MATH*1271 FDF: Discrete Mathematics

Fall 2021

Lectures: MW 08:00-09:30 **Lecture Room:** N/A (Zoom)
Labs: Th 14:00-15:00 **Lab Room:** N/A (Zoom)

Instructor: Dr. George Hutchinson **E-mail:** ghutchi1@lakeheadu.ca
Office Hours: TBA **Office:** N/A (Zoom)

Course Summary

This course will cover a multitude of topics in Discrete Mathematics. Areas of study include: Sets, logic, and functions; Boolean Algebras; Algorithms; Basic counting principles; Permutations and combinations; Discrete probability; Recurrence relations; The principle of inclusion and exclusion; The Pigeonhole principle; and Graph Theory.

See page 3-5 for a more detailed schedule of topics that we will be covering.

Course Materials

Website: This course uses a D2L (Courselink) site, on which grades and important course information will be posted. You are expected to check this website regularly for announcements and course materials.
(The website can be found at www.mycourselink.lakeheadu.ca.)

Required Textbook: *A beginner's guide to discrete mathematics (2nd edition)*, by W.D. Wallis.

A (free!) SpringerLink e-book of this text is available for download from the Library website.

Descriptions of Course Components

Lecture: While attendance is not technically mandatory, you are strongly encouraged to come to lecture. As we will not be adhering strictly to the textbook, the lecture notes are still the primary source of material. Further, there will often be important information regarding assignments and tests conveyed in lecture.

NOTE: Prior to each lecture, I will upload a document consisting of partially complete notes for that class. You are expected to bring these notes to lecture, and we will fill them in together.

Lab: While the purpose of the lectures is to introduce new material and discuss mathematical theory, it is in the lab that we will apply the lecture material to solve problems. The notes from these sessions should prove invaluable to you as you work through your assignments and study for your tests and exam.

Assignments: There will be 5 assignments over the course of the semester. These assignments will be released on the dates indicated on the Course Schedule (see next page).

NOTE: *If you cannot complete an assignment on time for a legitimate reason which you can document (e.g. doctor's note), I will either allow you to submit your assignment late, or (if the assignment solutions have already been released) I may allocate the weight of the assignment to the final exam.*

Term Tests: There are two term tests in this course, which will be written during lecture. These are scheduled for **October 06** and **November 08.**

NOTE: *If a term test is missed for a legitimate reason which you can document (e.g. doctor's note), the weight of the test will be added to the final exam.*

Final Exam: There will be a cumulative final exam, the date and time of which will be announced as soon as it is scheduled.

Course Schedule:

We will adhere to the following schedule of topics to the best of our abilities. It may be subject to minor changes due to unforeseen delays and/or expedition.

Week	Topics Covered	Evaluation
W1 Sept 06 – Sept 10 (Classes begin Sept 07)	**Set Theory, Logic, and Proofs:** Properties of Numbers and an Introduction to Sets	None
W2 Sept 13 – Sept 17	**Set Theory, Logic, and Proofs:** Elements of Set Theory; Operations on Sets; Properties of Set Operations;; Mathematical Induction	Assignment 1 is released on September 15.
W3 Sept 20 – Sept 24	**Set Theory, Logic, and Proofs:** Proof by Contradiction and the Contrapositive **Boolean Algebras:** Truth Tables; Boolean Algebras; Theorems on Boolean Algebras	Assignment 1 is due on September 22.
W4 Sept 27 – Oct 01	**Boolean Algebras:** Boolean Forms; Karnaugh Maps; Digital Circuits **Relations and Functions:** Basic Definitions; Partial and Total Orders Equivalence Relations and Equivalence Classes;	Assignment 2 is released September 27.

W5 Oct 04 – Oct 08	**<u>Relations and Functions:</u>** Functions; Injectivity, Surjectivity and Bijectivity; Inverse Functions; Countable vs. Uncountable Sets	Assignment 2 is due October 04. **Term Test #1: In class October 06.**
W6 Oct 11 – Oct 15 (No classes Oct. 11th due to Thanksgiving)	**<u>Graph Theory:</u>** Graphing Relations; Basic Definitions and Examples of Graphs; Special types of Graphs; Degree	None
W7 Oct 18 – Oct 22	**<u>Graph Theory:</u>** Walks, Paths and Cycles; Connectivity; Trees and Hamiltonian Graphs; Graph Coloring and the Chromatic Number	Assignment 3 is released on October 20.
W8 Oct 25 – Oct 29	**STUDY WEEK** **ENJOY THE BREAK!**	
W9 Nov 01 – Nov 05	**<u>Matrix Theory:</u>** Basic Matricial Definitions and Operations; Systems of Linear Equations and Gaussian Elimination; Matrix Inversion and Gauss-Jordan Elimination	Assignment 3 is due November 03.
W10 Nov 08 – Nov 12	**<u>Counting:</u>** Events and Operations on Events; Independence and Mutual Exclusivity; Venn Diagrams; Tree Diagrams; The Principle of Inclusion/Exclusion; Arrangements and Selections	**Term Test #2: In class November 08**

