Fall 2019

CS 506-851: Foundations of Computer Science I

David Nassimi

CS 506, Online Course Syllabus	Foundations of Computer Science I (Discrete Mathematics for CS)	Dr. David Nassimi Fall 2019

Prof.	David Nassimi
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TA:	TBA

Course Description: This is a graduate bridge course that provides the mathematical and analytical foundations of computer science. It is designed for entering MS students who need to strengthen their math background before taking the core course on algorithms (CS 610). This course carries credits towards MS degree. The course covers the material traditionally known as "discrete mathematics", with special emphasis on CS applications and analysis of algorithms. The course topics include sets and logic, proof techniques, proof by induction, functions, relations, analysis of algorithms, recursion, recurrence equations, divide-and-conquer technique, counting methods, permutations and combinations, basic discrete probability, and an introduction to number theory.
(Future plans are to also incorporate an introduction to graphs and trees.)
The course currently has 10 Homework Assignments (on paper exercises), and 2 Programming Assignments to be implemented and run on a computer.

Text: R. Johnsonbaugh, *Discrete Mathematics*, 7th Edition, Pearson Prentice Hall, 2009.
ISBN-13: 978-0-13-159318-3; ISBN-10: 0-13-159318-8

Course Objectives (what you are expected to know to complete this course)

1. Know basic mathematical tools and terminologies used in computer science
2. Know set algebra, propositional logic, reasoning, and basic proof techniques
3. Know induction, recursion, recurrence equations, and how they are interrelated
4. Know the mathematical tools used to analyze efficiency of algorithms
5. Implement simple programs and run experiments to measure their time complexity
6. Learn permutations/combinations, basic discrete probability, and applications
7. Understand basics of number theory

Course Evaluation (Assessment):

Evaluation:	
Assignments	24%
Midterm Exam	38%
Final Exam	38%

Notes: Pictured NJIT ID required for all exams. All exams are on campus, closed books/notes.

Policies:

1. Assignments must be done by you individually. Team-work not allowed.
2. Submit all assignments on Moodle by the due date.
3. **Moodle:** You must check the moodle page and your emails regularly for possible announcements.

4. **Website:** Copies of a few old exams are posted on my website.

Academic Integrity: Familiarize yourself with NJIT Honor Code: http://integrity.njit.edu. Any evidence of dishonesty will be dealt with seriously and reported to the Dean of Students.

Submission of Assignments: There are two types of assignments (all submitted on moodle):

- **Homework Assignments** (10): These are problem sets and may be either typed or hand-written neatly and scanned and uploaded in PDF format. If homework asks for an algorithm, it still means pseudocode on paper.
- **Programming Assignments** (2): These assignments must be implemented and run on computer to produce results. Submissions of these assignments must be in multiple files. (Please DO NOT Zip your files into one file, because the TA may have trouble unzipping it.) Multiple files are:
    1. **Source code** of the program. The TA will need to read this file to evaluate your program, and run the program to verify that it works. (PDF won't work!)
    2. Input data, if relevant
    3. Output produced by the program
    4. Discussion and Analysis, if relevant

CS 506 Course Outline

Week Approx.	**Topic**	**Reading Course Material**
	Algebra Self-Review	
1-2	**Sets and Logic** Sets Propositional Logic (App: Google Search) Quantifiers (App: Database operations)	Module 1 Sets Module 2 Logic
3	**Proof Techniques** Direct Proof, Counterexample, Contrapositive, Proof by Contradiction, Enumeration Proof Proof by Induction; Strong Induction	Module 3 Proofs
4-5	**Functions and Relations** Functions Relations Properties: Reflexive, Symmetric, Transitive Partial Order, Total Order, Equiv. Relations Matrices of Relations Application: Relational Databases	Module 4 Functions Module 5 Relations
6-7	**Algorithms** Analysis of Algorithms Recursive Algorithms Use of Recurrences to Analyze Algorithms	Module 6 Analysis Alg. Module 7 Recursion
8	**Midterm Exam**	

9	**Recurrence Equations** Divide-and-Conquer Recurrences Master Theorem Linear Recurrences	Module 8 Recurrences
10	**Counting Methods** Permutations and Combinations Principle of Inclusion/Exclusion Pigeonhole Principle	Module 9 Permutations & Combinations
11	**Discrete Probability**	Module 10 Probability
12-13	**Number Theory and Cryptography**	Module 11 Number Theory
14	Review	
16	**Final Exam**	