



MAD 3107 Discrete Math

Spring 2020

CRN 10329

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Meeting time/Location: MWF - 10:30 pm - 11:20 pm – Merwin Hall 112

I. Course Number and Title:

MAD 3107 – Discrete Mathematics

II. Prerequisites for the Course:

MAC 2312 for level Undergraduate with minimum grade of C

III. General Course Information:

Introduction to concepts of discrete mathematics, as used by computer scientists. Topics include symbolic logic and Boolean algebra, propositional and predicate calculus, sets, functions, and relations, enumeration and counting principles, introduction to graphs, trees, spanning trees, shortest path and matching algorithms, finite state automata, Turing machines.

IV. Course Objectives

The student will understand and use the concepts in the following chapters:

1. Chapter 1

- 1.1. Formal Logic
 - 1.1.1. Inquiry Problems
 - 1.1.2. Connectives and Propositions
 - 1.1.3. Truth Tables
 - 1.1.4. Logical Equivalences
- 1.2. Propositional Logic
 - 1.2.1. Tautologies and Contradictions
 - 1.2.2. Derivation Rules
 - 1.2.3. Proof Sequences
 - 1.2.4. Forward-Backward
- 1.3. Predicate Logic
 - 1.3.1. Predicates
 - 1.3.2. Quantifiers
 - 1.3.3. Translation
 - 1.3.4. Negation
 - 1.3.5. Two Common Constructions
- 1.4. Logic in Mathematics
 - 1.4.1. The Role of Definitions in Mathematics
 - 1.4.2. Other Types of Mathematical Statements
 - 1.4.3. Counterexamples
 - 1.4.4. Axiomatic Systems
- 1.5. Methods of Proof
 - 1.5.1. Direct Proofs
 - 1.5.2. Proof by Contraposition

- 1.5.3. Proof by Contradiction
- 2. **Chapter 2**
 - 2.1. Graphs
 - 2.1.1. Edges and Vertices
 - 2.1.2. Terminology
 - 2.1.3. Modeling Relationships with Graphs
 - 2.2. Sets
 - 2.2.1. Membership and Containment
 - 2.2.2. New Sets from Old
 - 2.2.3. Identities
 - 2.3. Functions
 - 2.3.1. Definition and Examples
 - 2.3.2. One-to-One and Onto Functions
 - 2.3.3. New Functions from Old
 - 2.4. Relations and Equivalences
 - 2.4.1. Definition and Examples
 - 2.4.2. Graphs of Relations
 - 2.4.3. Relations vs. Functions
 - 2.4.4. Equivalence Relations
 - 2.4.5. Modular Arithmetic
 - 2.5. Partial Orderings
 - 2.5.1. Definition and Examples
 - 2.5.2. Hasse Diagrams
 - 2.5.3. Topological Sorting
 - 2.5.4. Isomorphisms
 - 2.5.5. Boolean Algebra
 - 2.6. Graph Theory
 - 2.6.1. Graphs: Formal Definitions
 - 2.6.2. Isomorphisms of Graphs
 - 2.6.3. Degree Counting
 - 2.6.4. Euler Paths and Circuits
 - 2.6.5. Hamilton Paths and Circuits
 - 2.6.6. Trees
 - 2.6.7. (a) ion
- 3. **Chapter 3 Recursive Thinking**
 - 3.1. Recursive Relations
 - 3.1.1. Give definitions and examples
 - 3.1.2. Understand the Fibonacci Sequence
 - 3.1.3. Model with Recurrence Relations
 - 3.2. Closed-Form Solutions and Induction
 - 3.2.1. Guess a Closed-Form Solution
 - 3.2.2. Use Differences in Polynomial Sequences
 - 3.2.3. Verify a Solution using Induction
 - 3.3. Recursive Definitions
 - 3.3.1. Provide the Definition and Examples of Recursive Definitions
 - 3.3.2. Write Recursive Definitions
 - 3.3.3. Use Recursive Geometry
 - 3.3.4. Give a Recursive Joke
 - 3.4. Proof by Induction
 - 3.4.1. Understand the Principle of Induction
 - 3.4.2. Give Examples of Induction
 - 3.4.3. Understand and Use Strong Induction
 - 3.4.4. Understand and Use Structural Induction
 - 3.5. Recursive Data Structures
 - 3.5.1. Understand and Use Lists

