CS103 Syllabus

Part One: Discrete Mathematics			
Date	**Topics**	**Readings**	**Assignments**
M January 4	*Can computers solve all problems?* Set Theory The Limits of Computing	Notes, Ch. 1	
W January 6	*How do we prove results with certainty?* Direct Proofs	Notes, Ch. 2	
F January 8	*How do we prove something without directly proving it?* Proof by Contradiction Proof by Contrapositive	Notes, Ch. 2	PS1 Out
M January 11	*How can we formalize our reasoning?* Propositional Logic		PS1 Checkpoint Due
W January 13	*How can we reason about collections of objects?* First-Order Logic I		
F January 15	*How do we rigorously define our terms and definitions?* First-Order Logic II		PS1 Due PS2 Out
M January 18	**Martin Luther King, Jr. Day** **No Class**		
T January 19			PS2 Checkpoint Due
W January 20	*How do we model transformations between objects?* Functions Injections, Surjections, and Bijections	Notes, Ch. 6	
F January 22	*Why does the quantity of an object matter?* Cardinality and Diagonalization	Notes, Ch. 6	PS2 Due PS3 Out
M January 25	*How do we model relationships between objects?* Binary Relations Equivalence Relations	Notes, Ch. 5	PS3 Checkpoint Due
W January 27	*What does it mean to compare two objects?* Strict Orders Graphs I	Notes, Ch. 5	
F January 29	*How "random" can large objects be?* Graphs II The Pigeonhole Principle	Notes, Ch. 4	PS3 Due PS4 Out

Date	Topics	Readings	Assignments
M February 1	*How do we model stepwise processes?* Mathematical Induction I	Notes, Ch. 3	PS4 Checkpoint Due
W February 3	*How do we model stepwise processes?* Mathematical Induction II	Notes, Ch. 3	
Part Two: Computability Theory			
F February 5	*How do we mathematically model computers?* Formal Language Theory DFAs I	Sipser 1.1	PS4 Due PS5 Out
M February 8	*Does computation have to be deterministic?* DFAs II NFAs	Sipser 1.2	
	First Midterm Exam 7PM – 10PM, Location TBA Covers material from PS1 – PS3		
W February 10	*How can we transform machines?* Equivalence of DFAs and NFAs Closure Properties of Regular Languages	Sipser 1.2	
F February 12	*Can we generate new programs from old programs?* Regular Expressions Equivalence of Regular Expressions and NFAs	Sipser 1.3	PS5 Due PS6 Out
M February 15	**President's Day** **No Class**		
W February 17	*Can computers with finite memory solve all problems?* Nonregular Languages The Myhill-Nerode Theorem		
F February 19	*How do natural and formal languages overlap?* Context-Free Grammars Context-Free Languages	Sipser 2.1	PS6 Due PS7 Out
M February 22	*How do we model realistic computers?* Turing Machines Designing Turing Machines	Sipser 3.1	
W February 24	*How powerful are Turing machines?* The Church-Turing Thesis The Universal Turing Machine	Sipser 3.3	
F February 26	*What does it mean to solve a problem with a computer?* **R** and **RE** Languages The Recursion Theorem	Sipser 4.1 Sipser 6.1	PS7 Due PS8 Out
M February 29	*How do proofs relate to computability?* Undecidability	Sipser 4.2	
	Second Midterm Exam 7PM – 10PM, Location TBA Covers material from PS4 – PS6		

Date	Topics	Readings	Assignments
W March 2	*What is the full scope of computing power?* Verifiers Verifiers and **RE** Languages		
F March 4	*What are the hardest problems computers can touch?* Unrecognizable Languages		PS8 Due PS9 Out
Part Three: Intro to Complexity Theory			
M March 7	*How do we measure the difficulty of problems?* The **P** versus **NP** Question **NP**-Completeness I	Sipser 7.2 Sipser 7.3	
W March 9	*What makes hard problems hard?* **NP**-Completeness II	Sipser 7.4	
F March 11	*How does everything fit together?* The Big Picture Where to Go from Here		PS9 Due *No late submissions*
W March 16	**Final Exam: 3:30PM – 6:30PM** Location TBA Cumulative final exam, slightly focused on material from PS7 – PS9		