Carleton University
Department of Systems and Computer Engineering
Course Outline

SYSC 4101 - Software Validation
Fall 2018

Instructor
Yvan Labiche

TAs
TBD

Office Hours
Mondays, 13h30 to 14h30 in MC7080. By appointment otherwise.

TA office hours are TBD.

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 (software not being built right—verification issue) and software do not entirely satisfy customer needs (not the right software being built—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:

- to describe and discuss the concepts of verification, validation, testing, test model, test criteria;
- to describe the benefits and limitations of software testing;
- to apply testing techniques for unit testing, integration testing, and system testing;
- to apply standard black-box and white-box testing techniques;
- to discuss advantages and drawbacks of standard black-box and white-box testing techniques;
- to describe the problem of regression testing;
- to describe problems specific to procedural, object-oriented, distributed, or real-time software;
- to describe the general notion of quality assurance;
- to implement (design) test suites for standard black-box and white-box testing techniques;
- to appraise alternative testing techniques, while accounting for their advantages and drawbacks, for specific software development contexts.

Graduate Attributes

- Software Engineering

Course Web Site

cuLearn

Textbook and References


Evaluation and Marking Scheme

Grading Scheme:

- four assignments, each worth 2% of the final mark;
- two (closed-book) midterm exams, each worth 25%;
- a (closed-book) final exam worth 32%.
- 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.
Labs

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:

- 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. 14 and due on Oct. 1.
- Assignment 2 will be posted on Oct. 1 and due on Oct. 15.
- Assignment 3 will be posted on Oct. 15 and due on Nov. 5.
- Assignment 4 will be posted on Nov. 5 and due on Nov. 26.

Lab dates (beware, dates have changed from original schedule):

- Section L1E: on Fridays Sept. 21st, Oct. 5th, Oct. 19th, Nov. 9th, Nov. 23rd
- Section L1O: on Mondays Sept. 17th, Oct. 1st, Oct. 15th, Nov. 5th, Nov. 19th

Exams

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.

The two mid-term exams are scheduled on October 11th and November 15th. 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.
General Regulations

- **Copyright on Course Materials**: The materials created for this course (including course outline, 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).

- **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. Requests to accommodate a missed midterm exam, lab periods, etc., because of conflicts with jobs or vacation plans will not be considered.

- **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.

- **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 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 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.

- **Academic Accommodations**: Requests for Academic Accommodation You may need special arrangements to meet your academic obligations during the term. 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: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
  - **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: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
  - **Academic Accommodations for Students with Disabilities**
    If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC 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 your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc
  - **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 is 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: 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. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

**Tentative Week-By-Week Schedule**

Week 1&2: Context and Definitions

Week 3: Category-Partition software testing

Week 4: Graph criteria

Week 5: Control flow graph (application of graphs)

Mid-term 1

Week 6: State based testing (application of graphs)

Week 7: Criteria for logic expressions

Week 8: Regression testing

Week 9: Integration testing

Mid-term 2

Week 10: Drivers, stubs and oracles

Week 11: Testing object-oriented software

Week 12: Other considerations, including empirical software engineering