MATH 350 – GRAPH THEORY AND COMBINATORICS.

Fall 2016

Instructor:

Jan Volec

Office:	Room 1131, Burnside Building
Office hours:	Monday, 4:00-6:00 PM and by appointment
Email:	jan [at] ucw [dot] cz
Web:	http://honza.ucw.cz

Lecture:

Time:	Monday and Wednesday 2:35-3:55 PM.
Location:	Burnside 1B36

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. (great source of exercises)
- *Graph Theory* by R. Diestel. (more advanced)

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, connectedness, components of a graph.

Week 2: Trees and forests, leaves, fundamental cycles, algorithm for minimum-cost spanning tree.

Week 3: Euler tours, Euler's theorem, Hamilton cycles, Dirac's theorem, bipartite graphs, odd cycles, Dijkstra's algorithm for shortest path.

Week 4: Vertex- and edge-connectivity, Menger's theorem, digraphs, network flows, max-flow/min-cut theorem.

Week 5: Matchings in bipartite graphs, Hall's and Konig's theorems, algorithm for maximum matching in bipartite graphs.

Week 6: Matchings in general graphs, Tutte's theorem, Petersen's theorem.

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

Week 8: Vertex-coloring, Brooks' theorem, graphs with large chromatic number and no short cycles.

Week 9: Edge-coloring, Konig's theorem, Shannon's theorem, Vizing's theorem, extremal problems.

Week 10: Planar graphs, regions and cut-edges, Euler's formula and applications, planar duals, the five-color theorem, the four-color theorem and its equivalents.

Week 11: Minors of graphs, examples of excluded minor theorems, Kuratowski's theorem, series-parallel and outerplanar graphs.

Week 12: Perfect graphs, chordal graphs, the weak perfect graph theorem.

Week 13: List coloring. Stable matchings. Galvin’s solution of Dinitz conjecture.

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.