ECE 3790 – Engineering Algorithms

Course Objectives

The objective of this course is to obtain a better understanding of algorithm and algorithmic problems. Many interesting problems are inherently difficult if approached using deterministic methods. This course introduces a variety of useful methods for “solving” these problems.

Course Content

The following topics will be covered:

• Mathematical Foundations (as needed, throughout term)
• General Paradigms (Divide and Conquer, Greed)
• Dynamic Programming
• Greedy Algorithms
• Approximation Algorithms, Soft Computing, and Reasoning
• Simulated Annealing
• Genetic Algorithms
• Neural Networks (SOM)
• Kalman Algorithm
• Number-Theoretic Algorithms applied to Encryption
• Public Key, Key exchange
• Complexity
• NPC (as needed throughout term)
• Selected Topics (last 2 weeks)
  • Map Reduce

Textbook


Requirements/Regulations

• Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.

• It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University’s General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.

• No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

• Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Important Dates

• Term Test
  TBA (in-class)

• Voluntary Withdrawal Deadline
  March 20th, 2019

• Spring Break
  February 18th-22nd, 2019
  No classes or examinations
Learning Outcomes

1. Assign complexity metrics to algorithms and algorithmic problems.
2. Solve combinatorial problems through the use of non-deterministic algorithms such as simulated annealing and evolutionary algorithms.
3. Extrapolate and reorganize non-deterministic algorithm analogs to similar combinatorial types of problems solving.
4. Understanding the fundamentals of recursion and how it relates to algorithms.

Expected Competency Levels

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<th>Outcome</th>
<th>A1</th>
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Evaluation

The final course grade is determined by the student’s performance on the quiz, in laboratories, and on examinations (midterm and final). Students must complete all the laboratories in order to be eligible to receive a passing grade.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Method of Feedback</th>
<th>Learning Outcomes Evaluated</th>
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<td>Practice Problems</td>
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<td>Assignments</td>
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<td>F, S</td>
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<td>1, 2, 3</td>
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<td>Final Examination</td>
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* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University’s Intellectual Property Policy and the protection of privacy provisions of The Freedom of Information and Protection of Privacy Act (Manitoba). Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.