Course Information

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Lectures: 11:30 am–12:45 pm, Tu. & Th., EITC E2-164
Office hour: 10:30 am Tu. or by appointment
Web: www.cs.umanitoba.ca/~comp7922

Course Description. COMP 7922 (Computational Geometry): The design and analysis of efficient algorithms for geometric problems. Possible topics include

- convex hull algorithms
- Voronoi diagrams and Delaunay triangulations
- point location
- range searching
- geometric data structures
- geometric intersection algorithms
- guarding and visibility graphs
- geometric packing, covering, and partitioning
- geometric duality
- arrangements of lines and circles
- unit disc graphs and proximity graphs

Overview. COMP 7922 (Computational Geometry) is intended as an advanced course in theoretical computer science that provides a graduate-level introduction to the field of computational geometry for students with a strong undergraduate foundation in algorithms and data structures. Computational geometry is a field that examines questions related to the design and analysis of algorithms to efficiently solve problems whose input and output parameters involve geometric constraints.

Course Goals and Intended Learning Outcomes. Lectures will discuss fundamental concepts, algorithms, and techniques in computational geometry.

Prerequisites. An upper-year undergraduate course in algorithm analysis (COMP 3170 or equivalent) and an undergraduate course in discrete mathematics (COMP 2130, MATH 1240, or equivalent) are required. Consent of the instructor is required for undergraduate students. Students are expected to have a strong background in theoretical computer science (e.g., a grade of A or A+ in COMP 3170) and to be familiar with intermediate topics in design and analysis of algorithms, data structures, discrete mathematics, and combinatorics, including sorting, searching, common data structures, big Oh notation, trees, graph theory, and set theory. Only a basic knowledge of geometry is required (e.g., trigonometry and familiarity

with common geometric identities). Students will be required to complete a mandatory quiz during the first week of classes to help determine whether they possess the required background. Quiz marks will not count towards course grades, but students are required to pass the quiz to continue in the course. There is no need to study any specific material before the quiz.

Textbook. A list of required reading will be provided on the course webpage as these are assigned throughout the term. The following textbook is strongly recommended:

Computational Geometry: Algorithms and Applications, 3rd edition, by de Berg, Cheong, van Kreveld, and Overmars, 2008, Springer.

The following book is another helpful reference:

Discrete and Computational Geometry, by Devadoss and O'Rourke, 2011, Princeton University Press.

Grading. All students will be required to complete three assignments, a midterm exam, and a final exam. Graduate students will also be required to complete a course project (consisting of a project proposal, a class presentation, and a written report). Undergraduate students be required to complete either a course project or to write a review of a relevant publication (consisting of a proposal and a written report). Grades will be calculated according to the following table:

assignments	20%
midterm exam	20%
course project	20%
final exam	40%

letter grade	% grade	grade point
A+	90–100	4.5
A	80–89	4.0
B+	75–79	3.5
B	70–74	3.0
C+	65–69	2.5
C	60–64	2.0
D	50–59	1.0
F	0–49	0.0

Assignments. Assignments will consist of problem sets, seeking constructive solutions to algorithmic problems related to lecture material and assigned reading. Solutions should include sufficiently detailed descriptions, presented clearly and unambiguously. Three assignments will be distributed in class during the term. You will have one week to complete each assignment individually. Solutions must be submitted by the start of class on the due date. Include your name, student number, and email address at the top of the first page on all submitted material, as well as the names of people with whom you have discussed your assignment solution. Cite any sources to which you refer, as you should do when presenting any scientific document. You must submit your solution electronically using UMLearn. Only pdf files will be accepted. To permit the prompt distribution of solutions and return of marked assignments, **late assignments will not be accepted**.

Examinations. There will be a midterm exam held in class and a final exam held during the December exam period. Exams will be closed book.

Course Project/Review. The course project is required for graduate students and is optional for undergraduate students. The purpose of the course project is for students to

select and explore a topic in computational geometry, to study a current research problem in that topic, to make a new contribution on that topic (see below), and to present the results, in both a written report and a class presentation. The nature of the project can vary; examples include:

- writing a survey paper on a current topic in computational geometry,
- writing code to implement and compare the performance of algorithms for solving a problem in computational geometry, or
- exploring possible solutions to an open problem on a given topic in computational geometry.