W11 Nov 15 – Nov 19	**Counting:** The Binomial Theorem; Derangements; The Pigeonhole Principle; Recurrence Relations in Counting Problems **Probability:** Discrete Probability Distributions; Calculating Probabilities of Events; Venn and Tree Diagrams; Conditional Probability; Bayes' Theorem	Assignment 4 is released on November 17.
W12 Nov 22 – Nov 26	**Number Theory and Cryptography:** The Fundamental Theorem of Arithmetic; The GCD and the Euclidean Algorithm; Modular Arithmetic and the Chinese Remainder Theorem	Assignment 4 is due on November 24.
W13 Nov 29 – Dec 03	**Number Theory and Cryptography:** Elementary Cryptography and Basic Ciphers; RSA and its Variants; Attacks on the RSA system;	Assignment 5 is released on November 29.
W14 Dec 06 – Dec 10 (Classes end December 07)	**The Theory of Voting:** Methods of Elections; "Fair" elections and Strategic Voting; Condorcet Criterion; Independence of Irrelevant Alternatives; Monotonicity Condition; The Pareto Condition; Arrow's Impossibility Theorem	Assignment 5 is due on December 06.

Evaluation

Your final grade will be comprised of the following components, weighed as indicated:

25% Weekly Assignments (5 assignments total, worth 5% each)

20% Term Test 1

20% Term Test 2

35% Final Exam

Course Learning Outcomes:

Upon successful completion of this course, the student will have demonstrated the ability to:

- Understand and create mathematical proofs.
- Identify types of relations and functions, and use bijectivity to discuss the cardinality of a given set.
- Understand basic graph theory definitions and be able to solve a multitude of combinatorial problems that concern graphs.
- Apply matricial algorithms to solve linear systems and calculate the inverse of a given matrix.
- Apply elementary probability theory to calculate the likelihood of an event occurring.
- Understand and implement the Euclidean Algorithm, the Chinese Remainder Theorem, and RSA cryptography.

Lakehead-Georgian Policies

Academic and Student Code of Conduct Policies:

- Academic and student policies and procedures for those enrolled in the Lakehead-Georgian programs can be found on the Lakehead-Georgian Student Portal.
- All Lakehead-Georgian programs will follow the Lakehead Regulations as list in the Lakehead University Academic Calendar (http://csdc.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&loaduseredits=False).The University Regulations include but are not limited to Registration, Examinations, Reappraisals and Academic Appeals, Special Examinations, Academic Misconduct, Withdrawal, and Timely Feedback. Additional Faculty Regulations may also apply. Please review the Academic Calendar.

- The Lakehead University Student Code of Conduct - Academic Integrity (https://www.lakeheadu.ca/students/student-life/student-conduct) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Lakehead University Student Code of Conduct - Appeals (https://www.lakeheadu.ca/students/student-life/student-conduct) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Georgian College Student Code of Conduct (http://www.georgiancollege.ca/student-code-of-conduct/) will apply to the Lakehead-Georgian students studying at the Barrie campus. Additional campus policies of Sexual Violence Procedure and Protocol (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/sexual-violence), Alcohol, Drugs and Tobacco (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/alcohol-drugs-and-tobacco), and Information Technology Acceptable Use Procedure (http://www.georgiancollege.ca/wp-content/uploads/2-117IT-acceptable-use.pdf)also apply.
- The Lakehead University Student Code of Conduct – Non-Academic (https://www.lakeheadu.ca/students/student-life/student-conduct) will apply to the Lakehead-Georgian students studying at the Orillia campus.

