Cynthia Bailey Lee

CS103 Syllabus

Part One: Discrete Mathematics			
Date	**Topics**	**Readings**	**Assignments**
WEEK 1 **M** Jan 6	*Can computers solve all problems?* Set Theory The Limits of Computing	Notes, Ch. 1 Handouts Online Guides	PS0 Out
W Jan 8	*How do we prove results with certainty?* Direct Proofs	Notes, Ch. 2 Handouts	
F Jan 10	*How do we prove things resistant to direct proofs?* Proof by Contradiction Proof by Contrapositive	Notes, Ch. 2 Handouts	PS0 Due PS1 Out
WEEK 2 **M** Jan 13	*How can we formalize our reasoning?* Propositional Logic		PS1 Checkpoint Due
W Jan 15	*How can we reason about collections of objects?* First-Order Logic I		
F Jan 17	*How do we rigorously define key terms?* First-Order Logic II	Handouts Online Guides	PS1 Due PS2 Out
WEEK 3 **M** Jan 20	**No class – Martin Luther King Jr. Holiday** *Consider watching his 1967 "Twoj Americas" speech, given here on Stanford campus*		PS2 Checkpoint Due
W Jan 22	*How do we model relationships between objects?* Binary Relations Equivalence Relations	Notes, Ch. 5	
F Jan 24	*What does it mean to compare two objects?* Proving things with Binary Relations Other kinds of Relations, Orders	Handouts Notes, Ch. 5	PS2 Due PS3 Out

Date	Topics	Readings	Assignments
WEEK 4 **M** Jan 27	*How do we model transformations and associations?* Functions Injections, Surjections, and Bijections	Notes, Ch. 6	PS3 Checkpoint Due
W Jan 29	*How do we reason about infinity?* Cardinality Diagonalization	Notes, Ch. 6 Online Guides	
F Jan 31	*How do we model network structures?* Graphs, Part I	Notes, Ch. 4	PS3 Due PS4 Out
WEEK 5 **M** Feb 3	*Is disorder truly possible at a large scale?* Graphs, Part II The Pigeonhole Principle	Notes, Ch. 4	
W Feb 5	*How can we reason about sequential processes?* Mathematical Induction, Part I	Notes, Ch. 3	
F Feb 7	*How does recursion relation to mathematical proof?* Mathematical Induction, Part II	Notes, Ch. 3 Handouts	PS4 Due PS5 Out
Part Two: Computability Theory			
WEEK 6 **M** Feb 10	*How do we mathematically model computers?* Formal Language Theory DFAs I	Sipser 1.1	
W Feb 12	*What happens if computation involves choices?* DFAs II NFAs	Sipser 1.2	
F Feb 14	*How can we transform machines?* Equivalence of DFAs and NFAs Closure Properties of Regular Languages	Sipser 1.2	PS5 Due PS6 Out
WEEK 7 **M** Feb 17	**No class – President's Day Holiday**		
	Midterm Exam – Tuesday Feb 18 7:00PM – 10:00PM, Location TBA Covers topics from PS1 – PS4		
W Feb 19	*Can we generate new programs from old programs?* Regular Expressions Equivalence of Regular Expressions and NFAs	Sipser 1.3	
F Feb 21	*Can computers with finite memory solve all problems?* Nonregular Languages The Myhill-Nerode Theorem		PS6 Due PS7 Out

Date	Topics	Readings	Assignments
WEEK 8 **M** Feb 24	*How do natural and formal languages overlap?* Context-Free Grammars Context-Free Languages	Sipser 2.1	
W Feb 26	*How do we model realistic computers?* Turing Machines Designing Turing Machines	Sipser 3.1	
F Feb 28	*How powerful are Turing Machines?* The Church-Turing Thesis	Sipser 3.1	PS7 Due PS8 Out
WEEK 9 **M** Mar 2	*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 Mar 4	*What is the limit of algorithmic problem-solving?* Self-Reference Undecidability	Sipser 4.2	
F Mar 6	*What is the full scope of computing power?* Verifiers Unrecognizability	Online Guides	PS8 Due PS9 Out
Part Three: Complexity Theory			
WEEK 10 **M** Mar 9	*How do we measure the difficulty of problems?* The **P** versus **NP** Question **NP**-Completeness I	Sipser 7.2 Sipser 7.3	
W Mar 11	*What makes hard problems hard?* **NP**-Completeness II	Sipser 7.4	
F Mar 13	Quarter wrap-up!		PS9 Due *No late submissions*
Final Exam: Tuesday March 17th 8:30-11:30am, Location TBA			