

CS103 Syllabus

<i>Part One: Discrete Mathematics</i>			
Date	Topics	Readings	Assignments
WEEK 1 <i>M</i> Jan 7	<i>Can computers solve all problems?</i> Set Theory The Limits of Computing	Notes, Ch. 1 Handouts Online Guides	PS0 Out
<i>W</i> Jan 9	<i>How do we prove results with certainty?</i> Direct Proofs	Notes, Ch. 2 Handouts	
<i>F</i> Jan 11	<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
WEEK 2 <i>M</i> Jan 14	<i>How can we formalize our reasoning?</i> Propositional Logic		PS1 Checkpoint Due
<i>W</i> Jan 16	<i>How can we reason about collections of objects?</i> First-Order Logic I		
<i>F</i> Jan 18	<i>How do we rigorously define key terms?</i> First-Order Logic II	Handouts Online Guides	PS1 Due PS2 Out
WEEK 3 <i>M</i> Jan 21	No class – Martin Luther King Jr. Holiday <i>Consider watching his 1967 “Two Americas” speech, given here on Stanford campus</i>		PS2 Checkpoint Due
<i>W</i> Jan 23	<i>How do we model relationships between objects?</i> Binary Relations Equivalence Relations	Notes, Ch. 5	
<i>F</i> Jan 25	<i>What does it mean to compare two objects?</i> Proving things with Binary Relations Other kinds of Relations, Orders	Handouts Notes, Ch. 5	PS2 Due PS3 Out

Date	Topics	Readings	Assignments
WEEK 4 <i>M</i> Jan 28	<i>How do we model transformations and associations?</i> Functions Injections, Surjections, and Bijections	Notes, Ch. 6	PS3 Checkpoint Due
<i>W</i> Jan 30	<i>How do we reason about infinity?</i> Cardinality Diagonalization	Notes, Ch. 6 Online Guides	
<i>F</i> Feb 1	<i>How do we model network structures?</i> Graphs, Part I	Notes, Ch. 4	PS3 Due PS4 Out
WEEK 5 <i>M</i> Feb 4	<i>Is disorder truly possible at a large scale?</i> Graphs, Part II The Pigeonhole Principle	Notes, Ch. 4	
First Midterm Exam – Monday Feb 4 7:00PM – 10:00PM, Location TBA Covers topics from PS1 – PS2.			
<i>W</i> Feb 6	<i>How can we reason about sequential processes?</i> Mathematical Induction, Part I	Notes, Ch. 3	
<i>F</i> Feb 8	<i>How does recursion relation to mathematical proof?</i> Mathematical Induction, Part II	Notes, Ch. 3 Handouts	PS4 Due PS5 Out
Part Two: Computability Theory			
WEEK 6 <i>M</i> Feb 11	<i>How do we mathematically model computers?</i> Formal Language Theory DFAs I	Sipser 1.1	
<i>W</i> Feb 13	<i>What happens if computation involves choices?</i> DFAs II NFAs	Sipser 1.2	
<i>F</i> Feb 15	<i>How can we transform machines?</i> Equivalence of DFAs and NFAs Closure Properties of Regular Languages	Sipser 1.2	PS5 Due PS6 Out
WEEK 7 <i>M</i> Feb 18	No class – President’s Day Holiday		
<i>W</i> Feb 20	<i>Can we generate new programs from old programs?</i> Regular Expressions Equivalence of Regular Expressions and NFAs	Sipser 1.3	
<i>F</i> Feb 22	<i>Can computers with finite memory solve all problems?</i> Nonregular Languages The Myhill-Nerode Theorem		PS6 Due PS7 Out

Date	Topics	Readings	Assignments
WEEK 8 <i>M</i> Feb 25	<i>How do natural and formal languages overlap?</i> Context-Free Grammars Context-Free Languages	Sipser 2.1	
Second Midterm Exam – Monday Feb 25 7:00PM – 10:00PM, Location TBA Covers topics from PS3 – PS5.			
<i>W</i> Feb 27	<i>How do we model realistic computers?</i> Turing Machines Designing Turing Machines	Sipser 3.1	
<i>F</i> Mar 1	<i>How powerful are Turing Machines?</i> The Church-Turing Thesis	Sipser 3.1	PS7 Due PS8 Out
WEEK 9 <i>M</i> Mar 4	<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>W</i> Mar 6	<i>What is the limit of algorithmic problem-solving?</i> Self-Reference Undecidability	Sipser 4.2	
<i>F</i> Mar 8	<i>What is the full scope of computing power?</i> Verifiers Unrecognizability	Online Guides	PS8 Due PS9 Out
Part Three: Complexity Theory			
WEEK 10 <i>M</i> Mar 11	<i>How do we measure the difficulty of problems?</i> The P versus NP Question NP -Completeness I	Sipser 7.2 Sipser 7.3	
<i>W</i> Mar 13	<i>What makes hard problems hard?</i> NP -Completeness II	Sipser 7.4	
<i>F</i> Mar 15	Quarter wrap-up!		PS9 Due <i>No late submissions</i>
Final Exam: Monday March 18 th 3:30-6:30pm, Location TBA			