University of Massachusetts Global A private nonprofit affiliate

Course Number, Title and Credits

CSCU 240 - Discrete Structures - 4 credits

Course Description

This course is designed for students in math or computer science. Logic is emphasized, and topics include: proof and theory including inductive proofs, propositional and predicate logic, set theory, algorithms including recursion, trees, relations and functions, counting & probability. Elements of the theory of directed and undirected graphs, and the application of these topics to various areas of math and computer science. Additionally, an introduction to complexity of algorithms and recurrence relations are included in the curriculum.

Prerequisite: MATU 101 College Algebra or MATU 104 Pre-Calculus Mathematics I

Course Learning Outcomes

By the end of this course, students should be able to:

1. Demonstrate proficiency in propositional/predicate logic and mathematical proof techniques.
2. Analyze discrete structures such as sets, functions, relations, and graphs to model and solve computational problems in computer science.
3. Apply combinatorial principles and algebraic concepts to evaluate algorithmic efficiency and real-world scenarios.
4. Design solutions for optimization and graph-based problems using trees, matching algorithms, and finite state machines.
5. Evaluate algorithmic complexity through recurrence relations and generating functions, demonstrating awareness of computational limitations.

Required Textbooks

Susanna S. Epp, Discrete Mathematics with Applications, 5ed, ISBN: 9781337694193

Letter Grade/Percentage Equivalents

Grades are determined on a straight-scale basis using the following scales.

A	94%-100%	A-	90%-93%	B+	87%-89%
B	84%-86%	B-	80%-83%	C+	77%-79%
C	74%-76%	C-	70%-73%	D+	67%-69%
D	64%-66%	D-	60% - 63%	F	59% and below

Methods of Evaluation for Determining Grades

Assignment Detail for Course:

Assignments	**Possible Points**
Final Exam	280
Midterm Exam	200
Homework Assignments (20 total)	200
Module Quizzes (8 total)	320
Total Points Possible in Course	**1000**

Course Outline (Tentative):

Module	**Topics&Assignments**
Module 1	Logic and Logical Reasoning Students will be able to analyze mathematical statements using logical connectives, truth tables, predicates, and quantifiers, and determine logical equivalence and validity. ● Propositional logic and logical equivalence Predicates and quantifiers (Text Sections: 2.1, 2.2, 3.1, 3.2) ● Homework 1&2 ● Quiz 1

Module 2	**Proof Techniques and Induction** Students will be able to construct clear and rigorous mathematical proofs using standard proof techniques, including direct proof, contradiction, contrapositive, and mathematical induction. ● Methods of proof Properties of the integers Mathematical induction (weak and strong) (Text Sections: 4.1, 4.3, 5.2) ● Homework 3&4 ● Quiz 2
Module 3	**Recursion and Recurrence Relations** Students will be able to define recursive processes and analyze and solve recurrence relations arising in discrete models. ● Recursive definitions Recurrence relations Applications to counting and algorithms (Text Sections: 5.6) ● Homework 5 ● Quiz 3
Module 4	**Sets, Functions, and Discrete Structures** Students will be able to apply set theory and function concepts to model relationships among discrete objects. ● Set theory and set operations Cartesian products Functions and function notation One-to-one and onto functions (Text Sections: 6.1, 7.1, 7.2) ● Homework 6-8 ● Quiz 4
Module 5	**Relations and Modular Arithmetic** Students will be able to analyze relations, equivalence classes, partial orders, and perform computations using modular arithmetic. ● Relations and their properties Equivalence relations and partial orders Modular arithmetic and introductory rings (Text Sections: 8.1, 8.2, 8.3, 8.4) ● Homework 9-11 ● Quiz 5 ● Midterm Exam

Module 6	**Counting Techniques** Students will be able to solve counting problems using fundamental counting principles, permutations, combinations, and the principle of inclusion and exclusion. ● Fundamental principles of counting Permutations and combinations Principle of inclusion and exclusion (Text Sections: 9.1, 9.2, 9.3) ● Homework 12-14 ● Quiz 6
Module 7	**Graph Theory and Trees** Students will be able to model and analyze problems using graphs and trees, including connectivity and hierarchical structures. ● Graph terminology and representations Paths, cycles, and connectivity Trees and spanning trees (Text Sections: 10.1, 10.2, 10.4, 10.5) ● Homework15-18 ● Quiz 7
Module 8	**Optimization, Logic Systems, and Computation** Students will be able to apply discrete mathematics concepts to optimization, Boolean logic, and finite state machines. ● Optimization and matching Boolean algebra and switching functions Languages and finite state machines Generating functions (Text Sections: 10.6, 6.4, 12.1, 12.2) ● Homework19-20 ● Final Exam

