Carleton University   School of Mathematics and Statistics

Discrete Structures and Applications
Comp3805A/Math3825A/Math3855A, Fall 2023

Instructor: Daniel Panario
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Day and time of course: Mondays and Wednesdays 13:05 - 14:25.
Room: in Southam Hall 318.
Office hours: Wednesdays 11:35 - 12:25 in HP4372.

Textbook: "*Discrete Mathematics*" by Norman L. Biggs (Oxford Science Publications, 2nd edition).

Prerequisites: One of MATH2100, MATH2108 or MATH3101.

Course Objective: This course introduces students to the methods and techniques of discrete mathematics and applications. We study four major topics: Enumeration (elementary methods, inclusion and exclusion, etc); Generating functions and applications (recurrence relations, partitions of positive integers, etc); Graph theory and algorithms (connectivity, planarity, Hamiltonian cycle and Eulerian walk, etc); Error-correcting codes.

Evaluation: Midterm tests (30%), Tutorials (16%), Assignment (14%), and Final Examination (40%). You must pass the term work in order to pass the course. If you have a passing term mark (50% in total for midterm tests, tutorial/quizzes and midterm test) and you do better in the final exam, then I will count the final exam for 100% of the course.

Tutorials: Monday 8:35 - 9:25 in Loeb Building B146. **Tutor**: Jesse Niyo.
   Tutorials begin on September 18, 2023. Tutorials are a very important part of this course. In each tutorial you will be given a couple of questions to work on. There will be 8 tutorial quizzes in the term for a total of 16% of the final mark. Each quiz is marked as 0, 1 or 2; quizzes not completed are marked as zero. TA's office hour will be announced later.

Midterm Tests: There will be two midterm exams on October 16 and November 13, in tutorial; each midterm test is worth 15% of the final mark.

Assignment: There will be an assignment for 14% of the final mark. The assignment will be given by Wednesday October 11. Due date: November 8.

Final Examination: This is a three hour closed-book exam scheduled by the University that will take place sometime during the examination period. The exam is worth 40% of the final mark.

Withdrawal: The last day for withdrawal is November 15, 2023.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website.

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website.

Academic accommodations for students with disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Tentative lecture schedule

Week	Dates	Sections	Topics
1	Sep. 6	6.2; 6.4; 10.1-10.2	Introduction. Pigeonhole principle. Addition principle. Counting sets of pairs.
2	Sep. 11-13	10.3-10.6	Euler's function. Functions and words. Ordered selections without repetitions. Permutations.
3	Sep. 18-20	11.1-11.5	Binomial numbers. Unordered selections with repetitions. Binomial theorem. Sieve principle.
4	Sep. 25-27	11.5-11.7	Sieve principle. Designs and t-designs.
5	Oct. 2-4	12.1-12.4; 25.1	Partitions of sets. Multinomial numbers. Partitions of a positive integer. Power series.
6	Oct. 11	25.1-25.3	Power series and properties. Partial fractions. Binomial theorem with negative exponents. **Assignment handed out on Oct. 11.**
7	Oct. 16-18	25.4-25.6	Generating functions. Homogenous and non-homogenous linear recurrences. **Midterm #1 on Oct. 16 in tutorial.**
8	Oct. 23-27		Winter break, no classes.
9	Oct- 30 - Nov. 1	26.1-26.4	Partitions and diagrams. Partitions and generating functions. Restricted partitions.
10	Nov. 6-8	15.1-15.6	Graphs. Isomorphism. Valency. Paths and cycles. Trees. Vertex colouring. **Assignment due on Nov. 8.**
11	Nov. 13-15	Course notes	Planar graphs. Euler's theorem. **Midterm #2 on Nov. 13 in tutorial.**
12	Nov. 20-22	24.1-24.2	Words, codes and errors. Linear codes.
13	Nov. 27-29	24.3-24.4	Constructions. Error correction.
14	Dec. 4-6	Course notes	Hamming code. Bounds. Course review.