Boston University Metropolitan College

DISCRETE MATHEMATICS

MET CS24 A1/EX

Learn from Anywhere Course Format, Offered Simultaneously On Campus and Remote

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Wednesdays 6 pm to 7 pm or by appointment

Course Description:

Fundamentals of logic (the laws of logic, rules of inferences, quantifiers, proofs of theorems), Fundamental principles of counting (permutations, combinations), set theory, relations and functions, graphs, trees and sorting, shortest path and minimal spanning trees algorithms. Monoids and Groups.

Course Objectives

- Provide a survey of Discrete Mathematics, the study of finite systems, needed in computer science.
- Further develop the mathematical concepts and technique which should serve as a preparation for more advanced quantitative courses.

Prerequisites

- High school algebra
- One introductory computer science course (recommended).

Textbook

- Recommended not Required - "Mathematical Structure for Computer Science", Judith L. Gersting, W. H. Freeman & Company. *(Any edition).* Available at Barnes & Noble or on-line
- Any old or new discrete math textbook will also do the job.

Courseware:

All course materials for this class and information about the instructor can be found on: *Blackboard*

Fall 2020 COVID-19 Policies

Classroom Rotations: [*for courses with rooms that cannot accommodate the all students wanting to meet in-person*] Classrooms on campus have new capacities that follow guidelines issued by state and local health and government authorities related to COVID-19 and physical distancing. Before the beginning of the class, and throughout the semester, I will be reaching out to students who have indicated that they want to attend the classroom in-person. Our classroom hold [] students, and therefore we will have [two] rotations of students that come to class on campus alternate weeks. You will be asked to attend remotely on the week that you have rotated out the classroom.

Compliance: All students returning to campus will be required, through a digital agreement, to commit to a set of Health Commitments and Expectations including face coverings, symptom attestation, testing, contact tracing, quarantine, and isolation. The agreement makes clear that compliance is a condition of being a member of our on-campus community.

You have a critical role to play in minimizing transmission of COVID-19 within the University community, so the University is requiring that you make your own health and safety commitments. Additionally, if you will be attending this class in person, you will be asked to show your Healthway badge on your mobile device to the instructor in the classroom prior to starting class, and wear your face mask over your mouth and nose at all times. If you do not comply with these rules you will be asked to leave the classroom. If you refuse to leave the class, the instructor will inform the class that they will not proceed with instruction until you leave the room. If you still refuse to leave the room, the instructor will dismiss the class and will contact the academic Dean's office for follow up.

Boston University is committed to offering the best learning environment for you, but to succeed, we need your help. We all must be responsible and respectful. If you do not want to follow these guidelines, you must participate in class remotely, so that you do not put your classmates or others at undue risk. We are counting on all members of our community to be courteous and collegial, whether they are with classmates and colleagues on campus, in the classroom, or engaging with us remotely, as we work together this fall semester.

Class Policies

1) **Attendance & Absences** – Students are expected to attend and sit through the entire class meetings. In case of an absence, the student is responsible to arrange for notes and missed announcements. Three (3) or more absences may result in a withdrawal from the class.

2) **Assignment Completion & Late Work** – Late assignment submission is not allowed, unless a permission is granted by the instructor prior to the deadline. Students should submit a physical to the instructor by the due date. If the student is to be absent that day, completed assignments should be submitted via email before class begins.

3) **Academic Conduct Code** – Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Conduct Code:

   http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code.html.

   NOTE: [This should not be understood as a discouragement for discussing the material or your particular approach to a problem with other students in the class. On the contrary – you should share your thoughts, questions and solutions. Naturally, if you choose to work in a group, you will be expected to come up with more than one and highly original solutions rather than the same mistakes.]

Grading Criteria

- Midterm 35% - Thursday, October 22nd.
- Final 35% - Thursday, December 17th.
- Assignments 30% - Due dates detailed on Blackboard

Class Meetings, Lectures & Assignments

Lectures, Readings, and Assignments subject to change, and will be announced in class as applicable within a reasonable time frame.

WEEK	TOPIC	DESCRIPTION
1-2	Logic	I. Statements and logical connectives; truth tables. II. Predicates logic and Quantifiers III. Proof techniques, the nature of mathematical theorems and proofs; direct proof, proof by contraposition, by contradiction; use of counterexamples; the principle of mathematical induction
2-3	Sets	I. The notation of set theory - Subsets and the power set; binary and unary operations on a set; set operations of union, intersection, complementation, difference, and Cartesian product II. Demonstration of the denumerability of some sets and the use of Cantor diagonalization method to prove the uncountability; partition of a set
4-5	Relations & Functions	I. Binary relations as ordered pairs and verbal description; the reflexive, symmetric, transitive and antisymmetric properties of binary relations; the definition and terminology about partial orderings; graphs of partially ordered finite sets; the definition of equivalence relation and equivalence class II. Functions; definition and examples; properties of functions one-t-one, onto, bijective; function composition, inverse function
6	Combinatorics	I. Counting; fundamental counting principles, including the multiplication and addition principles II. Sampling and selecting III. Permutations and combinations; formulas for counting the number of permutations and combinations of k-objects from n distinct objects
8	*Midterm Examination*	

7-9	Graphs	I. Graph terminology; undirected graphs, simple, complete, path, cycle, adjacency matrix, connectivity; Euler's path and Hamiltonian circuit; graph representation, trees II. Digraphs and connectivity problems - Reachability matrix analysis; Warshall's algorithm
10 - 11	Boolean Algebra & Computer Logic	I. Discussion and Definition; similarities between propositional logic and set theory; mathematical structures as models or abstractions incorporating common properties found in different contexts II. Logic circuits; basic logic elements of AND gate, OR gate and inverter; representation of a Boolean expression as a combinational network and vice versa; procedure to find a canonical sum-of-product Boolean expressions using Karnaugh map or Boolean algebra properties
11 - 12	Algebraic Structures	I. Definition of binary operation and structure; discussion of the associative, commutative, identity and inverse properties; definition of semigroup, monoid, and a substructure II. Group structure; elementary group theorems, uniqueness of identity and inverse; cancellation laws; definition and properties of a subgroup; application to error correcting codes
13	Finite State Machines	I. Definition of FSM; state tables and state graphs II. FSM as transducers and recognizers III. Discussion of limitations of FSMs; introduction to formal languages
14	Final Examination	