As part of the project, graduate students will be asked to submit a preliminary project proposal, a final written report, and to give a class presentation. Students may choose to complete the project individually or in groups of two.

Undergraduate students may choose to complete a course project as described above, or to write a review of a published article examining a recent result in the field of computational geometry. As part of the review, undergraduate students will be asked to submit a preliminary proposal and a final written report. Students must write the report individually.

Assigned Reading. In addition to reading assignments from the textbook, journal and conference publications will be assigned as reading (approximately one paper per topic). Students will be expected to discuss and answer questions (in class and in examinations) related to the material contained in these assigned papers.

Important Dates.

September 6	first class
October 9	project/review proposal due
November 6	midterm exam
November 12–16	fall reading break, no classes
November 19	VW deadline
Nov. 29, Dec. 4, 6	project presentations
December 6	last class, project report/review due
December exam period	final exam

Referencing Style. Assignments and projects should use one of the standard citation formats for Compute Science, such as ACM, IEEE, or AMS. For example:
Boucher, C., Erdos, P., and Obama, B. *Title of Article.* Journal of Algorithms 10(2), 104–122 (2016).

Academic Integrity. The Faculty of Science takes academic integrity very seriously. Any evidence of academic dishonesty on assignments, labs and/or tests will be forwarded to the appropriate authorities for potential disciplinary actions.
The University Student Discipline By-Law may be accessed at: `http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html`. Information from the Faculty of Science regarding Cheating and Plagiarism can be found at `http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html`.

Students are encouraged to discuss course concepts and the general interpretation of homework problems with other students in the class. No written record should be taken from such discussion. Each student must work on the final solution of assignment problems independently. On a cover page, each student must list the names of people with whom he or she has discussed the assignment solution. Following conventions for citing reference materials in scientific writing is mandatory. Submitting the work of another person as your own constitutes academic misconduct. Any course work that does not follow these guidelines will be considered plagiarism and will be reported to the Faculty of Science. Students are to abide by the university's policies regarding academic dishonesty which can be found on this web site:
`http://umanitoba.ca/student/resource/student_advocacy/academicintegrity/students/`

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Course Technology. It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Student Accessibility Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline gaming during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (Copyright S. Kondrashov. Used with permission)

Class Communication. The University requires all students to activate an official University email account. Please note that all communication between myself and you as a student must comply with the electronic communication with student policy (`http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html`). You are required to obtain and use your U of Manitoba email account for all communication between yourself and the university.

Student Accessibility Services. If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may

have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation. Student Accessibility Services
http://umanitoba.ca/student/saa/accessibility/
520 University Centre
204 474 7423
mailto:Student_accessibility@umanitoba.ca

Academic Recourses. Various academic resources are available to students including the Science and Technology Library and various departmental help centers.

Health & Mental Health Resources. Students with Health and/or Mental Health issues may seek advice and/or help from Student Counselling Center, Student Accessibility Services, and University Health Services.

Respectful Behaviour Resources. Students are expected to act in a respectful manner. Policies regarding respectful work and learning environment and sexual assault can be found at http://umanitoba.ca/admin/governance/governing_documents/community/230.html.

Final Examinations, Grades and Grade Appeals Resources. Final examination and grades policies can be found at http://umanitoba.ca/admin/governance/governing_documents/academic/1299.html.
Students wishing to appeal their term work grade can do so through the Registrars office. A fee is charged for each appeal.
To view your final examination, please check with the department offering the course for policies.
To appeal your final grade, you can initiate the process at the Registrars office. A fee will be charged for each appeal. See the Registrars office for more information.

Limited Access and VW Resources. Students who fail or VW from a course will be subject to limited access to that course in future terms. That is, students will not be able to register for a course (for which they have VWed or failed) during the limited access registration period. For more information, please see the policy document for repeated courses at http://www.umanitoba.ca/admin/governance/media/Repeated_Course_Policy_-_2016_09_01.pdf.