexity
        Designing for Change
        Divide and Conquer
        Encapsulation and Information Hiding
    Design Techniques
        Stepwise Refinement
        Object-oriented Design
        Event-Driven Design
    Design Patterns
    Design Languages and Notations
        UML
    Design Documentation
    Design Tools
    Design Inspections and Reviews

Validating Software (Weeks 9-12)
    Testing
        Testing Phases
            Unit Testing
            Subsystem Testing
            Integration Testing
            System Testing
            Acceptance Testing
            Beta Testing
        Synthetic Testing
            Specification-based Testing

   Code-based Testing
   Fault-based Testing
   Interaction Testing
  Field Testing
  Regression Testing
 Code Inspection
 Static Analysis Tools
 Statistical Reliability Estimation
 Post-deployment Validation

Product Delivery (Weeks 13-14)
 Configuration Management
 Continuous Integration
 Defect Tracking
 Deployment Pipeline
 Build and Deployment Scripting
 Deploying and Releasing Applications
 Delivery Ecosystem

Project Presentations (Week 15)