Instructor Information and Office hours:
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tbd

Calendar Information
Course Number: SYSC4101
Course Title: Software Validation
Calendar description
http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites
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 are expected to:

- Be able to program with a procedural programming language as well as an object-oriented programming language,
- Be able to trace the execution of such programs, that is understand the flow of control of programs,
- Be able to understand a high-level design, a specification with a (extended) finite state machine,
- Be knowledgeable in discrete mathematics.

Course Objectives
Software Verification and Validation (V&V) are two important activities of any software development. One of the main techniques used for V&V is called software testing.

Some data reported in literature indicate that software testing usually amounts for 30% to 40% of the total software development cost, and that for safety critical software this percentage can go up to 70%. Other anecdotal evidence of the importance of software testing is that in large
projects, the amount of test code (for instance measured in number of lines of code) can be
double the amount of application code! Although a lot of testing is conducted, there are still
many defects in released software (verification issue) and software do not entirely satisfy
customer needs (validation issue).

One of the main limits of today’s testing activities is that they are often not conducted in a
systematic, repeatable way, using clear rationale. For instance, a study reported that open source
software development projects lack “attention to basic, accepted, and mature testing techniques.”

The main purpose of SYSC-4101 is to introduce you to basic, well-accepted, systematic, mature
software testing techniques so you become capable of using them wisely; to introduce you to the
notions of validation, verification and testing so you can precisely understand what activity you
conduct in practice; to introduce you to the challenges of using testing techniques and design
software test harness.

Learning Outcomes
By the end of the course, students will be able:

1. to describe and discuss the concepts of verification, validation, testing, test model, test
criteria;
2. to describe the benefits and limitations of software testing;
3. to understand results of a testing campaign in relation to the notion of faults, errors and
failures, to the test scaffolding.
4. to apply testing techniques for unit testing, integration testing, and system testing;
5. to apply standard black-box and white-box testing techniques;
6. to discuss advantages and drawbacks of standard black-box and white-box testing
   techniques;
7. to describe the problem of regression testing;
8. to describe problems specific to procedural, object-oriented, distributed, or real-time
   software;
9. to describe the general notion of quality assurance;
10. to implement (design) test suites for standard black-box and white-box testing
    techniques;
11. to appraise alternative testing techniques, while accounting for their advantages and
drawbacks, for specific software development contexts.

Graduate Attributes (GA’s)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to
possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed
above are measured throughout the course and are part of the department’s continual
improvement process. Graduate attribute measurements will not be taken into consideration in
determining a student’s grade in the course. For more information, please visit:
https://engineerscanada.ca/.
Graduate Attribute                  Learning Outcome (s)
1.8.S Knowledge Base: Discipline-Specific Concept SCE-5: Software Engineering  1-10
2.4 Problem analysis: Interpreting the solution - validity of results  2
3.5 Investigation: Interpretation of data (synthesis) and discussion  3
5.1 Use of engineering tools: Diagrams and engineering sketches  5

Textbooks (or other resources) if applicable


Evaluation and Grading Scheme

- five assignments, each worth 2% of the final mark;
- two (closed-book) midterm exams, each worth 20%;
- a (closed-book) final exam worth 40%.
- compulsory lab work worth 10%: each of the five labs is worth 2% of the final mark.

To pass the course, an appropriate overall mark (D- or higher) must be obtained, a passing mark (D- or higher) must be obtained at the final exam, and a passing mark (D- or higher) must be obtained for at least one of the two closed-book mid-term exams.

Breakdown of course requirements (labs, assignments, quizzes, exams, etc.)

Assignments and laboratories will lead you through the use of software testing techniques, and are a good starting point when preparing exams. Portions of the work from each assignment may be used and refined in subsequent assignments and/or laboratories. You are encouraged not to "write-off" any particular assignment or laboratory just because of its relatively low weight in the overall grading scheme. You are encouraged to discuss issues when working on assignments or laboratories. However, you are expected to submit your own work for grading (unless otherwise specified). There is a fine line between cooperating with your colleagues (discussing problems and ideas) and copying solutions (plagiarism). Not only is plagiarism an instructional offence (see the Undergraduate Calendar), but doing the assigned work by yourself is by far the best way to prepare for the exams.

Submission for Labs and Assignments

Assignments are due before midnight (23h55) of the due date. Late assignments will be graded according to the following policy: a 20% penalty per day (i.e., 24 hours) with a maximum of two late days (48 hours) after which the grade of 0 is assigned.

Laboratory work is due at the end of the laboratory session. Late laboratory work will receive a grade of 0.

All submissions are on cuLearn. It is your responsibility to ensure that your material has been submitted. You must check that your material has been submitted. If no material is received, the
grade of 0 is assigned (unless this was obviously a glitch in the online system, which will be investigated by the instructor and ITS).

Assignment dates:

• Assignment 1 will be posted on Sept. 20th and due on Oct. 4th.
• Assignment 2 will be posted on Oct. 4th and due on Oct. 18th.
• Assignment 3 will be posted on Oct. 18th and due on Nov. 1st.
• Assignment 4 will be posted on Nov. 1st and due on Nov. 15th.
• Assignment 5 will be posted on Nov. 15th and due on Nov. 29th.

**Exams**

The two mid-term exams are scheduled on **October 7th** and **November 11th**. The mid-term exams will take place in the class room, unless otherwise specified.

The final exam will take place during the December exam period.

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.

**Week-by-Week breakdown**

Week 1&2: Context and Definitions
Week 3: Category-Partition software testing
Week 4: Graph criteria
Week 5: Control flow graph (application of graphs)
Week 6: State based testing (application of graphs)
Week 7: Inheritance/Generalization and testing
Week 8: Integration testing
Week 9: Criteria for logic expressions
Week 10: Regression testing
Week 11: Drivers, stubs and oracles
Week 12: Other considerations, including empirical software engineering

**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 2.1.3, Course Selection and Registration and Section 2.1.7, Deregistration.

Health and Safety: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: [http://sce.carleton.ca/courses/health-and-safety.pdf](http://sce.carleton.ca/courses/health-and-safety.pdf)

Deferred Term Work: Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current Undergraduate Calendar, Academic Regulations of the University, Section 4.4, 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 3.3.4, Informal Appeal of Grade and Section 3.3.5, 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/](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/](http://www.carleton.ca/equity/). For an accommodation request, the processes are as follows:

- **Pregnancy or 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 see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

- **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](mailto: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). **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) 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/.

- **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 https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

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