SYLLABUS
Math 125-B01, Summer 2021 1B
3 Credit Hours, CRN 43759
Discrete Mathematics I

Live Office Hours:	M/F 10:30 am - 12:00 pm
Other Office Hours:	T/Th 11:00 am - 1:00 pm
Synchronous Mandatory Session:	W 10:30 - 11:30 am
Mode of Instruction:	Online
Instructor:	Tyler Russ
Phone:	703-993-1460 (Math Dept. Office)
e-mail:	truss3@gmu.edu (preferred method of contact)

The Course: Math 125 is a course in Discrete Mathematics. Discrete mathematics includes methods of counting, and functions with natural number domains. This distinguishes 'discrete' mathematics from the 'continuous' mathematics of Calculus, which studies continuous functions with real number domains.
The official catalog description follows: Introduces ideas of discrete mathematics and combinatorial proof techniques including mathematical induction, sets, graphs, trees, recursion, and enumeration. Offered by Mathematics. Limited to three attempts. The prerequisite for the course is one of the following: a minimum score of 13 in 'Math Placement Algebra I', or a grade of C or better in one of MATH 105, Math 108, or MATH 113.
Refer to this website: `https://catalog.gmu.edu/courses/math/`.
Mason Core: This course fulfills the Mason Core requirement for Quantitative Reasoning.

Course Goals: After completing the course you will

- approach *problem solving* methodically using the *4MAT Problem Solving Method*, and identify your problem solving steps explicitly.
- gain proficiency writing *proofs* both in clarity of writing and in logical reasoning with clearly defined transitions.
- internalize a variety of problem solving strategies, including 'solve a simpler problem', 'provide an example', 'make a table', and others.
- determine whether a *logical argument* is *valid*, devise and evaluate logical arguments using *implication* and other logical relations (e.g. "or","and","not", etc.), and apply basic rules of inference (modus ponens, modus tollens, etc.), as well as *negation* and *De Morgan's laws*.
- identify the elements of a *set* explicitly using *set builder* notation, calculate the *union* and *intersection* of sets, and represent data correctly in a *Venn diagram*.
- define the terms *relation*, *function*, *equivalence relation*; determine the *domain* of a function and calculate its *range*; distinguish functions from relations, and generate relations and functions (often as a set of *ordered pairs*) with specific properties (e.g., *antisymmetric, transitive; injective, surjective*), and perform function *compositions*; determine whether a function is *invertible*, and calculate its *inverse*.
- apply *mathematical induction* correctly, using a *base case* and *induction hypothesis*, to prove mathematical identities; inspect sequences for *recursive* relationships, express these as explicit functions, and calculate *partial sums* of *arithmetic* and *geometric* sequences.

- distinguish which counting technique–e.g., *inclusion-exclusion*, *addition rule*, *multiplication rule*, *permutation*, *combination*, or some combination of these–is most appropriate for a variety of real-world word problems, and correctly carry out the necessary calculations.
- detect when the *pigeon hole principle* is relevant and construct logical arguments applying the principle.
- expand sums of the form $(a+b)^n$, n an integer, using the *binomial theorem*, and determine any specified term in the sum.
- define the terms *graph* and *bipartite graph* (See Chapter 9), explain the relations among the *vertices* and *edges* of a graph, write the *degree sequence* of a graph, and test multiple graphs to determine if they are *isomorphic*.
- define the term *Eulerian circuit*, classify graphs as Eulerian, and produce a graph given its corresponding *adjacency matrix* and vice-versa.
- classify graphs as *trees* and illustrate subgraphs called *spanning trees* of a general graph.
- generalize from basic to more intricate problems, combining various counting techniques, such as the multiplication and addition rules, and permutations and combinations. (Working through homework problems helps with this ability.)
- classify problems as essentially discrete in nature (combinatorial, counting problems), as opposed to algebraic, or continuous (e.g. optimization, continuous functions).

