NORTHWESTERN POLYTECHNIC

SCIENCE DEPARMENT

COURSE OUTLINE – Winter 2025

CS2040 – Algorithms I (3-0-1) 60 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR	Dr. Mohammad Mirbagheri	**PHONE**	780 539 - 2739
OFFICE	C419	**E-MAIL**	MMirbagheri@NWPolytech.ca
OFFICE HOURS	appointment by email		

CALENDAR DESCRIPTION
The first course of a two course sequence on algorithm design and analysis stream, with the emphasis on the fundamentals such as searching, sorting and graph algorithms. Examples include divide and conquer, dynamic programming, greedy method, backtracking, and local search methods. Analysis techniques will be developed to aid in judging program efficiency.

PREREQUISITE(S)/COREQUISITE: CS1150, CS2720, MA1130

DELIVERY Mode Onsite face-to-face

REQUIRED TEXT/RESOURCE MATERIALS
Introduction to the Design and Analysis of Algorithms, 3rd Edition, Anany V. Levitin, Addision-Wesley, 2012
Note
Additional readings will be distributed throughout the course.

LEARNING OUTCOMES
Upon successful completion of the course, students will be able to

- illustrate, define, and generalize problems definitions
- give a proof that a (reasonably simple) algorithm solves a computational problem correctly
- analyze the running time of a (reasonably simple) algorithm using summations and recurrences, and express this running time using asymptotic notation
- design algorithms using different approaches such as Greedy, Dynamic Programming, and Divide and Conquer
- suggest a promising design approach given a problem, initial algorithm and target run-time

TRANSFERABILITY
Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.alberta.ca.

** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability**.

EVALUATION

Homework Assignments	8%
Quizzes	22%
Midterm Exam	30%
Final Exam	40%
Instructor Discretion	+/- 5%
Total	100%

Note: The student must pass the theory/concepts portion of the course in order to qualify for a passing grade for the term. That means, a student must obtain 46 out of a possible 92 points (from exams/quizzes) before adding the assignment marks to compute the final grade. If you cannot achieve the required 50% (on tests) then regardless of your assignment grades, you cannot pass the course.

Grading Chart

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	95-100	C+	2.3	67-69
A	4.0	85-94	C	2.0	63-66
A-	3.7	80-84	C-	1.7	60-62
B+	3.3	77-79	D+	1.3	55-59
B	3.0	73-76	D	1.0	50-54
B-	2.7	70-72	F	0.0	00-49

Seminars
Seminars will occur weekly starting from week 2. These sessions will focus on helping students master the course content and will also be used to administer quizzes. Quizzes will be taken every two weeks. The lowest quiz score will be dropped. Tests or seminars cannot be rescheduled. Any missed quiz without valid documentation will result in a grade of 0.

Attendance & Participation

Lectures are **interactive** discussions, meaning **attendance** is expected. Regular and **punctual** attendance is crucial to academic success in the course and is expected of all students. Students should make every effort not to miss class, as there is always a possibility of missing important information if class is skipped. Therefore, you are responsible for any material covered if you are late or absent. Furthermore, students who skip class usually do not perform as well as those who attend regularly. Note that attendance and participation may form part of your final grade to be adjusted by +/- 5% at the instructor's discretion.

COURSE SCHEDULE/TENTATIVE TIMELINE

Week	**Topics**
1	Introduction and Outline
2	Graphs, Weighted Graphs and Applications
3	Algorithm Fundamentals and Problem Solving
4	Analysis of Algorithm and Efficiency
5	Asymptotic Notations and Basic Efficiency Classes
6	Analysis of Recursive & Non Recursive Algorithms
7	Algorithm Design Techniques- Brute Force and Exhaustive Search
8	Decrease and Conquer
9	Divide and Conquer
10	**Midterm Exam**
11	Transform and Conquer
12	Balanced Search Trees and Problem Reduction
13	Space and Time Tradeoff
14	Dynamic Programming
15	P, NP and NP Complete Problems
16	**Final Exam**

Academic Integrity

Academic integrity requires students be honest. Assignments and exams are to help students learn; grades show how fully this goal is attained. Thus, all work and grades should result from a student's own understanding and effort.

Acts of academic misconduct violate academic integrity, and are considered serious offences by the College. Examples include, but are not limited to, cheating on tests or exams, plagiarizing, copying from others, submitting the work of others as your own, etc. Instances of academic misconduct will be reported. More details are provided at
https://www.nwpolytech.ca/about/administration/policies/index.html

STATEMENT ON ACADEMIC MISCONDUCT

Cheating will not be tolerated and there will be penalties**.** Co-operation on programming assignments is generally encouraged, but it must be limited to verbal discussion of concepts; not program code or any other written documentation that is submitted for grading. Copying of assignments or previous solution keys, and submitting this as your own work is plagiarism, a serious form of academic misconduct.

Knowingly **allowing an assignment to be copied** will also be treated as plagiarism. See the previous section on Academic Integrity for more information on what to do and what to avoid.
For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Calendar at https://www.nwpolytech.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at
https://www.nwpolytech.ca/about/administration/policies/index.html
**Note: all Academic and Administrative policies are available on the same page.

Generative AI
The use of generative artificial intelligence tools or applications in this course, including tools like **ChatGPT** and other AI writing or coding assistants, is **strictly prohibited**. Their usage is restricted solely to serve as learning aids and is not permitted for the completion or support of examinations, term tests, assignments, projects, or any other form of academic assessment. Any such usage is considered an academic offense in this course.

Policies and Procedures
Below is a list of general policies and procedures for this course:

1. No recording of any kind is allowed in the class, seminar or during consultation with the instructor.
2. If you have any concerns regarding a class mark, then take the following two steps: (i) clearly explain your concerns in an email; (ii) send the email to the course instructor. You must submit any concerns about an assigned mark **within one week** after it is posted.
1. There are no make-up quizzes or exams. Students who miss any of the quizzes or exams must provide a valid reason and include **supporting documentation**. In such cases, marks for the missed quiz or examination will be reallocated to the final examination.
2. Exams are "closed-book," with no additional material permitted.
3. Deferred final examinations can only be granted by the Chairperson. Deferred final examinations cannot be granted by the course instructor.

Assignments
Over the course of the semester, students will be required to complete assignments. Below is a list of policies and procedures regarding the assignments.

1. Assignments will be posted on Myclass.
2. Assignments are to be electronically submitted via MyClass. Keep a copy of all submitted work.
3. For each programming question, you will submit **source code** of your program files. To prove that your code works correctly, you will also submit screenshot of the output of your program in a file with an extension of **.png or .pdf**.
4. Assignments are to be handed in by the due date; otherwise, a **20% penalty per day** will be incurred; **after 2 days no credit** will be given for a late assignment. Homework that is habitually late will not be accepted.

5. If exceptional circumstances have occurred that have kept you from submitting your assignment on time, you should contact the course instructor as soon as possible. In some cases, an extension **may** be granted on the assignment. In other cases, the grades for the assignment **may** be reallocated.
6. Any incomplete work that is submitted will be considered for partial scores.