Instructor
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Office Hours: TBD and posted on cuLearn

Teaching Assistants (TAs)
TBD and posted on cuLearn

Dates, Times, and Locations
Lectures: Wednesdays 2:35PM–3:55PM
Fridays 2:35PM–3:55PM
Labs: Fridays 8:35AM–11:25AM (Even/Odd Weeks)

Calendar Description
Current techniques, notations, methods, processes, and tools used in Requirements Engineering. Requirements elicitation, negotiation, modeling requirements, management, validation. Skills needed for Requirements Engineering and the many disciplines on which it draws. Requirements analysis: domain modeling, modeling object interactions, UML modeling. Introduction to software development processes.

Prerequisites: SYSC 2100 and third-year status in Software Engineering
Students who have not satisfied the prerequisites for this course must either withdraw from the course, or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office. Students not meeting these conditions will be deregistered from the course after the last day for course registration.

Course Objectives
Requirements engineering is a branch of software engineering concerned with discovering, analyzing, modeling, validating, testing, and writing the real-world goals for, functions of, and constraints on software systems. It is also concerned with the relationship of these factors to precise specifications of software behaviour, and to their evolution over time, and across software families.

As more and more features are being defined for software systems, requirements engineering is becoming increasingly important to help manage the development and evolution of features throughout the product lifecycle. Requirements engineering has proven to be one of the most difficult and critical activities for the successful development of software and software-intensive systems. Contrary to common belief, software rarely fails. More often than not, software behaves exactly as it was designed to, but it was the requirements that were flawed. Some sources assert that over 90% of software issues result from deficient requirements. For example, if requirements are missing from a specification, then even the most careful implementation of a system will not result in a product that is complete or useful. Moreover, if requirements are included in the specification that are not actually valid, then the product or system becomes unnecessarily expensive. Therefore, experience teaches us that getting requirements right, as well as precisely specifying them, is essential for the establishment of safe, secure, and effective systems. As a result, solid requirements engineering has been recognized as the key to improved, on-time, and on-budget delivery of software and systems projects.
This course examines current software requirements engineering techniques, notations, methods, processes, and tools. It will cover informal, semi-formal, and formal approaches, while striking a balance between theory and practice. This course will involve building models of both software engineering processes and products, concerning both functional and non-functional goals, requirements, and specifications. It will provide students with the skills needed for software requirements engineering, as well as a foundation that can be used to systematically establish, define, and manage the requirements for large, complex, and changing software-intensive systems, from technical, organizational, and management perspectives.

Learning Outcomes

Upon completion of this course, students should know and understand:

1. the role of, and need for, requirements engineering for the development of software systems;
2. the breadth of skills needed for requirements engineering, and the many disciplines upon which it relies;
3. the main principles that underlie requirements elicitation, evaluation, documentation, and quality assurance;
4. how to elicit and document high-quality requirements;
5. how to effectively use visual models, diagrams and notations in requirements analysis;
6. critical issues affecting the success of various approaches in requirements engineering.

Upon completion of this course, students should be able to:

7. explain and identify the different types of requirements;
8. conduct requirements elicitation to describe the visible behaviour of a software system;
9. conduct requirements evaluation activities to make decisions based on multiple criteria;
10. specify and analyze scenarios using consistent diagrammatic (or graphical) notations and/or appropriate formal methods;
11. prepare well-organized, and maintainable software requirements documentation that can be reviewed, corrected, and (eventually) accepted by clients and stakeholders;
12. describe and participate in requirements verification, validation, and traceability activities.

Graduate Attributes

The Canadian Engineering Accreditation Board (CEAB) requires graduates of engineering programs to possess 12 attributes. This course will assess the following graduate attributes:

<table>
<thead>
<tr>
<th>Graduate Attribute</th>
<th>Learning Outcome(s)</th>
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<tbody>
<tr>
<td>1.8.S Knowledge Base: Discipline-Specific Concept SCE-5: Software Engineering</td>
<td>1-7</td>
</tr>
<tr>
<td>2.1 Problem Analysis: Problem Definition</td>
<td>8</td>
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<tr>
<td>2.2 Problem Analysis: Approach to the Problem</td>
<td>10-12</td>
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<tr>
<td>3.1 Investigation: Complex Problem Assessment</td>
<td>9</td>
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<tr>
<td>5.1 Use of Engineering Tools: Diagrams and Engineering Sketches</td>
<td>10</td>
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Data obtained from exam questions related to learning outcomes 1-7 will be collected to assess students’ progress towards achieving GA 1.8.S. Data obtained from assignments, lab exercises, and exam questions related to learning outcomes 8-12 will be collected to assess students’ progress towards achieving GA 2.1, GA 2.2, GA 3.1, and GA 5.1.
Textbook

The following textbook is strongly recommended and is available at the Carleton bookstore.