- 3.5.2. Understand and Compute the Efficiency of Lists
- 3.5.3. Re-exam Binary Search Trees
- 4. **Chapter 4 Quantitative Thinking**
 - 4.1. Basic Counting Techniques
 - 4.1.1. Addition
 - 4.1.2. Multiplication
 - 4.1.3. Mixing Addition and Multiplication
 - 4.2. Selections and Arrangements
 - 4.2.1. Permutations: The Arrangement Principle
 - 4.2.2. Combinations: The Selection Principle
 - 4.2.3. The Binomial Theorem
 - 4.3. Counting with Functions
 - 4.3.1. One-to-One Correspondence
 - 4.3.2. The Pigeonhole Principle
 - 4.3.3. The Generalized Pigeonhole Principle
 - 4.3.4. Ramsey Theory
 - 4.4. Discrete Probability
 - 4.4.1. Definitions and Examples
 - 4.4.2. Applications
 - 4.4.3. Expected Value
 - 4.5. Counting Operations in Algorithms
 - 4.5.1. Algorithms
 - 4.5.2. Pseudocode
 - 4.5.3. Sequences of Operations
 - 4.5.4. Loops
 - 4.5.5. Arrays
 - 4.5.6. Sorting
- 5. **Chapter 5 Analytical Thinking**
 - 5.1. Algorithms
 - 5.1.1. More Pseudocode
 - 5.1.2. Preconditions and Postconditions
 - 5.1.3. Iterative Algorithms
 - 5.1.4. Functions and Recursive Algorithms
 - 5.2. Three Common Types of Algorithms
 - 5.2.1. Traversal Algorithms
 - 5.2.2. Greedy Algorithms
 - 5.2.3. Divide-and-Conquer Algorithms
 - 5.3. Algorithm Complexity
 - 5.3.1. The Good, the Bad, and the Average
 - 5.3.2. Approximate Complexity Calculations
 - 5.4. Bounds on Complexity
 - 5.4.1. Algorithms as Decision
 - 5.4.2. A Lower Bound
 - 5.4.3. Searching an Array
 - 5.4.4. Sorting
 - 5.4.5. P vs. NP

V. Requirements for the Students:

The student should read all new topics before they are discussed in class and complete the homework assignments on time. The student is expected to spend between 6 and 9 hours per week on reading the text, reviewing and/or rewriting notes, solving problems - in general, STUDYING! Calculators and computers may be used to solve problems.

Students are strongly encouraged to participate in classroom discussions and to be prepared to demonstrate the solutions to assigned homework problems.

VI. **Assistance:**

Check the Math Tutoring Lab in LIB 122: <http://www.fgcu.edu/CAA/tutoring.html>
The Math Department offers tutoring in SH 126. Please check the website:
<http://www.fgcu.edu/CAS/Math/tutoring.html>.

VII. **Fragrances:**

In an effort to provide the most comfortable experience for all students and professors, I ask that students refrain from the use of scented fragrances during the course. Many people have strong reactions to scented products including perfumes and colognes. But please note that any scented laundry product – detergents, softeners and dryer sheets – can also cause severe reactions. Multiple Chemical Sensitivity (MCS) is one of the fastest growing conditions in the world. Many countries recognize this as a medical illness. The “fragrances” in these products can contain over 200 chemicals. There is NO regulation and NO requirement that companies divulge these chemicals to you.

VIII. **Absence Policy:**

Students are expected to attend all class periods. There are no “allowable cuts”. Students should recognize the very important sequential nature of this course, and that each absence tends to create a learning gap which can be very difficult to bridge. An absence in a three-credit course can have a disastrous effect on the student’s progress and understanding in the course.

