ENGI. 9867 - Advanced Computing Concepts for Engineering

Memorial University of Newfoundland

Winter, 2020 (Post-snow-break).

Instructor Theodore Norvell, EN-3064, 737-8962.

Email For course related email, please use online.mun.ca; user name "theo". For all other email, please use theo@mun.ca.

TAs Zhenxin Zhao

Lectures

Mondays, Wednesdays, Fridays 11:00–11:50 EN-4035

Tutorials

Thursdays 12:00–12:50 EN-1000

Office Hours Tuesday and Thursday 11:00am to 12:00noon.

Suitable for Graduate students in Computer Engineering or Computer Science or undergraduates in Computer Engineering interested in a somewhat theoretical course.

Web page `http://www.engr.mun.ca/~theo/Courses/acce`

Textbook Parts of: Theodore S. Norvell, *Theories of Computation*. Current draft. Available at the course web-site.

References

- Thomas Sudkamp, *Languages and Machines*, 3rd Ed., Addison-Wesley, 2005.
- Feldman and Harel, *Algorithmics: The Spirit of Computing*, 3rd Ed., Addison Wesley, 2004.
- Eric Hehner, *a Practical Theory of Programming*, current edition, 2019. `http://www.cs.toronto.edu/~hehner/aPToP/`

Outline The course looks a number of important questions from three general areas of computing theory: Theory of programming, formal language theory, computational complexity theory.

- Theory of Programming. *How do I describe a computational problem? How do I derive a program (or system) to solve a given problem. Does my program (or system) actually solve the problem it is meant to solve?*
  - Specification
  - Design synthesis
  - Verification
  - Documentation
- Formal Language Theory. *What kinds of computers are there? Which kinds of computers can solve which problems? Are there problems that no computer can solve? How can we finitely describe complex infinite sets such as the inputs to a computer program or the sentences in a human language?*
  - Finite machines
  - Regular expressions
  - Transducers and statecharts
  - Context free grammars
  - Computability and uncomputability
- Computational Complexity Theory. *How efficient is my algorithm? Is it maximally efficient for the problem? How hard are problems?*
  - O, Ω, and Θ
  - Complexity of algorithms
  - Complexity of problems – upper and lower bounds
  - The class **NP**
  - The class **NP**-complete and polynomial time reductions

It turns out that the answers to these questions have considerable engineering utility. The course deals with both the theory and the application of the theory.

Evaluation and approximate schedule

Assignments	15%	About 5. Times TBA.
Term paper / presentation	20%	Paper April 9. Presentations start March 28.
Midterm	10%	Feb 27
Midterm	10%	Mar 19
Final	35%	TBA
Better of midterms & final	10%	

Other Information

- Late assignments will **not** be accepted without prior arrangement or documented justification. Missed tests will require a note from a medical doctor or a nurse practitioner.
- Any questions about marks, addition, recording etc., or special circumstances (e.g., illness, bereavement) must be brought to my attention before the exam.
- Unless otherwise specified, assignments are to be done individually.
- Academic dishonesty will, as a minimum result, in a grade of zero for the offending work, and will be reported to the Associate Dean. Academic dishonesty includes copying, allowing your work to be copied, unauthorized working in groups, and failing to correctly cite sources. If you have any doubt about whether something constitutes academic honesty, consult with me. See section 4.12 of the School of Graduate Studies regulations for more information. `http://www.mun.ca/regoff/calendar/sectionNo=GRAD-0029`
- Asking questions is strongly encouraged. If you have a question, it is likely that others have the same question. Please ask questions during class, not after.
- Comments, suggestions and constructive criticisms are always welcome.

The Memorial University of Newfoundland Code

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.

Expectations of Student Conduct

Engineering students are expected to behave in a professional manner at all times. Memorial has two sets of rules which deal with inappropriate behaviour by students. The first set deals with academic offences such as cheating (http://www.mun.ca/regoff/calendar/sectionNo=GRAD-0029), while the other set deals with non-academic offences such as disruptive behaviour in class (see https://www.mun.ca/student/supports-and-resources/respectful-campus/student-code-of-conduct.php). The penalties can be severe, the severest being expulsion from the University. It is strongly recommended that students read and follow these rules.