

ENGINEERING 6892: Algorithms: Correctness and Complexity

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| Office Hours | TBD | | |

Website <http://www.engr.mun.ca/~theo/Courses/AlgCoCo/>

Communication

CALENDAR ENTRY:

6892 Algorithms: Correctness and Complexity presents fundamental theories and practices for the design of correct and efficient ^{computing} systems, including specification of computing systems and their components, correctness with respect to specifications; methods of verification; algorithmic problem solving strategies (such as divide and conquer, dynamic programming); tractability and intractability of computational problems.

LC: 36 lecture hours per semester

OR: Tutorials 1 hour per week

PR: ENGI 4424, ENGI 4892

LAB EXPERIENCE:

CREDIT VALUE: 3 credits

COURSE TYPE: Lecture + tutorial

COURSE DESCRIPTION:

SCHEDULE: LECTURE: Tues-Thurs: 10:30—11:45 Room: EN-4034
TUTORIAL: Thursday: 13:00—13:50 Room: EN-4034

RESOURCES:

TEXT BOOK

- Cormen, Lieserson, Rivest, Stein, Introduction to Algorithms, 3rd edition, MIT Press, 2009.

MAJOR TOPICS:

- The basics of program specification with preconditions and postconditions.
- Program development using proof outline logic and loop invariants.

- Design of brute-force recursive algorithms
- Context-free grammars and recursive-descent parsing.
- Big-oh, big-omega, and big-theta notation.
- Design of greedy algorithms.
- Design of dynamic programming algorithms.
- Intractability and the limits of computation.

LEARNING OUTCOMES:

Course Level Graduate Attribute Focus: Knowledge base, Design

1 A knowledge base for engineering 2 Problem analysis 3 Investigation 4 Design 5 Use of engineering tools

Upon successful completion of this course, the student will be able to:

| | LEARNING OUTCOMES | GRADUATE ATTRIBUTES. LEVEL OF COMPETENCE | Methods of Assessment |
|---|---|---|------------------------------------|
| 1 | Design contracts for software modules | 1.A 4.D | Assignments, Midterms, Final exam. |
| 2 | Design software modules to meet contracts | 1.A 4.D | Assignments, Midterms, Final exam. |
| 3 | Analyze software modules to check whether contracts are met | 2.D | Assignments, Midterms, Final exam. |
| 4 | Use tools (such as Dafny) to verify implementations. | 5.D | Assignments, Midterms, Final exam. |
| 5 | Design correct, if inefficient, algorithms to solve optimization and other problems | 1.D 2.D 4.D | Assignments, Midterms, Final exam. |
| 6 | Specify formal languages using CFGs and design recursive-descent parsers. | 1.A 2.D 4.D 5.D | Assignments, Midterms, Final exam. |
| 7 | Use complexity classes to describe the time complexity of algorithms and problems. | 1.A 2.D | Assignments, Midterms, Final exam. |
| 8 | Design efficient algorithms using greedy algorithms and dynamic programming. | 1.A 2.D 4.D | Assignments, Midterms, Final exam. |
| 9 | Understand and be able to explain limits of computation. | 1.A | Assignments, Midterms, Final exam. |

*Each Graduate Attribute for each learning outcome is rated at a Content Instructional Level of I=Introduced, D=Developed, or A=Applied.

See www.mun.ca/engineering/undergrad/graduateattributes.pdf for definitions on the 12 Graduate Attributes and the Content Instructional Levels.

ASSESSMENT:

Marking Scheme and dates

- Assignments 20% (Sept 28, Oct 12, Oct 26, Nov 9, Nov 30)
- In class quizzes 5% (Almost every Tuesday.)
- Midterms 20% (October 19, November 16)
- Float 10% (Better of final or both midterms)
- Final 45%

LAB SAFETY:

Students are expected to demonstrate awareness of, and personal accountability for, safe laboratory conduct. Appropriate personal protective equipment (PPE) must be worn (e.g. steel-toed shoes, safety glasses, etc.) and safe work practices must be followed as indicated for individual laboratories, materials and equipment. Students will immediately report any concerns regarding safety to the teaching assistant, staff technologist, and professor.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

The Memorial University of Newfoundland Code states that

All members of the Memorial University of Newfoundland Community, which includes students, faculty, and staff, shall treat others with respect and fairness, be responsible and honest, and uphold the highest standards of academic integrity.

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. In particular I would like to call to your attention to the definition of *plagiarism* as

the act of presenting the ideas or works of another as one's own.

It is not allowed. More information is available at <http://www.mun.ca/regoff/calendar/sectionNo=REGS-0748#REGS-0761> and <http://www.mun.ca/engineering/undergrad/academicintegrity.php>

The Faculty of Engineering and Applied Science Student Code of Conduct is as follows

Faculty of Engineering and Applied Science Code of Conduct

Like Professional Engineers, engineering students are expected to behave in a professional manner at all times. Students are encouraged to conduct themselves in a manner consistent with the [PEGNL code of ethics](#).

Memorial University has two sets of rules that deal with inappropriate behavior by students. The first set deals with [academic offences](#) such as cheating while the other set deals with [non-academic](#)

[offences](#) such as disruptive behavior in class.

Both sets of rules can be found in the University Calendar under Regulations. It is strongly recommended that students read and follow these rules because the penalties can be severe, the severest being expulsion from the University

INCLUSION AND EQUITY:

Students who require accommodations are encouraged to contact the Glenn Roy Blundon Centre, <http://www.mun.ca/blundon/about/index.php>. The mission of the Blundon Centre is to provide and co-ordinate programs and services that enable students with disabilities to maximize their educational potential and to increase awareness of inclusive values among all members of the university community.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE: Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student.