

Quinsigamond Community College School of Math, Science, & Engineering

Instructor's Information

Instructor: Professor XX (she/her/hers)
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Course Information

Course: MAT 125 Discrete Mathematics – Section XX
Meets: Mondays and Wednesdays from 11:00am – 12:15pm
Room: 177A
Credits: 3 credits
Semester: Fall 2024

Course Description

This course provides an introduction to the basic concepts in Discrete Mathematics. Topics include predicate and propositional calculus, sets, proof techniques, permutations and combinations, probability, relations, closure, partial order, functions, graph connectivity and shortest paths, and an introduction to languages, grammars and nondeterministic finite-state machines.

Prerequisites

MAT 123 Pre-Calculus or appropriate placement score

Required Textbook/Materials/Website

Textbook: *Discrete Math and Its Applications*, by Rosen, 8th edition, McGraw-Hill © 2019
Materials: Graphing calculator (recommended)
Website: Required access to connect.mheducation.com

Student Learning Outcomes

Upon completion of this course, students will be able to:

1. Apply properties of relations, functions, and sequences to solve problems with discrete structures.
2. Verify the correctness of an argument using propositional logic, predicate logic, and truth tables.
3. Construct mathematical proofs.
4. Apply counting techniques to determine discrete probability.
5. Model relationships using graphs and paths.
6. Set up and solve applied problems.

Course Topics & Required Section Readings/Assignments

The Foundations: Logic and Proofs

- Basic Operations, Propositions, Truth Tables
- Tautology
- Predicates, Quantifiers
- Inference
- Direct Proofs, Proof by Contradiction

Basic Structures: Sets, Functions, Sequences, Sums, and Matrices

- Basic Operations with Sets, Cardinality, Subsets and Power Sets, Cartesian Products
- Disjoint Sets, Set Equality
- Function Definitions, Total Functions, One-to-One, Onto

Induction and Recursion

- Mathematical Induction
- Recursive Definitions

Counting

- Basics of Counting, Pigeonhole Principle
- Permutations and Combinations

Discrete Probability

- Union and Intersection
- Basic Concepts (Events, Disjoint, and Independent)
- Conditional Probabilities
- Bayes' Theorem

Relations

- Properties of Relations
- Representation of Relations
- Closure
- Equivalence Relations, Partition of a Set
- Partial Orders

Graphs

- Introduction to Graphs
- Graph Terminology
- Connectivity
- Euler and Hamilton Paths
- Shortest Paths
- Coloring

Boolean Algebra

- Introduction to Languages and Grammars
- Introduction to Nondeterministic Finite State Machines
- Language Recognition
- Turing Machines

Instructional Objectives

- Use inductive and deductive reasoning.

- Apply formal methods of symbolic, propositional and predicate logic.
- Describe how formal tools of symbolic logic are used to model real-life situations.
- Use formal logic proofs and logical reasoning to solve problems such as puzzles.
- Describe the importance and limitations of predicate logic.
- Outline the basic structure and give examples of direct proofs, proofs by contradiction and proofs using mathematical induction.
- Discuss which type of proof is best for a given problem.
- Relate ideas of mathematical induction to recursion.
- Explain, with examples, the basic terminology of functions, relations and sets.
- Perform the operations associated with sets, functions and relations.
- Demonstrate basic counting principles, including the use of the pigeonhole principle.
- Compute permutations and combinations of a set and interpret the meaning in the context of a particular situation.
- Calculate the probabilities of events and expectations of random variables for elementary problems such as games of chance.
- Differentiate between dependent and independent events.
- Apply Bayes' Theorem to dependent events.
- Illustrate, by example, the basic terminology of graph theory.
- Demonstrate different traversal methods for graphs.
- Model problems in computer science using graphs.
- Introduce applications of graph coloring.
- Demonstrate how grammars are used to generate the words of a language.
- Explain the relationship between finite-state machines and grammars.
- Demonstrate how Turing machines can be used to recognize sets.

