Carleton University
Department of Systems and Computer Engineering
Course Outline
SYSC 5105 - (ELG 6115) Software Quality Engineering and Management
Fall 2018

Instructor
Yvan Labiche

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

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.

Course Web Site

cuLearn

Textbook and References


Evaluation and Marking Scheme

Grading Scheme:

- two (closed-book) midterm exams, each worth 20%;
- a (closed-book) final exam worth 35%.
- a course project worth 25%.

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.

Please refer to the Graduate Calendar for additional minimum grade requirements for courses credited
towards a Masters or PhD degree.

Project

See project related material on the course web site for further information about the course project.
Make sure to read that information ASAP.

You must inform the instructor about your choice of project by the end of September. Should you
require additional help to select a project or to discuss specifics of alternative projects, you are urged to
get in touch with the instructor so discussions can take place.

The project is a semester long, significant endeavour. You can expect to dedicate on average four hours
per week on the project.
The project is an individual work. No team-work is allowed.

**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 classroom, 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).

- **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. Consult the section 9.3 of the Graduate Calendar for more information.

- **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.

- **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

Additional Information

Prerequisites: Undergraduate studies in software engineering, computer systems engineering, computer science, or related field. You should be familiar with at least one programming language, and preferably an object-oriented language such as C++ or Java. You should be comfortable developing complex software with this programming language. Knowledge of UML is preferable. You should check prerequisites with the instructor.

Students from the University of Ottawa: You can request to have access to cuLearn: please see http://gradstudents.carleton.ca/forms-policies/.

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