



Course Outline

Instructors

- Ian Jeffrey, P.Eng. (he/him)
E3-504A EITC
(204) 474-7476
Ian.Jeffrey@umanitoba.ca

Office Hours

- TBD
or by appointment.
(Please include ECE 3790 in any
correspondence and be sure to email
from your University account.)

Teaching Assistant

- Lucas Banting
bantingl@myumanitoba.ca

Contact Hours

- 4 credit hours
- Lectures:
3 hours x 13 weeks = 39 hours
- Laboratories:
3 hours x 5 weeks = 15 hours

Prerequisites:

- COMP 2140 Data Structures and Algorithms

Corequisites

- MATH 3132 Engineering Mathematical Analysis 3

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on original lands of the Anishinaabeg, Cree, Ojibwe-Cree, Dakota, and Dene peoples, and on the homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of Reconciliation and collaboration.

ECE 3790 – Engineering Algorithms

Winter 2024

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)

Introduction to Algorithms, T.H. Cormen, C.E. Leiserson, R. L. Rivest and C. Stein, 3rd Edition, 2009.

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.

Important Dates

- **Term Test**
Friday, February 9th, 2024
(In class)
Thursday, March 7th, 2024
6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
March 20th, 2024
- **Louis Riel Day**
February 19th, 2024
No classes or examinations
- **Spring Break**
February 20th – 23rd, 2024
No classes or examinations
- **Good Friday**
March 29th, 2024
No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 33%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 34%
- Engineering Design: 33%

Graduate Attributes

KB: A knowledge base for engineering
 PA: Problem analysis
 IN: Investigation
 DE: Design
 ET: Use of engineering tools
 IT: Individual and team work
 CS: Communication skills
 PR: Professionalism
 IE: Impact of engineering on society/
 environment
 EE: Ethics and equity
 EP: Economics and project
 management
 LL: Life-long learning

Competency Levels

I - Introduced (Introductory)
 D - Developed (Intermediate)
 A - Applied (Advanced)

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	D	D	I	D	D							I
2	D	D	I	I	A							I
3	A	D	D	D	A							I
4	D	D	D	A	A	D	D	D				I
5	D	D	D	A	D							D

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 – Adapts or creates tools to meet specific analysis of design needs..

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.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	10	F, S	1, 2, 3, 5
Laboratories	20	F, S	1, 2, 3, 4, 5
Term Test 1	10	F, S	1, 2, 3, 5
Term Test 2	20	F, S	1, 2, 3, 5
Final Examination	40	S	1, 2, 3, 5

* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Student Absences

Attendance in lectures, tutorials, and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 120 hours (5 days) or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website. This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)

Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.

For absences longer than 120 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

Deferred Final Examinations

Students who miss the regular scheduled writing of a final examination, for valid medical or compassionate reasons, may be given the opportunity to write a deferred examination, subject to approval by the Associate Dean (Undergraduate). All requests for a deferred examination must be made within 48 hours of the missed examination, and must follow the procedure described on the Faculty website, without exception. Course instructors do not have the discretion to grant deferred final examinations.

(<https://umanitoba.ca/engineering/student-experience#engineering-student-policies>)

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

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

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.

 [Supplemental Resources](#)

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