IX. **Grading Procedure:**

A. *Grading Criteria:*

Chapter Exams (2@20%)	40%
WebAssign Homework	20%
Quizzes and Group Assignments in LaTeX	20%
Final Exam	20%

B. Percentage Ranges for Letter Grades

93	-	100	=	A
90	-	92	=	A-
87	-	89	=	B+
83	-	86	=	B
80	-	82	=	B-
77	-	79	=	C+
70	-	76	=	C
60	-	69	=	D
0	-	59	=	F

C. Incompletes (I):

Incompletes will be given only for extreme emergency conditions and must be approved by the professor before the final examination begins. The student must

be doing passing work at the time the request is made and must reasonably expect to complete the work within three weeks after the close of the semester.

D. Course Work:

All Group Homework assignments must be completed in LATEX and submitted on Canvas in *.pdf format, and in the *.tex file (with any accompanying *.png files). Group assignments must identify the member of the group responsible for each problem and the Lead Student who is submitting the assignment. A student who does not submit a problem on an assignment will receive a “0” for that assignment. All students will be responsible for all problems and all problems must be submitted. It will be considered a form of cheating to submit a problem with another student’s name. If a student misses submission on two group assignments, the student will be removed from the group.

E. Make-Up Exam:

Make-up exams will be **EXTREMELY DIFFICULT!** They are to be avoided whenever possible.

F. Special Needs:

Students with special needs must make them known to the professor at the beginning of the semester.

X. **Textbook Requirements:**

Required: WebAssign Access Code: includes ebook.

Optional: Essentials of Discrete Mathematics, 3rd edition, by David J. Hunter, Jones and Bartlett Learning.

XI. **University Policies:**

Approved 3-27-09 by Faculty Senate; Approved 4-30-09 by VPAA; Revised & Approved by Faculty Affairs Team 4-11-16, Faculty Senate Approved 4/15/16
Academic Behavior Standards and Academic Dishonesty (08/02/18)

All students are expected to demonstrate honesty in their academic pursuits. The university policies regarding issues of honesty can be found in the FGCU Student Guidebook under the Student Code of Conduct and Policies and Procedures sections. All students are expected to study this document which outlines their responsibilities and consequences for violations of the policy.

The FGCU Student Guidebook is available online at
<http://studentservices.fgcu.edu/judicialaffairs/new.html> .

University Nondiscrimination Statement (08/02/18)

Florida Gulf Coast University is committed to ensuring equity and fairness for all University employees, students, visitors, vendors, contractors and other third parties. As such, the University prohibits discrimination on the bases of race, color, national origin, ethnicity, religion, age, disability, sex (including sexual harassment/assault), gender identity/expression, marital status, sexual orientation, veteran status or genetic predisposition with regard to admissions, employment, programs or other activities operated by the University. This prohibition extends to enforcement of Title IX of the Education Amendments of 1972. Questions or complaints should be directed To the Office of Institutional Equity and Compliance (OIEC). The OIEC’s phone number is (239)745 - 4366; the OIEC email address is OIEC@fgcu.edu.

Disability Accommodations Services (08/02/18)

Florida Gulf Coast University, in accordance with the Americans with Disabilities Act and the university's guiding principles, will provide classroom and academic accommodations to students with documented disabilities. If you need to request an accommodation in this class due to a disability, or you suspect that your academic performance is affected by a disability, please see me or contact the Office of Adaptive Services. The Office of Adaptive Services is located in the Wellness Building. The phone number is 239-590-7956 or Video Phone (VP) 239-243-9453. In addition to classroom and campus accommodations, individuals with disabilities are encouraged to create their personal emergency evacuation plan and FGCU is committed to providing information on emergency notification procedures. You can find information on the emergency exits and Areas of Rescue Assistance for each building, as well as other emergency preparedness materials on the Environmental Health and Safety and University Police Department websites. If you will need assistance in the event of an emergency due to a disability, please contact Adaptive Services for available services and information.

Student Observance of Religious Holidays (08/02/18)

All students at Florida Gulf Coast University have a right to expect that the University will reasonably accommodate their religious observances, practices, and beliefs. Students, upon prior notification to their instructors, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith. Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence. Students shall not be penalized due to absence from class or other scheduled academic activity because of religious observances. Where practicable, major examinations, major assignments, and University ceremonies will not be scheduled on a major religious holy day. A student who is to be excused from class for a religious observance is not required to provide a second party certification of the reason for the absence.

