Boston University Metropolitan College

DISCRETE MATHEMATICS

MET CS248 A1

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

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Office hours: Before and after class

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 techniques 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 College-level discrete math textbook should be good enough.

Courseware:

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

Classroom Rotations: Classes will run face to face. Occasionally, you will be asked to attend class remotely. All lectures will be recorded whenever possible and made available to students on Blackboard.

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 for arranging 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 allowed with a 25% penalty. Once solutions are posted no submission is accepted.

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 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, March 20th - (Tentative)
- Final 35% - Last day of the term – Thursday, May 8th.
- 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	