CS103 Syllabus

Part One: Discrete Mathematics			
Date	**Topics**	**Readings**	**Assignments**
M January 8	*Can computers solve all problems?* Set Theory The Limits of Computing	Notes, Ch. 1 Handouts Online Guides	PS0 Out
W January 10	*How do we prove results with certainty?* Direct Proofs	Notes, Ch. 2 Handouts	
F January 12	*How do we prove something without directly proving it?* Proof by Contradiction Proof by Contrapositive	Notes, Ch. 2 Handouts	PS0 Due PS1 Out
M January 15	***Dr. Martin Luther King, Jr. Day*** No Class		PS1 Checkpoint Due
W January 17	*How can we formalize our reasoning?* Propositional Logic		
F January 19	*How can we reason about collections of objects?* First-Order Logic I		PS1 Due PS2 Out
M January 22	*How do we rigorously define key terms?* First-Order Logic II	Handouts Online Guides	PS2 Checkpoint Due
W January 24	*How do we model relationships between objects?* Binary Relations Equivalence Relations	Notes, Ch. 5	
F January 26	*What does it mean to compare two objects?* Strict Order Relations	Handouts Notes, Ch. 5	PS2 Due PS3 Out
M January 29	*How do we model transformations and associations?* Functions Injections, Surjections, and Bijections	Notes, Ch. 6	PS3 Checkpoint Due
W January 31	*How do we reason about infinity?* Cardinality Diagonalization	Notes, Ch. 6 Online Guides	
F February 2	*How do we model network structures?* Graphs, Part I	Notes, Ch. 4	PS3 Due PS4 Out

Date	Topics	Readings	Assignments
M February 5	*Is disorder truly possible at a large scale?* Graphs, Part II The Pigeonhole Principle	Notes, Ch. 4	PS4 Checkpoint Due
	First Midterm Exam 7:00PM – 10:00PM, Location TBA Covers topics from PS1 – PS2.		
W February 7	*How can we reason about sequential processes?* Mathematical Induction, Part I	Notes, Ch. 3	
F February 9	*How does recursion relation to mathematical proof?* Mathematical Induction, Part II	Notes, Ch. 3 Handouts	PS4 Due PS5 Out
Part Two: Computability Theory			
M February 12	*How do we mathematically model computers?* Formal Language Theory DFAs I	Sipser 1.1	
W February 14	*What happens if computation involves choices?* DFAs II NFAs	Sipser 1.2	
F February 16	*How can we transform machines?* Equivalence of DFAs and NFAs Closure Properties of Regular Languages	Sipser 1.2	PS5 Due PS6 Out
M February 19	***Presidents' Day*** No Class		
W February 21	*Can we generate new programs from old programs?* Regular Expressions Equivalence of Regular Expressions and NFAs	Sipser 1.3	
F February 23	*Can computers with finite memory solve all problems?* Nonregular Languages The Myhill-Nerode Theorem		PS6 Due PS7 Out
M February 26	*How do natural and formal languages overlap?* Context-Free Grammars Context-Free Languages	Sipser 2.1	
	Second Midterm Exam 7:00PM – 10:00PM, Location TBA Covers topics from PS3 – PS5.		
W February 28	*How do we model realistic computers?* Turing Machines Designing Turing Machines	Sipser 3.1	
F March 2	*How powerful are Turing machines?* The Church-Turing Thesis	Sipser 3.3	PS7 Due PS8 Out

Date	Topics	Readings	Assignments
M March 5	*What does it mean to solve a problem with a computer?* **R** and **RE** Languages The Universal Turing Machine	Sipser 4.1 Sipser 6.1	
W March 7	*What is the limit of algorithmic problem-solving?* Self-Reference Undecidability	Sipser 4.2	
F March 9	*What is the full scope of computing power?* Verifiers Unrecognizability	Online Guides	PS8 Due PS9 Out
Part Three: Complexity Theory			
M March 12	*How do we measure the difficulty of problems?* The **P** versus **NP** Question **NP**-Completeness I	Sipser 7.2 Sipser 7.3	
W March 14	*What makes hard problems hard?* **NP**-Completeness II	Sipser 7.4	
F March 16	*How does everything fit together?* The Big Picture Where to Go from Here		PS9 Due *No late submissions*
M March 19	***Final Exam: 3:30PM – 6:30PM*** Location TBA		