

**Instructor — Jorn van der Pol**

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**Lecture Times**

Lectures take place in RCH208 at 8:30–9:50 TTh.

**Grading**

There will be approximately 5 assignments, and no examinations.

**Course Content**

This course deals with matroid theory, with a particular focus on its links to graph theory. Topics covered will include some or all of the following in some order:

- **Basic Notions:** Rank axioms, independence axioms, bases, circuits, representable matroids, graphic matroids, minors, duality.
- **Graphic Matroids:** Regularity and total unimodularity, the matrix tree theorem, vertical connectivity, uniqueness of representation, testing graphicness and planarity, excluded minor characterisation.
- **Binary Matroids:** Cycle space, cocycle space, characterisations by circuit/cocircuit intersections and by excluded minors.
- **Critical Exponent and Chromatic Number:** Affine matroids, Turán's theorem, Erdős-Stone Theorem, Bose-Burton theorem, excluding an affine geometry restriction, the Erdős-Stone theorem for binary matroids.
- **Growth Rates:** Excluding a line minor (Kung's Theorem), Heller's Theorem, the Growth Rate Theorem.
- **Matroid Intersection:** Partitionable sets, applications including König's theorem, packing spanning trees, covering graphs with forests and even graphs, Rado's theorem, the strong basis exchange axiom.
- **Connectivity:** Bixby-Coullard inequality, Tutte's linking theorem, Menger's theorem, Bixby's lemma, Tutte's wheels and whirls theorem, Seymour's splitter theorem, decomposition into 3-connected minors.

- **Regular matroids:** Seymour's decomposition theorem.
- **Matching:** Matchable sets matroid, the Tutte-Berge formula.

## Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/) for more information.]

## Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

## Discipline

A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline at <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>. For typical penalties, check Guidelines for the Assessment of Penalties at <http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.

## Appeals

A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.

## Note for students with disabilities

The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.