Course Outline: The text for the course is *Discrete Mathematics with Graph Theory*, by Goodaire and Parmenter, Third Edition, published by Pearson. (ISBN-13: 978-0-13-468955-5) We will cover sections 1.1 - 1.3, 2.1 - 2.4, 3.1 - 3.2, 5.1 - 5.2, 6.1 - 6.3, 7.1 - 7.2, 7.7, 9.1 - 9.3, 10.1, 10.3, 12.1 - 12.2.

Course Expectations You can expect to put in 15-20 hours of work each week on assignments outside of lectures. It is your responsibility to watch the recorded lectures and to complete the provided lecture notes. This is the most crucial element of your success in this course. It is expected that you will complete every quiz, minitest, and worksheet to the best of your ability. This course satisfies Mason's Quantitative Reasoning requirement, so a requisite level of effort is expected of you. As your instructor, I am dedicated to your success at Mason. I am providing transparency on course expectations by providing access to explicit course objectives, and frequent quizzes and minitests. If you strive to master these components of the course, you stand your best chance of succeeding. In the end, you must put in the time and effort, but I am here to support you through this with office hours, lectures, advising by email, and our weekly sessions on Wednesday. Mastery of the logical reasoning developed in this course is crucial to your continuing success at Mason and in your future studies.

Lecture Notes Lecture note outlines, typewritten, will be available on our Blackboard page. It is recommended that you print a copy of the lecture notes for each chapter, and make additional notes as you watch the lecture videos. If you are unable to print the notes, an alternative is to download the notes to your device, so that you can access them while watching the video lectures. You can then take complete handwritten notes, as you would in a traditional classroom. Also, the lecture notes contain a number of exercises that you can use to verify comprehension. I plan to provide a complete solution for the exercises in the lecture notes following the end of each chapter.

Quizzes: There will be a total of 11 quizzes as in the Course Calendar on the Syllabus page in Blackboard. You can consult the list of Course Goals, and the list of Course Objectives for each chapter, as you prepare for the quizzes. Once you can successfully complete problems matching the stated course goals and objectives, you should be successful on the quizzes. Conversely, success on the quizzes demonstrates a basic mastery of

the Course Goals listed in this syllabus and the relevant chapter-specific objectives.

Worksheets and Mandatory Wednesday Meeting 10:30 - 11:30 am: On Wednesdays, we will have a virtual class session resembling a recitation. These will most likely be conducted in Collaborate Ultra throughout the semester. We will use Miro whiteboards to show our work. This is a mandatory synchronous component of the course. During these meetings, we will complete a worksheet related to the material covered that week, working in small groups. The worksheet is designed to fit the Inquiry Based Learning (IBL) style of instruction.

Group Projects: We will have a small group project that you will work on in groups of 3-4 students. The project is worth 15% of your grade. Specific due dates are in the Course Calendar in our Blackboard page. A primary goal of the project is to connect material in our course to other courses and research you are interested in. This is to reinforce your conviction that concepts in this course are applicable to other fields. You should choose a topic you are familiar with from an internship, another course, or other research. You will relate that topic to at least one concept covered in this course (e.g., Logic, pigeonhole principle, Inclusion-Exclusion, graph theory, combinations and permutations, ways of counting, etc.). I will provide a list of possible topics to help you generate ideas for your own project. Each of you will contribute a minimum of 1-3 pages of meaningful text, diagrams and analysis to your group's project. Your particular minimum will depend on the complexity of your contribution. I am grading for content over style. You can contribute your rough sketches and ideas to the project. We will schedule 20-minute meetings with your respective groups at strategic times during the term on Mondays and Fridays. These dates are indicated in the Course Calendar. Remember that these times are 'mandatory' synchronous times for which you have agreed to be available by registering for this course. Presentations, as listed in the Course Calendar, will be for extra credit, as a presenter or as an audience member.

