



THE UNIVERSITY OF WINNIPEG

APPLIED COMPUTER SCIENCE

Course Number: **ACS-3947-050**
Course Name: **Algorithm Design**
Course Webpage: <https://www.acs.uwinnipeg.ca/liu-qi/ACS3947AlgorithmDesign.html>
<https://nexus.uwinnipeg.ca/d2l/home/55395>

Instructor Information

Instructor: Dr. Qian Liu
E-mail: qi.liu@uwinnipeg.ca
Office Hours: Thursdays 3:00 - 4:00 pm 3C07
Class meeting time: Tuesdays 6:00 - 9:00 pm 3D04

Important Dates

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|--|------------------------------|
| 1. First Class: | Tuesday, September 5, 2023 |
| 2. Reading Week (no classes): | October 8-14, 2023 |
| 3. Midterm Test: | Tuesday, October 31, 2023 |
| 4. Final Withdrawal Date w/o academic penalty*: | Monday, November 13, 2023 |
| 5. Last Class: | Tuesday, November 28, 2023 |
| 6. Final Exam: | TBD |
| 7. University closures: Truth and Reconciliation Day | Saturday, September 30, 2023 |
| Thanksgiving | Monday, October 9, 2023 |
| Remembrance Day | Saturday, November 11, 2023 |

*A minimum of 20% of the work on which the final grade is based will be evaluated and available to the student before the voluntary withdrawal date.

Course Objectives / Learning Outcomes

This course focuses on the connection between data structures and the corresponding algorithms, including simple analysis of computational complexity. The emphasis is on comparative study of alternate ways to implement solutions to computing problems.

Evaluation Criteria

- Assignments (20%)
 - 4 assignments, worth 5% each.
 - All assignments are to be completed individually and submitted electronically via Nexus.
 - All coding is to be done using Python and submitted in .py format.
 - Any written work is to be submitted in PDF format.
 - Individual due dates and other assignment submission details will be stated in each assignment.
 - Assignments will be accepted up to 1 day late with a 20% penalty.
- Midterm Test (30%)
 - During the regular class time (see Important Dates)
- Final Exam (50%)

Test / Exam Requirements

- Photo ID is required for the final exam.
- The use of computers, calculators, phones, or other electronic devices is not permitted during exams.
- Midterm and final exams are closed-book.

Students should contact the instructor as soon as possible if extenuating circumstances require missing a lab, assignment, test or examination. A medical certificate from a practicing physician may be required before any adjustments are considered.

Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 204-786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential.

<https://www.uwinnipeg.ca/accessibility-services>.

Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work examinations without penalty. A list of religious holidays can be found in the 2019-20 Undergraduate Academic Calendar online at <http://uwinnipeg.ca/academics/calendar/docs/important-notes.pdf>

Final Letter Grade Assignment

Historically, numerical percentages have been converted to letter grades using the following scale. However, instructors can deviate from these values based on pedagogical nuances of a particular class, and final grades are subject to approval by the Department Review Committee.

A+	90 – 100%	B+	75 – 79%	C	60 – 64%
A	85 – 89 %	B	70 – 74%	D	50 – 59%
A-	80 – 84%	C+	65 – 69%	F	below 50%

Required Text Book

- PDF version of Class Notes will be available on course webpage.

Prerequisite and Restriction Information

Requisite Courses: ACS-2913 (or the former ACS-2911 and ACS-2912) and ACS-2947 with a minimum grade of C.

Regulations, Policies, and Academic Integrity

Students are encouraged to familiarize themselves with the Academic Regulations and Policies found in the University Academic Calendar at:

<https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf>

Particular attention should be given to subsections 8 (Student Discipline), 9 (Senate Appeals) and 10 (Grade Appeals).

Avoiding Academic Misconduct: Academic dishonesty is a very serious offense and will be dealt in accordance with the University's policies.

