University of Lethbridge
Department of Mathematics and Computer Science

Computer Science 4110/5110/7110 – Advanced Algorithms in Facility Location
Course Outline – Winter 2026

LECTURES: Mon Wed 13:30 – 14:45 **ROOM:** AH118

INSTRUCTOR: Robert Benkoczi (office C556)
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TEXTS: Reading will be assigned from academic papers and a selection of chapters from "Algorithm Design" by Kleinberg and Tardos, to review notions of complexity theory.

GRADING SCHEME:

Final exam	40%
Midterm	20%
Assignments (approx 5)	20%
Project	10%
Lecture quizzes	10%

GRADE DISTRIBUTION: This information is provided as a guideline only and may be revised in this offering. Minimum percentages for each letter grade are:

A+	95	B+	77	C+	67	D+	55
A	85	B	73	C	63	D	50
A-	80	B-	70	C-	60	F	< 50

TOPICS:
(as time permits):

1) What is facility location? Examples, problem complexity, easy problem instances and simple algorithms vs NP-hard instances. Introducing p-median, p-center, and covering problems. Executable definitions (integer programs).
2) Advanced algorithmic approaches for exact solutions to facility location problems in special networks: dynamic programming, prune and search, exploiting duality between center and coverage (binary search).
3) Applying the advanced algorithmic approaches to solve more general and difficult facility location problems; clustering.
4) Useful data structures: centroid decomposition of tree graphs, path and tree decomposition of general graphs.
5) Applying the algorithms to different variations of facility location problems such as geometric facility location, locating obnoxious facilities, facility location with uncertain information.

COMMENTS:

- Exams are written in groups: in part 1, questions are answered individually. In Part 2, ad-hoc groups are formed and the team submits a revised answer for a subset of the questions from Part 1. The grade is calculated as the average between the individual grade and the team grade.
- Assignments are individual.
- Lecture quizzes are submitted in pairs. They are written during the lecture, on topics discussed in the lecture. They are submitted at the end of the class.
- The project is written in a group (max. 3 members).
- Work must be submitted at the scheduled time; no provision is made for make-up midterm or late assignments, except for medical reasons or emergencies. Missed tests and assignments receive 0 points.
- Requests for remarking tests and assignments are accepted only in writing *no later than one week from the date your graded work was returned*. On the request: identify the assignmemnt or midterm, briefly explain why you believe the mark is incorrect, date and sign. Note that if your work is remarked, your grade may go up, down, or remain unchanged.
- Copying is strictly prohibited. Plagiarism can lead to severe penalties. Please consult the student code of conduct: `https://www.ulethbridge.ca/policy/resources/student-code-conduct-policy`

AI USE:

- You may use generative AI platforms to help you develop ideas to solve a problem in an assignment or project, or to expand your knowledge. Always check the answers given and analyse them critically.
- Choose carefully which AI engine you use to summarize academic work and obtain references. ChatGPT is known to generate credible but fake paper references.
- Any submitted work must be the result of your own thinking process. Work submitted that you are unable to explain receives 0 points.