ECE 3790 – Engineering Algorithms

Winter 2021

IMPORTANT NOTICE – Mandatory Requirement to Report

This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA must notify the instructor and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

Course Objectives

The objectives of this course are to introduce students to common engineering algorithms. Students will develop the ability to understand, evaluate, analyze, design, and implement a wide array of generally useful algorithms. These skills will enable students to engineer their own algorithms in the future, or properly use existing engineering algorithms to solve a wide range of problems from sorting and searching, to global optimization.

Course Content

The following topics will be covered:

- Mathematical Foundations
- Asymptotic Complexity Analysis
- General Paradigms (Incremental, Divide-and-Conquer, Greed)
- Divide-and-Conquer
- Greedy Algorithms
- Dynamic Programming
- Numerical methods (Root finding, linear algebra, regression)
- Approximation Algorithms
- Optimization
- Graph Algorithms
- Select Topics

Textbook (optional)


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.

Learning Outcomes

1. The ability to evaluate the computational complexity of algorithms and use complexity analysis to make prudent algorithm choices.
2. The ability to recognize, evaluate, and design recursive algorithms.
3. The ability to recognize general classes of algorithmic problems and apply related algorithm paradigms for solving those problems (divide-and-conquer, greedy algorithms, optimization, etc.)
4. The ability to implement algorithms in software and report the details and performance of these algorithms in an organized and clear fashion.
5. A developed understanding needed to extrapolate and reorganize learned engineering algorithms so that they may be applied to similar, but distinct, engineering problems.

Updated: January 13, 2021

ECE 3790
Evaluation
The final course grade is determined by the student’s performance on laboratories, term quiz, midterm test, and final examination. Students must complete all components of the course and receive a minimum grade of 50% in the examination in order to be eligible to receive a passing grade.

CEAB Graduate Attributes Assessed
KB.3 – Recalls and defines, and/or comprehends and applies information, first principles, and concept in fundamental engineering science.
ET.2 – Evaluates and selects appropriate tools for a given scenario.

Grading Scale

<table>
<thead>
<tr>
<th>Letter</th>
<th>Mark</th>
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<tbody>
<tr>
<td>A+</td>
<td>95–100</td>
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<tr>
<td>A</td>
<td>85–94</td>
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<tr>
<td>B+</td>
<td>80–84</td>
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<tr>
<td>B</td>
<td>70–79</td>
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<tr>
<td>C+</td>
<td>65–69</td>
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<tr>
<td>C</td>
<td>55–64</td>
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<tr>
<td>D</td>
<td>45–54</td>
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<tr>
<td>F</td>
<td>&lt; 45</td>
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* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

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.

Copyright Notice
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ECE 3790
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.