

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website

<https://news.uoguelph.ca/2019-novel-coronavirus-information/>

**Illness:**The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

## Math 4310: Winter 2021, Provisional Outline Pending Approval

Department of Mathematics and Statistics

### General Information

**Course Title:** Combinatorics and Graph Theory

**Course Description:**

This course is an introduction to combinatorics with a focus that includes graph theory. Specific topics covered are enumerative combinatorics up to inclusion-exclusion, the theory of simple graphs, Latin squares and orthogonal Latin squares, and introductory coding theory. Instructors may continue to one or more of the Polya theory of counting, graph coloring and embedding, combinatorial design theory, Ramsey theory, or advanced topics in enumerative combinatorics.

**Prerequisite(s):** Math 2000 and 10 credits.

**Credit Weight:** 0.5

**Academic Department (or campus):** Mathematics & Statistics

**Campus:** University of Guelph

**Semester Offering:** Winter 2021

**Class Schedule and Location:**

Synchronous Lectures through CourseLink 11:30-12:20 MWF

### Instructor Information

**Instructor Name:**Daniel Ashlock

**Instructor Email:**dashlock@uoguelph.ca

**Office location and office hours:**Online via Google Meet

Office hours can be found on the class page on CourseLink, they may change.

**GTA Information** TBA when known

### Course Content

**Specific Learning Outcomes:**

This course will introduce combinatorics and graph theory. The learning outcomes are:

- Students will be introduced to the theory of enumeration, counting objects with specific properties. This will include basic material such as binomial coefficients, recurrence relations, inclusion exclusion, and the application of multinomial coefficients to counting.
- Students will be introduced to and demonstrate proficiency with graph theory for simple graphs including Euler and Hamilton cycles, various constructions of graphs, and a variety of graph invariants.
- Students will be introduced to the theory of graphs with added properties and demonstrate proficiency with the application of the added properties. These include colorings and drawings of graphs, graphs as metric spaces, and topological graph theory.
- Students will be introduced to and demonstrate proficiency with Latin squares, mutually orthogonal Latin squares, and combinatorial designs including the origin of these objects and their application as a foundation of experimental design.

- Time permitting students will be introduced to the theory and application of error correcting codes and demonstrate proficiency with the material.

### **Lecture Content:**

Week	Content
1	Basic enumeration and recurrence relations, Sec. 1.1, 1.2
2	Inclusion exclusion and multinomial coefficients, Sec 1.3, 1.4
3	Basic graph theory and examples, Sec 2.1, 2.2
4	Isomorphism and automorphism of graphs, Sec 2.3
5	Euler and Hamilton cycles, Sec 2.4
6	Colorings and drawings of graphs, Sec 3.1
7	Distances in Graphs and Topological Graph Theory Sec 3.2,3.3
8	Latin squares, Sec. 4.1
9	Finite fields and Mutually Orthogonal Latin Squares, Sec 4.2, 4.3
10	Combinatorial designs, Sec. 4.4
11	Coding theory, introduction and Hamming codes, Sec. 5.1, 5.2
12	Review of material and final project clinic.

All references to chapters and sections are for the class lecture notes.

### **Labs:**

No labs

### **Course Assignments and Final Project:**

Assignments consists of 8 problem sets due the Friday after they are assigned. If Friday of a given week is a holiday the homework is due during the next non-holiday weekday. The class will also have original, individual projects for its final assessment. Topics will be posted on the classes Courselink page or students may propose projects. Weighting is homework 80%, final project 20%.

**Final project due date:** Electronic submission as a PDF (no Word documents!) or paper submission by mail are acceptable. The project is due on Wednesday, April 21st.

### **Course Resources**

**Required Texts:** Lecture notes on courselink

**Recommended Texts:** None

**Other Resources:** Lecture notes on courselink

### **Course Policies**

#### **Grading Policies**

Performance on the homework assignments is worth 80% of the grade, the score on the final project is worth 20% of the grade.

Late assignments not accompanied by a reasonable medical or personal excuse are docked 5% per day late and are not accepted more than a week late.

#### **Course Policy on Group Work:**

Students are encouraged to work on homework problems together but must each write up individually the material they turn in. Work on the final project may be done in consultation with other students or with faculty but the final project must be completely written by the student.

#### **Course Policy regarding use of electronic devices and recording of lectures**

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

### **Additional Course Information**

Lecture notes are available on courselink or by e-mail request to the instructor. If you need large print, I can adjust the print size on request.

## Policy Appendix

### University Policies

#### **Academic Accommodation of Religious Obligations**

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

#### **Academic Consideration**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

#### **Academic Misconduct**

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml>

#### **Accessibility**

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services (SAS) as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca) or see the website: <http://www.uoguelph.ca/csd/>

#### **Drop date**

The last day to drop the class is the last day of classes.

**Inappropriate online behaviour will not be tolerated.**

Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Making false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your user name and password
- Recording lectures without the permission of the instructor