General Counsel Policies can be found at: <http://www.fgcu.edu/generalcounsel/policies-view.asp>

Counseling and Psychological Services (CAPS) provides free counseling and therapy services (including psychiatry) to all FGCU students. Please walk in to the second floor Howard Hall office any week day between 8:30 and 4:30 to schedule an initial contact appointment. Visit the CAPS website at www.fgcu.edu/caps for more information. CAPS offers a 24/7 Helpline at (239) 745-3277 (EARS).

SCHEDULE¹

1	1/06	Chapter 1.1 – Formal Logic 1.1.1 – Inquiry Problems 1.1.2 – Connectives and Propositions 1.1.3 – Truth Tables	
	1/08	1.1.4 – Logical Equivalences Chapter 1.2 – Propositional Logic 1.2.1 – Tautologies and Contradictions 1.2.2 – Derivation Rules	
	1/10	1.2.3 – Proof Sequences 1.2.4 – Forward-Backward	
2	1/13	Chapter 1.3 – Predicate Logic 1.3.1 – Predicates 1.3.2 – Quantifiers	
	1/15	1.3.3 – Translation 1.3.4 – Negation 1.3.5 – Two Common Constructions	
	1/17	Chapter 1.4 – Logic in Mathematics 1.4.1 – The Role of Definitions in Mathematics 1.4.2 – Other Types of Mathematical Statements	
3	1/20	MLK Day – No Classes	
	1/22	1.4.3 – Counterexamples 1.4.4 – Axiomatic Systems	
	1/24	Chapter 1.5 – Methods of Proof 1.5.1 – Direct Proofs 1.5.2 – Proof by Contraposition	
4	1/27	1.5.3 – Proof by Contradiction Chapter 2.1 – Graphs 2.1.1 – Edges and Vertices 2.1.2 – Terminology	
	1/29	2.1.3 – Modeling Relationships Chapter 2.2 – Sets 2.2.1 – Membership and Containment 2.2.2 – New Sets from Old	
	1/31	2.2.3 – Identities Chapter 2.3 – Functions 2.3.1 – Definition and Examples 2.3.2 – One-to-One and Onto Functions	
5	2/3	2.3.3 – New Functions from Old Chapter 2.4 – Relations and Equivalences 2.4.1 – Definition and Examples 2.4.2 – Graphs of Relations	
	2/5	2.4.3 – Relations vs. Functions 2.4.4 – Equivalence Relations	
	2/7	2.4.5 – Modular Arithmetic Chapter 2.5 – Partial Orderings 2.5.1 – Definition and Examples 2.5.2 – Hasse Diagrams	

¹ Subject to change

6	2/10	2.5.3 – Topological Sorting 2.5.4 – Isomorphisms 2.5.5 – Boolean Algebras	
	2/12	Review	
	2/14	Test 1	
7	2/17	Chapter 2.6 – Graph Theory 2.6.1 – Graphs: Formal Definitions 2.6.2 – Isomorphisms of Graphs	
	2/19	2.6.3 – Degree Counting 2.6.4 – Euler Paths and Circuits	
	2/21	2.6.5 – Hamiltonian Paths and Circuits 2.6.6 - Trees	
8	2/24	Chapter 3.1 – Recurrence Relations 3.1.1 – Definition and Examples 3.1.2 – The Fibonacci Sequence 3.1.3 – Modeling with Recurrence Relations	
	2/26	Chapter 3.2 – Closed-Form Solutions and Induction 3.2.1 – Guessing a Closed-Form Solution 3.2.2 – Polynomial Sequences: Using Differences	
	2/28	3.2.3 – Inductively verifying a Solution Chapter 3.3 – Recursive Definitions 3.3.1 – Definition and Examples 3.3.2 – Writing recursive Definitions	
	3/2 – 3/7	Spring Break	
9	3/9	3.3.3 – Recursive Geometry 3.3.4 – Recursive Jokes	
	3/11	Chapter 3.4 – Proof by Induction 3.4.1 – The Principle of Induction 3.4.2 – Examples	
	3/13	3.4.3 – Strong Induction 3.4.4 – Structural Induction	
10	3/16	Chapter 3.5 – Recursive Data Structures 3.5.1 – Lists 3.5.2 – Efficiency 3.5.3 – Binary Search Trees Revisited	
	3/18	Chapter 4.1 – Basic Counting Techniques 4.1.1 – Addition 4.1.2 – Multiplication 4.1.3 – Mixing Addition and Multiplication	
	3/20	Chapter 4.2 – Selections and Arrangements 4.2.1 – Permutations: The Arrangement Principle 4.2.2 – Combinations: The Selection Principle 4.2.3 – The Binomial Theorem	
11	3/23	Chapter 4.3 – Counting with Functions 4.3.1 – One-to-One Correspondences 4.3.2 – The Pigeonhole Principle	
	3/25	4.3.3 – The Generalized Pigeonhole Principle 4.3.4 – Ramsey Theory	