Academic Integrity

The University of Massachusetts Global is an academic community based on the principles of honesty, trust, fairness, respect and responsibility. Academic integrity is a core University value, which ensures respect for the academic reputation of the University, its students, faculty and staff, and the degrees it confers. The University expects that students will conduct themselves in an honest and ethical manner and respect the intellectual work of others.

Submitting to faculty work completed by the use of any artificial intelligence tool without permission and/or when prohibited by class policy. When faculty require the use of technology, including artificial intelligence,

as a part of an assignment for the course, there is no violation. Students are reminded to consult syllabi, assignment sheets/rubrics, program documents and their faculty. Use of artificial intelligence, when permitted, must be correctly cited in the assignment.

The UMass Global online library provides resources to support research, proper citation styles, and the safe and responsible use of generative artificial intelligence or Gen AI.

- The Academic Integrity and Plagiarism Avoidance page provides guidance to help students better understand academic integrity and includes tips on how to avoid plagiarism.
- The Citing Sources page offers guidance on how to properly cite using APA, MLA, and Chicago styles.
- The Artificial Intelligence Resource Guide for Students provides advice for understanding and appropriately using generative artificial intelligence tools such as ChatGPT and Bard.

UMass Global's Office of Accessible Education

Students who require disability-related services or accommodations to access their educational experience can register with the Office of Accessible Education (OAE). The Office of Accessible Education (OAE) is committed to ensuring equal educational access and opportunity for all members of our academic community. Students will be provided equitable and reasonable accommodations and services that are in compliance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 (ADA)/Americans with Disabilities Act Amendments Act of 2008 (ADAA). Registration with OAE is on a voluntary, self-identifying basis. Please visit the Office of Accessible Education (OAE) website for more information about how to register for services, eligibility requirements, and information about potential academic accommodations and services.

Our university is committed to ensuring equal access for all students. Let us know about any accessibility barriers you encounter using any of our online systems or websites by submitting a Feedback or Accessibility Concern Submission Form. We'll do our best to improve things and get you the information you need.

UMass Global’s CARES Team

The CARES team is a campus-wide team of appointed staff and faculty responsible for identifying, assessing, and responding to concerns and/or disruptive behaviors by students, faculty/staff, and community members who struggle academically, emotionally, or psychologically, or who present a risk to the health or safety of the university or its members.

Individuals may refer themselves or other community members of concern by emailing cares@umassglobal.edu or by filling out a referral form here. The CARES Team provides short term assessment, intervention, support, and recommendations of resources to those referred and engaged in the process.

UMass Global's Title IX Statement

The University of Massachusetts Global strives to maintain and foster a climate that promotes respect and human dignity. Sexual misconduct and relationship violence in any form is antithetical to the university's mission and core values, violates university policies, and may also violate federal and state law. The office of Title IX is primarily concerned for students' safety and well-being and is tasked with investigating all reports of sexual misconduct experienced by our community members. Title IX prohibits sex-based and gender-based discrimination and harassment, which includes discrimination based on pregnancy and/or pregnancy-related complications, parental status, and marital status. Students expecting or experiencing pregnancy-related complications, that may require educational accommodations, should contact the University's Title IX Coordinator and/or the Office of Accessible Education.

The University and Title IX's prohibition of sex discrimination also covers sexual harassment, sexual violence, and any other form of sexual misconduct. We offer options and resources to all students affected by these issues and are committed to providing a fair, thorough, and prompt investigation and adjudication process. If you or someone you know has been impacted by sexual assault, dating, and domestic violence, stalking, or sexual exploitation, please visit the University's Title IX Resource Page to access additional resources and information.

UMass Global's staff and faculty are tasked with reporting any possible sex or gender-based discrimination or Title IX violations to the University's Title IX Coordinator at civilrightscomplaints@umassglobal.edu.

Click on this Link to our University Title IX Policy