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 CS 610. According to a new CS department policy starting Fall 2010, 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 and relations, analysis of algorithms, recursion, recurrence equations, divide-and-conquer design technique, counting methods (permutations and combinations), basic discrete probability, and if time permits, introduction to number theory and a brief introduction to graphs and trees.


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

Course Evaluation (Assessment):

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Exam Dates</th>
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<tbody>
<tr>
<td>Assignments 25%</td>
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<tr>
<td>Exam 1 25%</td>
<td>Week 6 Wed Feb 26</td>
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<td>Exam 2 25%</td>
<td>Week 12 Wed April 16</td>
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<tr>
<td>Final 25%</td>
<td>Finals week To be announced by the Registrar</td>
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Notes: Pictured NJIT ID required for all exams. All exams are closed books/notes.

Policies:
1. Assignments must be done by you individually. Team-work not allowed.
2. Submit paper-copy of assignments at the start of the class period on the due date.
3. Late assignments will not be accepted.
4. Website: You must check the course website regularly for posting of syllabus, assignments, announcements, and old exams.
5. **Academic Integrity:** Familiarize yourself with NJIT Honor Code: [http://integrity.njit.edu](http://integrity.njit.edu). Any evidence of dishonesty will be dealt with seriously and reported to the Dean of Students.

**CS 506 Course Outline**

<table>
<thead>
<tr>
<th>Week (Approx)</th>
<th>Topic</th>
<th>Reading from Johnsonbaugh (7th Ed.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Algebra Self-Review</strong></td>
<td>Appendix B, pp.631-643</td>
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<tr>
<td>1-2</td>
<td><strong>Sets and Logic</strong></td>
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<tr>
<td></td>
<td>Sets</td>
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<td></td>
<td>Propositional Logic (Application: Google Search)</td>
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<td>Quantifiers (Application: Database operations)</td>
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<td>3-4</td>
<td><strong>Proof Techniques</strong></td>
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<td>Direct Proof, Counterexample, Contrapositive, Proof by Contradiction, Enumeration Proof</td>
<td>Ch. 2</td>
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<td>Proof by Induction; Strong Induction</td>
<td>Skip 2.3; Resolution proofs</td>
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<td>5</td>
<td><strong>Functions and Relations</strong></td>
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<td>Functions</td>
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<td>Relations</td>
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<td>Properties: Reflexive, Symmetric, Transitive</td>
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<td>Partial Order, Total Order, Equivalence Relations</td>
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<td>Matrices of Relations</td>
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<td>Application: Relational Databases</td>
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<td><strong>Exam 1 (See page 1 for Exam Date)</strong></td>
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<tr>
<td>7-8</td>
<td><strong>Algorithms</strong></td>
<td>Ch. 4</td>
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<td>Analysis of Algorithms</td>
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<td>Recursive Algorithms</td>
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<td>Use of Recurrences to Analyze Algorithms</td>
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<td>9-10</td>
<td><strong>Recurrence Equations</strong></td>
<td>Ch. 7</td>
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<td>Divide-and-Conquer Recurrences</td>
<td>Posted Notes</td>
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<td>Master Theorem</td>
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<td>Linear Recurrences</td>
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<td><strong>Exam 2 (See page 1 for Exam Date)</strong></td>
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<tr>
<td>12</td>
<td><strong>Counting Methods</strong></td>
<td>Ch. 6</td>
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<td>Permutations and Combinations</td>
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<td>Principle of Inclusion/Exclusion</td>
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<td>Pigeonhole Principle</td>
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<td>Introduction to Basic Probability</td>
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<td>13</td>
<td><strong>Introduction to Number Theory</strong> (if time permits)</td>
<td>Ch. 5</td>
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<td>14</td>
<td><strong>Introduction to Trees and Graphs</strong></td>
<td>Ch. 8, 9</td>
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