Grading Breakdown

20%	Homework
10%	Quizzes
10%	<Attendance or Project & Presentation>
35%	Exams
25%	Comprehensive Final Exam

Grade	Range	Grade	Range	Grade	Range
A	95 – 100	B –	80 – 82	D +	67 – 69
A –	90 – 94	C +	77 – 79	D	63 – 66
B +	87 – 89	C	73 – 76	D –	60 – 62
B	83 – 86	C –	70 – 72	F	0 – 59

Teaching Procedures

Most classes will be a combination of lectures, group activities, and in-class assignments. You will be given homework assignments to be completed outside of class. Occasionally, a quiz or exam will be given in class.

Attendance Policy

Students are expected to attend all classes for the entire period. Attendance will be taken in every class. If you are absent from class, proper documentation will excuse your absence.

Diversity, Equity, and Inclusion Statement for the School of Math & Science

The School of Math and Science is motivated to teach and learn from the diverse community we have at QCC. In Science, Technology, Engineering, and Mathematics (STEM), it is advantageous to approach problems from multiple perspectives. The power of diversity, equity and inclusion allows us to persevere and overcome challenges.

The faculty of the School of Math and Science pledge to help students meet the demands of STEM regardless of race/ethnicity, gender identity and expression, sexual orientation, faith, abilities/disabilities, age, socioeconomic background, political leaning, ancestry, national origin, home language and all other identities. We are dedicated to nurturing a culture of collaboration, mutual respect and understanding; and to empowering members of our community to embrace their full potential.

Accessibility Statement

Quinsigamond Community College is committed to providing access and inclusion for all persons with disabilities. Students who require an accommodation in this course should notify the professor as soon as possible. Students are responsible for forwarding the Accommodation Letter to the professor (via email or hard copy). Students may request accommodations at any time during the semester, which begin upon receipt (accommodations are not retroactive). Please discuss any barriers which may arise during the semester with your professor or coordinator in the Student Accessibility Services office.

Contact Information for Student Accessibility Services (SAS):

Call: 508-854-4471

Sorenson Video Phone: 508-502-7647

Email: disabilityservices@qcc.mass.edu

Services for Veterans

If you are a veteran of the US Armed Forces, please visit the Veteran Affairs Office located in 258A (Administration Building) or contact them at veteranaffairs@qcc.mass.edu.

Academic Honesty and Plagiarism

Our purpose of education is to seek the truth; this work requires trust and honesty between teacher and student. If we are not honest about what we know and don't know, our learning will always be impaired. Because our teaching and learning depends on this honest communication, we expect all students to understand what plagiarism is and why it is unacceptable.

Plagiarism means taking someone else's ideas or words and presenting them as one's own. The offense can take many forms including cheating on a test, passing in a paper taken from the Internet or from another student, or failing to properly use and credit sources in an essay. Sometimes the issue is subtle, involving getting too much help on an assignment from someone else. In every instance,

plagiarism means cheating both oneself and the owner of the source. Since cheating sabotages a student's learning experience, consequences range from no credit for the assignment to failure for the course and possible expulsion from the college.

The penalty for getting caught cheating in this course is a failure of the quiz or test, or failure of the entire course. This is solely at the discretion of the instructor.

For further information concerning plagiarism, refer to the QCC Student Handbook.

Math Center & QCC Math YouTube Channel

The Math Center provides free, drop-in tutoring assistance for students in any QCC mathematics course. Located on the second floor of the Harrington Learning Center (HLC), the Math Center is a welcoming place where students have the opportunity to work collaboratively with tutors and classmates. Students can work intensively to improve their mathematical skills or simply drop by to ask a few questions. In addition to tutoring, the Math Center houses various math-related resources, and computers and software for math coursework. Visit their website for details and the semester schedule: <https://www.qcc.edu/services/tutoring/math-center>

Assignment & Test Schedule

<list all assignments, quizzes, and exam dates>