Minitests: Every two weeks, we will have a minitest. Minitest 1 will be available June 9th, and must be completed by June 14th at 12:00 pm. It covers chapters 1, 2 and 3. Minitest 2 will be available June 23rd, and must be completed by June 26th at 12:00 pm. It covers chapters 5, 6 and 7 with some problems from chapters 1-3. Minitest 3 will be available July 7th, and must be completed by July 13th at 1:00 pm. It covers chapters 9, 10 and 12 with some problems from chapters 1-7. The minitests are used in place of a single midterm. More frequent testing is designed to decrease the anxiety that can build up in anticipation of major tests. You can consult the list of Course Goals, and the list of Course Objectives for each chapter, as you prepare for the minitests. Once you are able to successfully complete problems matching the stated goals and objectives, you should be successful on the minitests. Conversely, success on the minitests guarantees an intermediate mastery of the Course Goals listed above and chapter-specific objectives.

Grading: *Quizzes*: There will be a total of 11 quizzes as in the schedule on Blackboard. The lowest score will be dropped, and the quiz score calculated based on 10 quizzes at 7.5 points each for a total of 75 points. The quizzes will consist of T/F, multiple choice and short answer questions. *Worksheets*: On Wednesdays, we will have a virtual class session resembling a recitation. During these meetings, we will complete a worksheet for that week, working in small groups. There will be a total of 7 worksheets at 10 points each for a total of 70 points. (Five points are built-in for a total of 75.) If you must be absent from a Wednesday meeting you need to seek approval prior to the meeting time. To earn points, you will then complete the worksheet and post it asynchronously in the corresponding Discussion Board forum by the date listed in the Course Calendar. If you are absent from a Wednesday meeting without prior approval, you may earn up to half credit for the worksheet. *Group Project*: Your group project will be worth 75 points. Your score will depend on the degree to which you complete your portion of the project according to feedback from your instructor as provided in the "Group Meetings" detailed in the Course Calendar in weeks 2-4. *Minitests*: Every two weeks, we will have a mini-test. These follow the point scale in the table below. Notice that the minitests increase in points. You must complete the minitests according to the time frame as detailed in the Course Calendar. *Final Exam*: The minitests culminate with the final exam following the last week of classes. **The**

final exam is on the 23rd of July from 10:30 am - 2:30 pm. You will have a maximum of three hours to complete the test. You must begin the test by 11:30 am in order to have the full three hours. The make up time for the final exam is the 24th of July from 10:30 am - 2:30 pm. The final exam is cumulative.
Homework: Homework problems will be ungraded. A list of suggested homework problems will be provided. It is advised that you work through as much of the homework as you can. We will have forums in Discussion Board for homework.

	Quiz	Worksheet	Project	Minitest 1	Minitest 2	Minitest 3	Final	Total
Points Each	7.5	10	75	35	40	50	150	
Number	10	7	1	1	1	1	1	
Points Total	75	70 + 5	75	35	40	50	150	500
Percentage	15	15	15	7	8	10	30	100

Late Work: Quizzes and Minitests must be completed within the allotted time frame listed. For a complete list of these time frames refer to the Course Calendar on the Syllabus page on the Blackboard page for this course. Each minitest will be available for a period of at least 4 days. Each quiz will be available for a period of at least 3 days. These time frames allow a reasonable amount of time for each student to complete the test items. **If you feel you cannot complete a quiz or minitest within the allotted time, you must email me (truss3@gmu.edu) in advance of the deadline. Any missed quiz or minitest without prior approval will result in a score of zero (0) for that item.**

Office Hours: My office hours will be held online. Every Monday and Friday, I will hold office hours in Collaborate Ultra from 10:30 am - 12:00 pm. Every Tuesday and Thursday, I will hold synchronous office hours in Discussion Board from 11:00 am - 1:00 pm. You can post your questions to the office hour forum in Discussion Board at any time. You are permitted to post anonymously. You can also email your questions to me (**truss3@gmu.edu**). I check my e-mail frequently throughout the day. Additionally, you can contact me (truss3@gmu.edu) to arrange office hours at other times if you are unavailable for the scheduled office hours. We will use email and Blackboard for communication throughout the semester. You must use your MasonLive student email account when emailing me.