	3/27	Chapter 4.4 – Discrete Probability 4.4.1 – Definitions and Examples 4.4.2 – Applications 4.4.3 – Expected Value	
12	3/30	Review	
	4/01	Test 2	
	4/03	Chapter 4.5 – Counting Operations in Algorithms 4.5.1 – Algorithms 4.5.2 – Pseudocode	
13	4/06	4.5.3 – Sequences of Operations 4.5.4 – Loops	
	4/08	4.5.5 – Arrays 4.5.6 - Sorting	
	4/10	Chapter 5.1 – Algorithms 5.5.1 – More Pseudocode 5.5.2 – Preconditions and Postconditions	
14	4/13	5.5.3 – Iterative Algorithms 5.5.4 – Functions and Recursive Algorithms	
	4/15	Chapter 5.2 – Three Common Types of Algorithms 5.2.1 – Traversal Algorithms 5.2.2 – Greedy Algorithms 5.2.3 – Dived-and-Conquer Algorithms	
	4/17	Chapter 5.3 – Algorithm Complexity 5.3.1 – The Good, the Bad, and the Average 5.3.2 – Approximate Complexity Calculations	
15	4/20	Chapter 5.4 – Bounds on Complexity 5.4.1 – Algorithms as Decisions 5.4.2 – A Lower Bound	
	4/22	5.4.3 – Searching an Array 5.4.4 – Sorting 5.4.5 – P vs. NP	
	4/24	Review	
	4/27	Review	
	4/29	Final Exam 12:30 – 2:45	

Student Quick Start Guide WebAssign in Canvas™



If enabled, you can access WebAssign from Canvas™ to complete coursework.

ACCESS WEBASSIGN FROM CANVAS

If enabled, you can sign in to WebAssign directly from your Canvas class.

NOTE:

- You can't sign in to Canvas from WebAssign.
- Ask your instructor if you are not sure whether your course uses Canvas and WebAssign.

1. Sign in to Canvas and navigate to your class.
2. To access WebAssign from your Canvas course, either:
 - If you see a list of assignments, click an assignment to open it in WebAssign.
 - If no assignments are listed, click the WebAssign tool.

PURCHASE ACCESS

WebAssign gives you free access for two weeks after the start of class. To continue using WebAssign after that, either enter an access code or purchase access online.

NOTE: An access code included with some textbooks verifies that you have already purchased WebAssign access.

I have an access code

1. Verify your access code at webassign.net/user_support/student/cards.html.
2. Sign in to WebAssign.
3. Click **Verify Payment**.
4. Enter your access code and click **Redeem**.

I do not have an access code

1. Sign in to WebAssign.
2. Click **Verify Payment**.
3. Select the items you want to purchase and click **Continue**.
4. Review the items in your cart and click **Start Secure Checkout**.
5. Enter your billing contact information and click **Continue**.
6. Select your payment method and enter your payment information.

NOTE:

- If you need to contact Customer Support regarding this transaction, provide the transaction ID from your receipt.
- If you drop a class, you can request a refund within 14 days of the purchase date.