*Note: This course may not always follow the textbook closely.*

Additional References & Resources

Throughout this course, the following useful references and resources may also be used:


Course Webpage

The course announcements, course syllabus, lecture slides used in class, assignments, and any material needed or used in the problem analysis or lab sessions, can be found on cuLearn. It is the student’s responsibility to be aware of the information on cuLearn, and to check regularly for announcements.

Email Correspondence

In order to ensure that you receive a timely response to emails that are sent to the instructor or TAs, please include [SYSC 3120] in the Subject, as emails will be filtered using this identifier.

Students are expected to show and maintain a high-level of professionalism in all email correspondence. This means that emails should include a proper salutation and sign-off/signature, and should refrain from using slang, texting abbreviations and acronyms, and emojis/emoticons.

Note that email is not the best medium for technical questions. Technical questions submitted by email will be answered at the beginning of the next lecture.

Evaluation and Grading Scheme

Labs (9%)

There will be a total of six (6) lab sessions for each Lab Section (alternating weeks). Each lab session will involve a short assignment worth 1.5% of the final grade. Lab assignments will be due at the end of each lab session and must be submitted on cuLearn. To receive credit for the lab assignments, you must make reasonable progress towards correctly completing the exercises, demonstrate your work to the TA in the lab, and individually submit the final result of your work on cuLearn. Late lab assignments will receive a grade of 0. A lab is considered late if submitted after 11:30AM on the day of the lab session. You must attend your section of the lab. Being absent from a lab, except for reasons accepted by the Associate Dean’s Office (see Academic Regulations of the University), will result in a grade of 0.
Assignments (21%)
There will be three (3) assignments. Each assignment is worth 7% of the final grade. Assignments will be posted on cuLearn and will be posted and due on the following dates:

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<tr>
<th>Assignment #</th>
<th>Posted Date</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>1</td>
<td>January 11, 2019</td>
<td>February 1, 2019</td>
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<tr>
<td>2</td>
<td>February 1, 2019</td>
<td>March 1, 2019</td>
</tr>
<tr>
<td>3</td>
<td>March 1, 2019</td>
<td>March 29, 2019</td>
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The assignment solutions are due by 8:00PM on the due date. Students must submit their assignment solutions on cuLearn. Students are permitted to discuss general aspects of the assignments with other students in the class, but each person should hand in their own work. Students may consult outside sources, such as textbooks, but any use of any source must be documented/cited in the assignment solutions. Late assignments will be graded with a late penalty of 20% of the full grade per day up to 48 hours past the deadline, except for reasons accepted by the Associate Dean’s Office (see Academic Regulations of the University).

The assignments will be graded by the TAs. Any request for regrading must be first directed to the TA that has graded your assignment. If after having talked to the TA you still believe that you deserve a higher grade, then you can contact the instructor. When the instructor regrades an assignment, all of the assignment solutions will be regraded.

Surprise Quizzes (0-5%)
During the lectures, the instructor can give a surprise five to ten minute quiz. There will be up to six (6) surprise quizzes. If the class writes one quiz during the term, it counts for 1% of the final grade. If the class writes more than one quiz, the quiz with the lowest grade does not count, while each of the others count for 1% of the final grade.

Midterm Exam (15%)
There will be one (1) midterm examination. It will be a closed book examination. The midterm exam is worth 15% of the final grade and will take place on Friday, February 15, 2019, from 2:35PM–3:55PM (during the lecture time). The location of the midterm exam will be announced on cuLearn in due time. The midterm exam will cover the material from the lectures, labs, assignments, and the required textbook.

Final Exam (50-55%)
The final examination will be scheduled by the Registrar’s office in the usual way. It will be three (3) hours in duration and will cover the material from the lectures, labs, assignments, and the required textbook. The final exam counts for \((55 - \#\text{QuizzesThatCount})\%\) of the final grade. For example, if the class writes 4 quizzes, only 3 quizzes count and the final exam will be worth \((55 - 3) = 52\%\). The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

Tentative Course Outline
Note that this course outline is subject to change as circumstances dictate.