Plagiarism and academic dishonesty: A breach of Academic Integrity is a serious offence. The principle of Academic Integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should view the Student Code of Conduct -Academic Integrity (https://www.lakeheadu.ca/students/student-life/student-conduct) for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

Student Services and Support

Student Advisors (https://georgiancollege.sharepoint.com/sites/student/Student-Services/StudentAdvisors/SitePages/Home.aspx)

- Help students build both academic and personal resilience so that they can flourish at Georgian and beyond
- Provide individual, group and web-based advising sessions
- Are housed within the academic areas
- To book an appointment with your advisor go to the **Student Portal (preferred)** or call **705-728-1968 Ext. 1307**

Library (http://library.georgiancollege.ca/main)

Customer Service

- Off campus access

Research help

- Help finding books, articles and credible sources.
- Using specialty databases.
- Creating a search strategy.

Academic Success (https://library.georgiancollege.ca/help/contact-academic-success)

Writing Centre (http://library.georgiancollege.ca/writing_centre)

- Improve your writing.
- Help with citing sources and laying out your paper.

Math Centre (http://library.georgiancollege.ca/math_centre)

- Make sense of math questions.
- Understand concepts and develop skills.

Tutors (http://library.georgiancollege.ca/tutoring)

- Further understand course content.
- Build your study practices.

Accessibility Services (https://www.georgiancollege.ca/student-life/student-services/accessibility-services/)

If you are a student experiencing a disability who may require academic accommodations and have not yet registered with Accessibility Services, please contact their office at 705-722-1523, email studentsuccess@georgiancollege.ca, or visit their offices in B110. You must be registered with Accessibility Services to access academic accommodations. Support for those students whose success at college may be affected by a disability include:

- Ongoing support from our Accessibility Advisors including arranging a confidential psychoeducational assessment where required
- Training in the use of specialized computer technology
- Classroom and test accommodations

Testing Services (http://www.georgiancollege.ca/student-life/student-services/testing/)

- Accommodated testing
- Missed/Makeup testing
- Proctoring services are also available for external and Ontario Learn exams

Counselling (http://www.georgiancollege.ca/student-life/student-services/counselling/)

- Free, confidential counselling is available to all students
- Walk in counselling is available on a daily basis Monday to Friday

Career Success (http://www.georgiancollege.ca/student-life/student-services/co-op-and-career-services/)

Career assessments and exploring options

- Job search workshops
- Labour market information
- Resume/cover letter help

- Interview practice
- Graduate employment information
    - Links to job postings and online resource

Campus Safety and Security Syllabus Addendum

Emergency Evacuation (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire)

- Evacuate buildings when a fire alarm is activated or an official announcement is given. Review evacuation guidelines. (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire)
- Students requiring assistance in emergency situations must inform their faculty during the first week of class.
- Familiarize yourself with all fire exit doors of classrooms and buildings you may occupy.
- Do not re-enter a building until instructions are given by the Fire Department or college personnel.

Lockdown (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/lockdown)

- Lockdown is initiated when there is a potential or actual violent incident on campus that could result in a serious injury or threat to life.
- Students can download the new Safe@Georgian app to stay updated on Campus Safety and Security information including lockdown.
- Familiarize yourself with the College Lockdown procedure (https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf)
- Lockdown tests occur each semester.

Resources:

- Get Out, Hide, Fight Lockdown Video (http://youtu.be/JA8cckMbVDk)
- Lockdown quick reference sheet (http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf)
- Lockdown Model – Get Out, Hide, Fight: Lockdown Tools and Tactics and FAQs.

Unscheduled Campus Closure (https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/campus-closures)

Resources:

- How to find out if your campus is closed (http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed)
- Unscheduled Campus Closure Procedure (https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf)

Timing of Closures/Notification:

Closure	Decision	Communication / Notification*	Notes

College has made the decision to close a campus or location <u>in the morning</u>:	6:00 a.m.	By 6:30 a.m.	If re-opening for noon or evening classes is being considered, this will be mentioned in the message
College closes a campus(s) in the morning and <u>expects to re-open by 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	Only affects classes beginning at 12 noon or later
Closure expected to continue <u>past 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	
College intends to <u>re-open for evening classes</u> which commence at 5 p.m. or later	2:30 p.m.	By 3:00 p.m.	
College intends to <u>NOT re-open for evening classes:</u>	2:30 p.m.	By 3:00 p.m.	

****Notification will be made via:***

- Georgian social media (Facebook, Twitter)
- Safe@Georgian app
- Georgian website (homepage)
- Recorded message when you call into Barrie campus at 705-728-1968
- Student or employee portal
- Georgian email account
- Radio and television announcements through local and regional media

Note: We only announce the names of campuses that are closed. If your campus is not named in a closure, it's open.
