CS 506, Online Course Syllabus	Foundations of Computer Science I (Discrete Mathematics for CS)	Ruby Kapoor Spring 2025

Instructor	Ruby Kapoor
Canvas	Canvas.njit.edu
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Office Hours	Zoom Live Sessions, Thurs 7-8 PM EST (Link provided on Weekly Schedule.)

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 CS degree. The course covers the material known as "discrete mathematics", with special emphasis on CS applications and analysis of algorithms. The course topics include sets and logic, proofs and induction, functions/relations, analysis of algorithms, recursion, recurrence equations, divide-and-conquer technique, counting methods, permutations and combinations, discrete probability, and number theory/cryptography.
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*, 8th Edition, Pearson Prentice Hall, 2018.
ISBN-13: 978-0-321-96468-7. ISBN-10: 0-321-96468-3

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, discrete probability, and basics of number theory

Course Evaluation (Assessment):

Evaluation:	
Assignments (12)	30%
Midterm	35%
Final	35%

Policies:

1. Assignments must be done by you individually. Team-work not allowed nor is Generative AI.
2. Submit all assignments on Canvas by the due date. Please notify me via email two weeks prior to any religious holidays and communicate the necessary make-up.
3. Announcements: You must check the Canvas page and your emails regularly for announcements.

4. Homework and Examinations grades are numerically graded on a scale of 0-100. For Final Letter Grades, a curve is used depending on the performance of the current semester.

Academic Integrity: Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

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

- **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. I 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 Review (Self-Study)	Appendix B
1-2	**Sets and Logic** Sets and set-algebra 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 (covers modules 1-7)**	March 25, 2025 6-8:30PM EST
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**	