

MTH525: Discrete Mathematics

Credit Hours: 3

Contact Hours: This is a 3-credit course, offered in accelerated format. This means that 16 weeks of material is covered in 8 weeks. The exact number of hours per week that you can expect to spend on each course will vary based upon the weekly coursework, as well as your study style and preferences. You should plan to spend 14-20 hours per week in each course reading material, interacting on the discussion boards, writing papers, completing projects, and doing research.

Faculty Information



Faculty contact information and office hours can be found on the faculty profile page.

Course Description and Outcomes



Course Description:

This graduate-level course will provide an introduction to discrete structures. The topics will range from logic, number theory, recursion, combinatorics, graph theory to basic probability. Great emphasis will be focused on methods of mathematical proof: direct proof, induction, and contradiction. This course will also offer best practices for Dual Credit course instruction and discussions of standard pedagogy.

Course Overview:

This course will examine common topics in discrete mathematics at an advanced level with an emphasis on gaining a deep understanding of the subject that facilitates effective teaching.

Course Learning Outcomes:

1. Manipulate logical statements and identify valid and invalid arguments.
2. Construct mathematical proofs of various kinds.
3. Understand mathematical induction, sequences and series.
4. Compare the differences between different kinds of relations.
5. Solve probability problems.
6. Construct and solve problems using graphs.
7. Reflect on implications for application of mathematical concepts in the classroom.

Participation & Attendance



Prompt and consistent attendance in your online courses is essential for your success at CSU-Global Campus. Failure to verify your attendance within the first 7 days of this course may result in your withdrawal. If for some reason you would like to drop a course, please contact your advisor.

Online classes have deadlines, assignments, and participation requirements just like on-campus classes. Budget your time carefully and keep an open line of communication with your instructor. If you are having technical problems, problems with your assignments, or other problems that are impeding your progress, let your instructor know as soon as possible.

Course Materials



Required:

Rosen, K. (2012). *Discrete Mathematics and its Applications: Combinatorics and Graph Theory*, 7th ed. McGraw Hill: New York, NY. ISBN 9780073383095

Suggested:

NOTE: All non-textbook required readings and materials necessary to complete assignments, discussions, and/or supplemental or required exercises are provided within the course itself. Please read through each course module carefully.

Course Schedule



Due Dates

The Academic Week at CSU-Global begins on Monday and ends the following Sunday.

- Discussion Boards: The original post must be completed by Thursday at 11:59 p.m. MT and Peer Responses posted by Sunday 11:59 p.m. MT. Late posts may not be awarded points.
- Check Your Understanding Exercises: These exercises occur at various points in the week's content to see which areas you will need to focus on. You may take these exercises as many times as you need. The Check Your Understanding exercises will not affect your final grade.
- Students have one attempt on the midterm and final exams. The time limit is 400 minutes for each exam, and the exam must be completed in one sitting.
- Critical Thinking: Assignments are due Sunday at 11:59 p.m. MT.
- Live Classroom: Although participation is not required, Live Classroom sessions are held during Weeks 3 and 6. There are two total sessions.

Week #	Readings	Assignments
1	<ul style="list-style-type: none"> Chapter 1.1-1.5 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points)
2	<ul style="list-style-type: none"> Chapter 4.1-4.2 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (65 points)
3	<ul style="list-style-type: none"> Chapter 4.3-4.4 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (65 points)
4	<ul style="list-style-type: none"> Chapter 5.1-5.3 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (65 points) Midterm Exam (200 points)
5	<ul style="list-style-type: none"> Chapters 7.1-7.2 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (65 points)
6	<ul style="list-style-type: none"> Chapter 7.3-7.4 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (65 points)
7	<ul style="list-style-type: none"> Chapters 9.1-9.2 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Critical Thinking (75 points)
8	<ul style="list-style-type: none"> Chapters 10.1-10.2 in <i>Discrete Mathematics and its Applications: Combinatorics and Graph Theory</i>, 7th ed. 	<ul style="list-style-type: none"> Discussion (25 points) Final Exam (200 points)

Assignment Details



This course includes the following assignments/projects:

Module 1

None

Module 2

Critical Thinking (65 points)

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1: Proving Statements About Z_m

For this assignment, provide a full explanation to prove each statement, with each step clearly shown.

1. The distributive property of multiplication over addition holds for Z_m where $m > 1$.
2. That Z_m with addition modulo m satisfies the closure, associate, and commutative properties.

Review the **Module 2 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Option #2: Proving Statements about Modular Arithmetic

For this assignment, provide a full explanation to prove each statement, with each step clearly shown.

1. If $k > 0$ and $m > 1$ and $a = b \pmod{m}$, then $a^k \equiv b^k \pmod{m}$.
2. Prove that if n is an odd positive integer, then $n^2 = 1 \pmod{8}$.

Review the **Module 2 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Module 3

Critical Thinking (65 points)

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1: The Extended Euclidean Algorithm

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Use the extended Euclidean algorithm to express $\gcd(252, 356)$ as a linear combination of 252 and 356. Also, prove or disprove that $n^2 - 79n + 1601$ is prime if $n > 1$.

Review the **Module 3 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Option #2: The Greatest Common Divisor

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Show that if $a = b \pmod{m}$, then $\gcd(a, m) = \gcd(b, m)$. Also show that $p_1 * p_2 * \dots * p_n + 1$ is prime for every positive integer n , where p_1, p_2, \dots, p_n are the n smallest prime numbers.

Review the **Module 3 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Module 4

Midterm Exam (200 points)

Critical Thinking: (65 points)

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1: The Winning Strategy

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Prove that the first player has a winning strategy for the game of Chomp, introduced in Example 12 in Section 1.8, if the initial board is two squares wide, or, in other words, a $2 \times n$ board.

