CS 241: Foundations of Computer Science 1

A.K.A. Discrete Mathematics with Applications in Computer Science

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Course Description: This course provides an introduction into Discrete Mathematics and how it applies to the field of Computer Science. By taking this course a student should have a clear understanding about how the topics covered provide a foundation on how they should think when tackling various Computer Science problems they encounter further down their career. By the end of the summer student should be comfortable writing a formal mathematical proof using techniques learned in class.

Course Prerequisites:

1. CS 114: Intro to Computer Science (aka Data Structures 1)
    a. Basic understanding of past algorithms and problems (sorting, searching, trees, etc.) to view applications
2. MATH 112: Calculus II
    a. Basic algebra and knowledge of common functions (example that x^2 is always non-negative) required for first few sections on proofs. Limits and derivatives used in some derivations/problems. Mathematical and logical thinking required

"Textbook": Eric Lehman, Mathematics for Computer Science.

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Grading: Pressure of exams is usually not fair, so I put tons of weight onto homework so that you have the chance to work on something with a larger time window

- Final Project: 30%
- Midterm Exam: 20%
- Homework: 35%
- Code Assignments: 15%

Grade Scale: Standard grading distribution. This scale is inflexible as I already give you a ton of extra credit

- A: grade >=89.5%
- B+: 84.5% <= grade < 89.5%

- B: 79.5% <= grade < 84.5%
- C+: 74.5% <= grade < 79.5%
- C: 69.5% <= grade < 74.5%
- D: 64.5% <= grade < 69.5%
- F: grade < 64.5%

Course Policies:

- ***Extra Credit***: I provide extra credit to students who participate in class, as well as +2 points per homework for assignments that are submitted in Latex
- ***Attendance***: Attendance is not a graded mandatory section, I won't hold you to coming, but if you are not present in class you won't get in class extra credit, AND I will not assist at the end of the semester for asking me to boost your grade. Sending me an email in advance is sufficient to be excused, you don't need DoS excusal
- ***Group Homework***: Collaboration on homework is expected but plagiarism is not. If I believe a student blindly copied an assignment from a fellow classmate or the internet without an understanding, I may ask that student to explain their logic. If said student is unable to do so they will not receive credit for the assignment. Everyone must turn in an individual assignment
- ***Homework Deadlines***: Homework is due before class starts, because we go over it in class.
- ***Grade Disputes***: Homework and exam grade concerns are to be discussed outside of class.
- ***Exam Difficulty***: In an effort to avoid problems from online exams, I intend on making exams straightforward, while making the homework assignments more difficult.
- ***Chegg***: Any student caught using Chegg for anything will instantly be given a zero for the assignment. Should you wish to request online assistance for a problem, I suggest Math-StackExchange (math version of Stack Overflow) instead, which requires you to put in more effort to ask a question, as is not wrong as often as Chegg is.
- ***Homework Format***: Homework is to be turned in online in a typed or scanned format. If you wish to handwrite your assignment, use please scan into a PDF rather than taking pictures, if I cannot read your work I cannot give you credit. Typing in Latex or Word Equation editor is preferred.
- ***Cheating*****:** Review NJIT's policy on academic integrity. I personally am taking measures to combat cheating, but in the event you are caught you will be reported to the school.
- ***Lecture Jokes***: Interact with me in class because if y'all like me, I'll like you, and all of this stuff will be much more fun

Course Outline:

1. Logic and Basic Proof Techniques
    a. Logical Operators
    b. Propositional Logic
    c. Basic Proof Techniques
    d. Quantifiers and Notation
2. Introduction to Set Theory
    a. Basics of Set Theory and Simple Set Operations
    b. Advanced Set Operations and Set Proofs
    c. Infinite Sets and Proof by Induction
    d. Axiom of Choice
3. Generalized Functions
    a. Operators and Functions
    b. Injective, Surjective, and Bijective functions
    c. Pigeonhole Principle
4. Generalized Relations
    a. General Relations on Sets
    b. Equivalence Relations and Ordering Relations
    c. Well Ordering Theorem
5. Asymptotics of Functions and Algorithms
    a. Theoretical Definition of Big O notation
    b. Big Omega and Big Theta Notation
6. Introduction to Recurrence Relations
    a. Derivation of characteristic equations
    b. Master Theorem
7. Introduction to Game Theory (if time permits)
8. Introduction to Combinatorics (if time permits)
9. Introduction to Graph Theory (if time permits)
10. Introduction to Number Theory (if time permits)