MATH 350 – GRAPH THEORY AND COMBINATORICS.

Fall 2017

Instructor:

Jan Volec

Office:	Room 1242, Burnside Building
Office hours:	Tuesday, 10:30 AM-12:30 PM and by appointment
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Lecture:

Time:	Tuesday and Thursday 8:35-9:55 PM.
Location:	Burnside 1B24

Topics:

The course covers fundamental concepts in graph theory: trees, matchings, connectivity, graph coloring, planar graphs.

Pre-requisites:

The pre-requisites are 1) **MATH 235** or **MATH 240** *and* 2) **MATH 251** or **MATH 223**.

Restrictions:

Not open to students who have taken or are taking **MATH 343** or **MATH 340**.

Textbooks:

References that you may find helpful are

- *Introduction to Graph Theory* by D. West. (basics, great source of exercises)
- *Graph Theory* by A. Bondy and U.S.R. Murty. (basics + some advanced stuff)
- *Graph Theory* by R. Diestel. (more advanced, available for free: http://diestel-graph-theory.com/)

Grading policy:

Course grades will be based upon assignments (20%), midterm (20%), and a final exam (60%) - or assignments (20%) and final exam (80%) if this leads to a better mark.

Tentative schedule:

Week 1: Examples of graphs, basic definitions, walks, paths, cycles, connectedness, components of a graph.

Week 2: Trees and forests, leaves, fundamental cycles. Counting graphs and trees, Cayley's formula.

Week 3: Algorithm for minimum-cost spanning trees, Dijkstra's algorithm for shortest path.

Week 4: Euler tours, Euler's theorem, Hamilton cycles, Dirac's theorem, bipartite graphs.

Week 5: Matchings in bipartite graphs, Hall's and Konig's theorems.

Week 6: Vertex- and edge-connectivity, Menger's theorem, digraphs, network flows, max-flow/min-cut theorem.

Week 7: Stable sets, Ramsey theory, probabilistic method, Gallai's equations.

Week 8: Matchings in general graphs, Tutte's theorem, Petersen's theorem.

Week 9: Vertex-coloring, Brooks' theorem, graphs with large chromatic number and no short cycles.

Week 10: Edge-coloring, Konig's, Shannon's and Vizing's theorems.

Week 11: Planar graphs, Euler's formula and applications, planar duals, the five-color and four-color theorems.

Week 12: Minors of graphs, Kuratowski's theorem, series-parallel and outerplanar graphs.

Week 13: Extremal graph theory, Mantel's & Turan's theorems.

Week 14: Review.

Academic Integrity:

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information). Most importantly, work submitted for this course must represent your own efforts. Copying assignments or tests from any source, completely or partially, allowing others to copy your work, will not be tolerated.

Miscellaneous:

- In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or French any written work that is to be graded.
- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.