Detailed information can be found at the following:

- Academic Misconduct Policy and Procedures: <https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf> and <https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf>
- About Academic Integrity and Misconduct, Resources and FAQs: <https://library.uwinnipeg.ca/use-the-library/help-with-research/academic-integrity.html>

Uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) involves “aiding and abetting” plagiarism. Students who do this can be charged with Academic Misconduct.

Academic Integrity and AI Text-generating Tools: Students must follow principles of academic integrity (e.g., honesty, respect, fairness, and responsibility) in their use of material obtained through AI text-generating tools (e.g., ChatGPT, Bing, Notion AI). If an instructor prohibits the use of AI tools in a course, students may face an allegation of academic misconduct if using them to do assignments. If AI tools are permitted, students must cite them. According to the MLA (<https://style.mla.org/citing-generative-ai/>), writers should

- cite a generative AI tool whenever you paraphrase, quote, or incorporate into your own work any content (whether text, image, data, or other) that was created by it
- acknowledge all functional uses of the tool (like editing your prose or translating words) in a note, your text, or another suitable location
- take care to vet the secondary sources it cites

If students are not sure whether or not they can use AI tools, they should ask their professors.

Non-academic misconduct: Students are expected to conduct themselves in a respectful manner on campus and in the learning environment irrespective of platform being used. Behaviour, communication, or acts that are inconsistent with a number of UW policies could be considered “non-academic” misconduct. More detailed information can be found here:

- Respectful Working and Learning Environment Policy
<https://www.uwinnipeg.ca/respect/respect-policy.html>,
- Acceptable Use of Information Technology Policy
<https://www.uwinnipeg.ca/institutional-analysis/docs/policies/acceptable-use-of-information-technology-policy.pdf>
- Non-Academic Misconduct Policy and Procedures: <https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf> and <https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf>.

Copyright and Intellectual Property: Course materials are the property of the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides—irrespective of format. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also seek prior permission of the instructor/presenter before, for example, photographing, recording, or taking screenshots of slides, presentations, lectures, and notes on the board. Students found to be in violation of an instructor’s intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy; such consequences could possibly involve legal sanction under the Copyright Policy:

<https://copyright.uwinnipeg.ca/basics/copyright-policy.html>

Privacy

Students have rights in relation of the collecting of personal data the University of Winnipeg

- Student Privacy: <https://www.uwinnipeg.ca/privacy/admissions-privacy-notice.html>
- Zoom Privacy: <https://www.uwinnipeg.ca/privacy/zoom-privacy-notice.html>

Class Cancellation, Correspondence with Students and Withdrawing from Course

When it is necessary to cancel a class due to exceptional circumstances, the course instructor will make every effort to inform students via uwinnipeg email and Nexus.

Students are reminded that they have a responsibility to regularly check their uwinnipeg e-mail addresses to ensure timely receipt of correspondence from the University and/or the course instructor.

Please let course instructor know if you plan on withdrawing from the course. Note that withdrawing before the VW date does not necessarily result in a fee refund.

Topics to be covered (tentative)

1. Introduction
 - Python primer
 - Introduction to algorithm design
 - Basics of Algorithm Analysis
2. Trees
 - Review of Binary trees
 - AVL trees
 - Red-black trees
 - Segment trees
3. Graphs
 - Data structure for graphs
 - Graph traversals
 - Topological sort
 - Strongly connected components
4. Greedy Algorithm
 - Interval scheduling (Activity selection problems)
 - Shortest paths
 - Minimum spanning trees
 - Data compression
5. Divide and Conquer
 - Sorting algorithms (Review of Merge-sort and Quick-sort)
 - Maximum subarray problem
 - Matrix multiplication
 - Recurrences
6. Dynamic Programming
 - Weighted interval scheduling
 - Segmented least squares
 - Subset sums and knapsacks
 - Longest common subsequence
 - Shortest paths
7. Network Flow
 - Maximum flow
 - Bipartite matching
 - Image segmentation
8. String Matching (tentative)

Note that all topics listed may not be covered and can be offered in a different time order.

A permitted or necessary change in mode of delivery may require adjustments to important aspects of course outlines, like class schedule and the number, nature, and weighting of assignments and/or exams.