

CS103 Syllabus

<i>Part One: Discrete Mathematics</i>			
Date	Topics	Readings	Assignments
M September 25	<i>Can computers solve all problems?</i> Set Theory The Limits of Computing	Notes, Ch. 1 Handouts Online Guides	PS0 Out
W September 27	<i>How do we prove results with certainty?</i> Direct Proofs	Notes, Ch. 2 Handouts	
F September 29	<i>How do we prove something without directly proving it?</i> Proof by Contradiction Proof by Contrapositive	Notes, Ch. 2 Handouts	PS0 Due PS1 Out
M October 2	<i>How can we formalize our reasoning?</i> Propositional Logic		PS1 Checkpoint Due
W October 4	<i>How can we reason about collections of objects?</i> First-Order Logic I		
F October 6	<i>How do we rigorously define key terms?</i> First-Order Logic II	Handouts Online Guides	PS1 Due PS2 Out
M October 9	<i>How do we model relationships between objects?</i> Binary Relations Equivalence Relations	Notes, Ch. 5	PS2 Checkpoint Due
W October 11	<i>What does it mean to compare two objects?</i> Strict Order Relations	Notes, Ch. 5	
F October 13	<i>How do we model transformations and associations?</i> Functions Injections, Surjections, and Bijections	Notes, Ch. 6	PS2 Due PS3 Out
M October 16	<i>How do we reason about infinity?</i> Cardinality Diagonalization	Notes, Ch. 6 Online Guides	PS3 Checkpoint Due
W October 18	<i>How do we model network structures?</i> Graphs, Part I	Notes, Ch. 4	
F October 20	<i>Is disorder truly possible at a large scale?</i> Graphs, Part II The Pigeonhole Principle	Notes, Ch. 4	PS3 Due PS4 Out

Date	Topics	Readings	Assignments
M October 23	<i>First Midterm Exam; No Class</i> 7:00PM – 10:00PM, Location TBA Covers material from PS1 – PS2		PS4 Checkpoint Due
W October 25	<i>How can we reason about sequential processes?</i> Mathematical Induction, Part I	Notes, Ch. 3	
F October 27	<i>How does recursion relation to mathematical proof?</i> Mathematical Induction, Part II	Notes, Ch. 3 Handouts	PS4 Due PS5 Out
<i>Part Two: Computability Theory</i>			
M October 30	<i>How do we mathematically model computers?</i> Formal Language Theory DFAs I	Sipser 1.1	
W November 1	<i>What happens if computation involves choices?</i> DFAs II NFAs	Sipser 1.2	
F November 3	<i>How can we transform machines?</i> Equivalence of DFAs and NFAs Closure Properties of Regular Languages	Sipser 1.2	PS5 Due PS6 Out
M November 6	<i>Can we generate new programs from old programs?</i> Regular Expressions Equivalence of Regular Expressions and NFAs	Sipser 1.3	
W November 8	<i>Can computers with finite memory solve all problems?</i> Nonregular Languages The Myhill-Nerode Theorem		
F November 10	<i>How do natural and formal languages overlap?</i> Context-Free Grammars Context-Free Languages	Sipser 2.1	PS6 Due PS7 Out
M November 13	<i>Second Midterm Exam; No Class</i> 7:00PM – 10:00PM, Location TBA Covers material from PS3 – PS5		
W November 15	<i>How do we model realistic computers?</i> Turing Machines Designing Turing Machines	Sipser 3.1	
F November 17	<i>How powerful are Turing machines?</i> The Church-Turing Thesis	Sipser 3.3	PS7 Due PS8 Out
<i>Thanksgiving Break</i> <i>November 20 – 24</i> <i>No Class</i>			

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M November 27	<i>What does it mean to solve a problem with a computer?</i> R and RE Languages The Universal Turing Machine	Sipser 4.1 Sipser 6.1	
<i>Part Three: Intro to Complexity Theory</i>			
W November 29	<i>What is the limit of algorithmic problem-solving?</i> The Recursion Theorem Undecidability	Sipser 4.2	
F December 1	<i>What is the full scope of computing power?</i> Verifiers Unrecognizability	Online Guides	PS8 Due PS9 Out
M December 4	<i>How do we measure the difficulty of problems?</i> The P versus NP Question NP -Completeness I	Sipser 7.2 Sipser 7.3	
W December 6	<i>What makes hard problems hard?</i> NP -Completeness II	Sipser 7.4	
F December 8	<i>How does everything fit together?</i> The Big Picture Where to Go from Here		PS9 Due <i>No late submissions</i>
M December 11	<i>Final Exam: 3:30PM – 6:30PM</i> Location TBA		