- **Part I: Introduction to Requirements Engineering**
  - Software Engineering Processes
  - Definition, Role, and Importance of Requirements Engineering
  - Requirements Engineering Activities and Processes
  - Types of Requirements (Functional vs. Non-Functional)
  - Techniques for Writing High-Quality Requirements
• **Part II: Requirements Inception, Elicitation, Evaluation, and Documentation**
  – Domain Understanding, Product Vision, and Scope
  – Elicitation Approaches and Techniques
  – Business Events, Viewpoints, and Stakeholders
  – Requirements Evaluation and Risk Management
  – Software Requirements Specification (SRS) Documentation Standards and Templates

• **Part III: Requirements Analysis, Modeling, and Specification**
  – Description vs. Specification
  – Modeling Techniques and Diagrammatic Notations
  – Use Case Modeling and Scenario Descriptions
  – Analysis for Understanding the Domain and Requirements
  – Formal Specification

• **Part IV: Requirements Verification and Validation**
  – Verification vs. Validation
  – Techniques for Inspection, Verification, and Validation
  – Detection of Conflicts, Inconsistencies, and Completeness

• **Part V: Requirements Evolution and Management**
  – Requirements Traceability
  – Priorities, Changes, Baselines
  – Reusing Requirements

• **Part VI: Advanced Topics**
  – Hazard Analysis and Safety-Critical System Requirements
  – Threat Modeling and Security-Critical System Requirements
  – Tool Support for Requirements Engineering
  – Open Research Problems in Requirements Engineering

**Instructor Expectations, Policies, and Notes**

1. A regrading request of an assignment, lab, quiz, or exam will be considered by the instructor only if it is made within the **two weeks that follow the return date of the majority of the concerned assignment, lab, quiz, or exam.**

2. The instructor reserves the right to assign extra grades for extra work done by willing students. However, the work subject to extra grades will be advertised during the lectures to provide the opportunity to all students.

3. No responsibility for loss of assignments or labs can be assumed by either the instructor or the TAs. **Keep copies of your own assignments and labs.**

4. Students are responsible for ensuring that their assignments are submitted correctly and without corruption.

5. The lectures will not necessarily follow the order in which the topics are presented in the detailed course outline. Regular class attendance is required.
6. Significant study, reading, and group discussions outside of class are required. Looking at, or only reading the slides that are provided may not be enough to achieve the level of understanding required for the assignments and exams.

7. Students are expected to show professional behaviour. This includes being on-time for lecture, lab, and/or problem analysis sessions, meeting assignment deadlines, and maintaining a suitable level of professionalism in oral and written (email) correspondence with the instructor and TAs.

8. Students that are having difficulty with the course content are expected to seek help early. Students are encouraged to ask questions in class and/or seek help during the instructor’s office hours.

9. **Suggestions on how to improve the course and the instructor’s teaching methods are always welcomed.**

**General Regulations**

**Attendance:** Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 1.2, Course Selection and Registration* and *Section 1.5, Deregistration.*

**Health & Safety:** Every student should have a copy of the Health and Safety Manual. Students are reminded to consult the Health and Safety Manual should they, at any time have any questions or concerns regarding Health and Safety.

**Deferred Term Work:** Students who claim illness, injury, or other extraordinary circumstances beyond their control as a reason for missed term work are responsible for immediately informing the instructor and for making alternate arrangements with the instructor. This must occur no later than three (3) working days after the term work was due. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.6, Deferred Term Work.*

**Appeal of Grades:** The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 2.7, Informal Appeal of Grade* and *Section 2.8, Formal Appeal of Grade.*

**Academic Integrity:** Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University’s Senate.

**Plagiarism:** Plagiarism (copying and handing in for credit someone else’s work) is a serious instructional offense that will not be tolerated.

**Academic Accommodation:** You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/. For an accommodation request, the processes are as follows:

- **Pregnancy Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.

- **Religious Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.
• **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC Dates and Deadlines for the deadline to request accommodations for the formally-scheduled exam (if applicable).

• **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [https://carleton.ca/sexual-violence-support/](https://carleton.ca/sexual-violence-support/).

• **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Senate Policy on Accommodation for Student Activities.

**Copyright on Course Materials**

The materials created for this course (including course syllabus, slides, posted notes, labs, project, assignments, quizzes, exams and solutions) are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s).