Technology: According to Mason: To take an online course, you must have a Mason username and password, have an official Mason email account, and meet minimum technical requirements. See our What Technologies Do I Need page. Also, check the syllabus, our Blackboard page, and contact me (truss3@gmu.edu) if you have a question or a concern.
For this online course, you must meet the university's minimum requirement for accessing the course. It is additionally recommended that you have access to a printer, so that you can print the course lecture notes. There is no requirement for a calculator or any specific mathematics software for this course. You may choose to use a scientific or graphing calculator when working on homework, or any other software you choose.

Expectations on Students, Environment of Inquiry: Our classroom is a participatory environment where freedom of thought is encouraged. Disparaging comments and inappropriate language do not contribute to an open atmosphere. Though we are operating in an online space, there are standard rules of etiquette that remain in place. Expectations for this course require that you adhere to the same standards of behavior that you use in face-to-face environments. If you would like to evaluate your online behavior, please refer to the following: `http://www.albion.com/netiquette/corerules.html`.

Special Accommodations: If you are a student with a disability and you need academic accommodations, please contact me (truss3@gmu.edu) and contact the Office of Disability Services (ODS) at 993-2474 or by email at ods@gmu.edu. You can access their website at `https://ds.gmu.edu/`. All academic accommoda-

tions must be arranged through the ODS with the appropriate documentation https://ds.gmu.edu/forms/.

Important Dates: This course meets in the summer 1B session from 06/01 to 07/21. The last day to add classes or drop with no tuition liability is Thursday, June 3rd (06/03/21). The last day to drop classes with a 50% tuition liability is Wednesday, June 9th (06/09/21). There will be no classes on Monday, July 5th in observation of Independence Day. There will be no classes on Friday, June 18th in observation of the Juneteenth Emancipation Day.
Our final class meeting will be on Wednesday, July 21st (07/21/21). **Our final exam is scheduled for Thursday, July 23rd (7/23) from 10:30 am - 2:30 pm.**

Academic Integrity: The Honor Code will be taken seriously in this course. It is expected that students adhere to the George Mason University Honor Code as it relates to integrity regarding coursework and grades. The Honor Code reads as follows: "To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this: Student members of the George Mason University community pledge not to cheat, plagiarize, steal and/or lie in matters related to academic work."
More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at
https://oai.gmu.edu/mason-honor-code/full-honor-code-document/.
The honor code will be strictly observed during tests.

Diversity, A Cornerstone at Mason: Mason strives to maintain a quality environment for work, study and personal growth. An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual, group and organizational level. The implementation of this commitment to diversity and inclusion is found, notably, in the classroom setting, including, but not limited to, curriculum, teaching, and advising. Mason seeks to continuously improve its environment. For the University's complete statement see https://stearnscenter.gmu.edu/knowledge-center/general-teaching-resources/mason-diversity-statement/
Diversity includes a variety of cultural backgrounds. If a holiday coincides with a class session or due date, please alert me by email (truss3@gmu.edu) prior to the absence. A list of religious holidays is provided by the university at https://ulife.gmu.edu/religious-holiday-calendar/.

Know Your Rights under FERPA: When a student turns 18, or attends a postsecondary institution, FERPA rights belong to the student, not the parent. In general, Mason does not disclose non-directory information to third parties unless the student has provided consent. For more information see https://registrar.gmu.edu/ferpa/.

Title IX: Diversity and Ethics: As a faculty member and designated "Responsible Employee," I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per university policy 1412. If you wish to speak with someone confidentially, please contact the Student Support and Advocacy Center (703-380-1434), Counseling and Psychological Services (703-993-2380), Student Health Services, or Mason's Title IX Coordinator (703-993-8730; cde@gmu.edu); https://diversity.gmu.edu/sexual-misconduct. If you feel harassed or threatened by another student, please report it to me or to Compliance, Diversity, and Ethics in Aquia Hall 373, MS 2C2, or at (703) 993-8730.