LEARN

Your current assignments are listed on the **Home** page for each class.

1. Click the assignment name.
2. Answer the assignment questions.
WebAssign supports many different question types. Some questions display a tools palette or open in a new window.
3. Submit your answers.
4. Review your marks and feedback.
Usually you will see ✓ or ✗ for each answer.
5. Change your incorrect answers and submit again.
6. When you are done, always click **sign out**.

TROUBLESHOOTING

To access this assignment, open it first from your learning management system

RESOLUTION

Open the assignment first from Canvas.

If doing so shows the same message again, notify your instructor.

A specific error in setting up the integration between WebAssign and Canvas can cause this problem. Your instructor can fix this by following instructions in the instructor help.

Scores Synced to Canvas Are Incorrect

When using an advanced LMS integration, WebAssign assignment scores greater than 100% or less than 0% are synced to Canvas as 100% or 0%, respectively.

The Learning Tools Interoperability (LTI) specification requires this behavior.

SYSTEM REQUIREMENTS

WebAssign is tested and supported for the following web browsers:

Mozilla® Firefox® (38+)
Windows®, macOS®, Linux®
Internet Explorer® /
Microsoft® Edge (11+)
Windows
Google® Chrome™ (44+)
Windows, macOS
Apple® Safari® (8+)
macOS, iOS 8 or later on iPad®

BROWSER SETTINGS

Configure the following settings in your Web browser.

- Allow cookies and pop-up windows from webassign.net.
- Accept third-party cookies when accessing WebAssign from Blackboard®.
- Do not allow your browser to store your password.
- Enable Adobe® Flash® Player.

CUSTOMER SUPPORT

ONLINE: webassign.com/support/student-support
CALL: 800.354.9706

The Customer Support staff can **NOT**:

- change your username or password
- give extensions
- change your score
- give you extra submissions
- help you with the content of assignments

Contact your instructor for help with your grade or coursework.

MORE INFORMATION

Search the online help for answers to most questions:
webassign.net/manual/student_guide/

Sources for Latex (You need a compiler, MacTeX for macs : <https://www.tug.org/mactex/>, MikTeX for Windows <https://miktex.org/> , and an editor – I use TexMaker which is available for both mac and windows.

LaTeX Users Group: <https://www.latex-project.org/get/>

Best LaTeX Editors: <https://beebom.com/best-latex-editors/>

TEXMaker: <http://www.xmlmath.net/texmaker/>

Windows: <https://listoffreeware.com/list-of-best-free-latex-editors-for-windows/>
<http://www.texniccenter.org/>

Online Editors:

Overleaf: <https://www.overleaf.com/>

Wikipedia Comparison of TeX editors:

https://en.wikipedia.org/wiki/Comparison_of_TeX_editors

List of editors

- [Archimedes](#)
- [Atom](#)
- [Auto Latex Equations for Google Docs](#)
- [Bakoma TeX Word](#)
- [Compositor](#)
- [Emacs with AUCTeX](#)
- [Emacs with WhizzyTeX](#)
- [gedit with the gedit-LaTeX-plugin](#)
- [Geany with GeanyLaTeX](#)
- [gummi](#)
- [Inlage](#)
- [IntelliJ IDEA](#)
- [jEdit](#)
- [JOVE](#)
- [Kile](#)
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- [LaTeX Base](#)
- [LEd](#)
- [LyX](#)
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- [Overleaf](#)
- [Open LaTeX Studio](#)
- [Papeeria](#)
- [QuatraTeX](#)
- [RTextDoc](#)
- [DMelt](#)
- [Scientific Word](#)
- [Scientific Workplace](#)
- [Scribo](#)
- [Sublime Text with LaTeXTools or LaTeXing Plugin](#)
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- [TeXworks](#)
- [Verbosus](#)
- [Vim with LaTeX-Box](#)
- [Vim with LaTeX-plugin](#)
- [Vim with Snipmate plugin and rubber](#)
- [Vim with vimtex](#)
- [Visual Studio Code with LaTeX-Workshop](#)
- [WinEdt](#)
- [Winefish](#)
- [WinShell](#)