Review the **Module 4 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Option #2: Dividing a Chocolate Bar

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Assume that a chocolate bar consists of n squares arranged in a rectangular pattern. The entire bar, or any smaller rectangular piece of the bar, can be broken along a vertical or a horizontal line separating the squares. Assuming that only one piece can be broken at a time, determine how many breaks you must successively make to break the bar into n separate squares. Use strong induction to prove your answer.

Review the **Module 4 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Module 5**Critical Thinking (65 points)**

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1: Monty Hall Puzzle

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Suppose that instead of three doors, there are four doors in the Monty Hall puzzles. What is the probability that you win by not changing once the host, who knows what is behind each door, opens a losing door and gives you the chance to change doors? What is the probability that you win by changing the door you select to one of the two remaining doors among the three that you did not select?

Review the **Module 5 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Option #2: Thinking through the Monty Hall Puzzle

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Explain what is wrong with the statement that in the Monty Hall Three-Door Puzzle the probability that the prize is behind the first door you select and the probability that the prize is behind the other of the two doors that Monty does not open are both $\frac{1}{2}$, because there are two doors left.

Review the **Module 5 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Module 6**Critical Thinking (65 points)**

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1: Spam Filters

For this assignment, provide a full explanation of the problem, with each step clearly shown.

Suppose that a Bayesian spam filter is trained on a set of 500 spam message and 200 messages that are not spam. The word "exciting" appears in 40 spam messages and 25 messages that are not spam. Would an incoming message be rejected as spam if it contains the word "exciting" and the threshold for rejecting spam is 0.9?

Review the **Module 6 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Option #2: Successful Products

For this assignment, provide a full explanation of the problem, with each step clearly shown.

An electronics company is planning to introduce a new camera phone. The company commissions a marketing report for each new project that predicts either the success or the failure of the product. Of new products introduced by the company, 60% have been success. Furthermore, 70% of their successful products were predicted to be success, while 40% of failed products were predicted to be successes. Find the probability that this new camera phone will be successful if its success has been predicted.

Review the **Module 6 Critical Thinking Rubric** for full details on how you will be graded on this assignment.

Module 7**Critical Thinking (75 points)**

Choose one of the following two assignments to complete this week. Do not complete both assignments. Identify your assignment choice in the title of your submission.

Note that while there are two options for the Critical Thinking Assignment, there is only one rubric. Review the rubric to confirm you are meeting the assignment requirements.

Option #1

For this option, you will make a video. You will create a game that uses reflections. Create physical game boards/pieces/props and use these to demonstrate where relations come into play. You must discuss at least five non-trivial rotations/reflections/symmetries/etc. in your video that relate to your game.

Think about this week's learning outcomes for inspiration:

Learning Outcomes

1. Compare reflexive and symmetric relations.
2. Prove that a given relation is symmetric and transitive.
3. Explain the qualities of an irreflexive relation.
4. Solve problems using projection mappings.
5. Apply relations to real world situations.
6. Apply pedagogical principles and practices to teaching materials for course content.

Requirements:

1. Submit a .mp4 file or make a Youtube video and submitting the URL.
2. The video should be over 10 minutes in length.
3. Your instructor will be looking for your physical game creation within the video and a clear discussion of your rotations, etc.

Option #2:

Through research, find a famous mathematician who contributed to the field of relations. Write a biography on their personal life, their challenges, their successes, and several of their key findings in the area of relation theory. Then research and find a famous mathematician who contributed to the field of probability. Compare and contrast the lives of these two mathematicians. What was similar about their experiences? What was different? What made each successful in their respective fields?

Requirements:

1. Your written paper should be 4-6 pages in length, not counting the title and reference pages, which you must include.
2. You need to cite 4 – 6 sources. The [CSU-Global Library](#) is a great place to find resources.
3. You should have an introduction, which will tell the reader what your paper is about. You should have a conclusion paragraph, which will summarize your paper.
4. Your paper must be formatted according to [CSU-Global Guide to Writing and APA Requirements](#).
5. If you need assistance with your writing style, start with the links under the Research Help and Writing Help tabs on the [CSU-Global Library's](#) homepage.

Module 8

Final Exam (200 points)

Course Policies



Course Grading

20% Discussion Participation
0% Opening Exercises
40% Critical Thinking Assignments
40% Midterm and Final Exams

Grading Scale and Policies

A	95.0 – 100
A-	90.0 – 94.9
B+	86.7 – 89.9
B	83.3 – 86.6
B-	80.0 – 83.2
C+	75.0 – 79.9
C	70.0 – 74.9
D	60.0 – 69.9
F	59.9 or below

In-Classroom Policies

For information on late work and incomplete grade policies, please refer to our [In-Classroom Student Policies and Guidelines](#) or the Academic Catalog for comprehensive documentation of CSU-Global institutional policies.

Academic Integrity

Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /re-purposing your own work (see *CSU-Global Guide to Writing and APA Requirements* for percentage of repurposed work that can be used in an assignment), unauthorized possession of academic materials, and unauthorized collaboration. The CSU-Global Library provides information on how students can avoid plagiarism by understanding what it is and how to use the Library and Internet resources.

Citing Sources with APA Style

All students are expected to follow the *CSU-Global Guide to Writing and APA Requirements* when citing in APA (based on the APA Style Manual, 6th edition) for all assignments. For details on CSU-Global APA style, please

review the APA resources within the CSU-Global Library under the “APA Guide & Resources” link. A link to this document should also be provided within most assignment descriptions in your course.

Disability Services Statement

CSU–Global is committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Disability Resource Coordinator at 720-279-0650 and/or email ada@CSUGlobal.edu for additional information to coordinate reasonable accommodations for students with documented disabilities.

Netiquette

Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom.

If you have concerns about something that has been said, please let your instructor know.