Campus Resources

- If you feel harassed or threatened by another student, please report it to me, another professor, or to Compliance, Diversity, and Ethics in Aquia Hall 373, MS 2C2, or at (703) 993-8730.
- Title IX protects any person from sex-based discrimination, including sexual assault. Call 703-993-8730, email cde@gmu.edu, or complete the intake form online at `https://diversity.gmu.edu/intake-form`.
- Office of Student Conduct, 703-993-6209, `https://studentconduct.gmu.edu/`
  National Sexual Assault Lifeline: 1-800-656-4673 (on back of GMU ID card)
- Counseling and Psychological Services (CAPS), 703-993-2380, `https://caps.gmu.edu/`
- Here are numbers if you or a student you know is in crisis:
  Crisis Text Line: Text 741-741
  CrisisLink: 703-527-4077
  National Suicide Prevention Lifeline: 800-273-8255 (on back of GMU ID card)
- Student Support and Advocacy Center: Provides comprehensive services for students in an effort to foster the safety and well-being of the Mason community. Call 703-993-3686. `https://ssac.gmu.edu`.
  Call 703- 380-1434 for the 24-hour sexual and intimate partner violence helpline.
  In an emergency you can dial 911 or 703-993-2810 (University Police and Public Safety; on back of GMU ID card), `https://police.gmu.edu`
- Sign up for the following to receive texts to your phone:
  Visit `https://alert.gmu.edu` today to add your cell phone to receive text alerts from Mason Alert.
  Rave Guardian is a campus safety mobile application that enhances preparedness and safety on-campus. The app is free for all students with a university email address through the iTunes store and the Google Play store. See `https://ready.gmu.edu` for more information.
- Office of Housing and Residence Life: Professional and student staff are available 24 hours a day to assist students and ensure safety. For 24-hour, non-emergency line, Call 703-993-2720.
  `https://housing.gmu.edu/`.
- Online Education Services, University Libraries `https://library.gmu.edu/for/online`.
- Take advantage of the Writing Center as you work on written assignments in any course you take at Mason. You can book free 45-minute appointments with tutors who will work with you on any phase of a writing project. They can provide feedback on a draft, answer your questions, and show you strategies for brainstorming, organizing, drafting, revising, and editing. To schedule an appointment, visit the center's main location in Robinson Hall B 213 or go to `https://writingcenter.gmu.edu`, register with the center, and make an appointment using the online scheduler.

Mathematical text-editing software: Homework in this class is not required to be typed-up. If you would like to learn how to type-set mathematical documents, you can begin using the now-standard (free) software called LaTeX. I can provide basic examples to help you get started using LaTeX. You can find it here: `https://www.latex-project.org/get/`
Alternatively, a more immediate alternative is ShareLaTeX, which can be found here:
`https://www.sharelatex.com/`

Tutoring for Mathematics: Mathematics tutoring is available over Summer 2021 at Mason. Information for accessing tutors is available here:
`https://science.gmu.edu/academics/departments-units/mathematical-sciences/math-tutoring/tutoring-center`
The instructions for joining are provided on this website. If you expand the "Hours of Operation" text box

on the website above, you will see the tutoring center is open May 17 through August 5th with the following hours: Mon-Th, 2:00 - 7:00 pm and Friday, 1:00 - 5:00 pm.

Blackboard Log-in Instructions: You can find access the Blackboard homepage for GMU by searching for "my gmu" in your browser. The url is the following:

`https://mymason.gmu.edu`

Click the "Mason Bb Login" button, a large green virtual button. Enter your username/NetID and password. Your username/NetID is the same as your email excluding the last part. For example if your mason email is "flast@gmu.edu" (or flast@masonlive.gmu.edu), then the string 'flast' is your username/NetID. Be sure you've created your account before logging in.