Theor	etical Computer Science CS 310
Chadd Williams	
Office Hours: Mon 3:00 – 4:00 PM Tues 2:00 – 4:00 PM	chadd@pacificu.edu 202 Strain

Fri 11:00 – 12:00 PM and by appointment

http://zeus.cs.pacificu.edu/chadd/cs310f06/

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Syllabus http://zeus.cs.pacificu.edu/chadd/cs310f06/syllabus.html

Introduction to the Theory of Computation by Michael Sipser, (Second Edition)

- I will assign problems out of this book

Grades:

Dates: • Midterm 1, Wed Oct 11, 2006

• 2 Exams: 25% each

• Midterm 2, Wed Nov 13, 2005 • 1 Final 35% (Comprehensive) • Final, Tue Dec 5 (8:30 – 11:00 AM)

Homework: 15%

Policies:

· Assignments are due at the beginning of class. Late assignments will not be accepted.

- · The cheating policy is defined in the Pacific Catalog
- Silence all electronic devices

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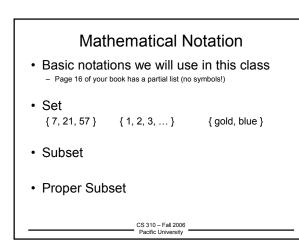
- · Overview of class
- Mathematical Notation
- · Proof by Induction
- Who Am I?

1

Overview

- What are the fundamental capabilities and limitations of computers?
- Computer Science is really the science of computation, not of computers.
- How does theory related to programming?
- Complexity Theory
- · Computability Theory
- Automata Theory

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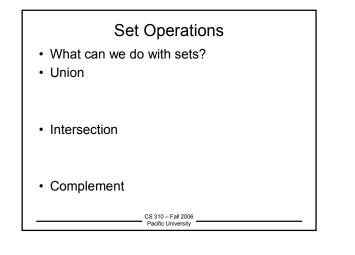
Sets

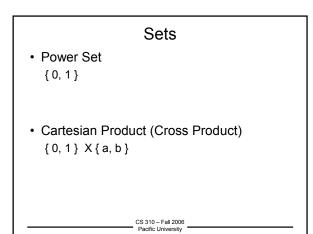
 Shorthand for describing a set { n | rule about n}

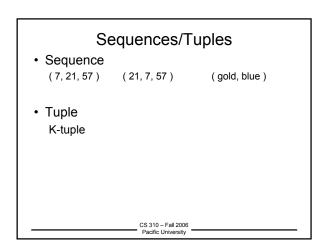
 $\{ n \mid n = m^2 \text{ for some } m \in N \}$

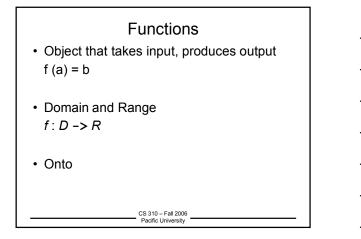
 $\{\,\{{\rm i},\,{\rm i}^2\,\}\,|\,{\rm i}\in N\,\}$

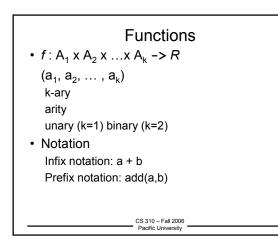
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Relations

- Predicate (property)
 f: D -> {TRUE, FALSE}
- Relation
 f: A₁ x A₂ x ... x A_n -> {TRUE, FALSE}
- Notation table Set

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Equivalence Relations

binary relation shows that two objects are equal

must satisfy 3 conditions:

- 1. R is *reflexive* if for every x, xRx;
- 2. R is *symmetric* if for every x and y,
- xRy if and only if yRx;R is *transitive* if for every x, y, and z, xRy and yRz implies xRz

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Proof by Contradiction

- · Assume it is false
- · Show this leads to a false consequence
- Prove $\sqrt{2}$ is irrational
 - Assume it is rational: $\sqrt{2} = m/n$
 - Reduce m/n to lowest terms: m and n are not both even (could reduce out a 2)
 - sometimes tricky to pick exactly what false consequence to show

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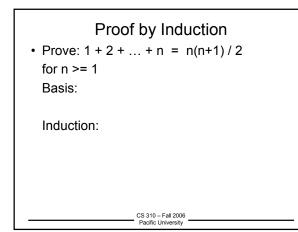
Proof by Induction

Basis

Prove P(1) is true

- Induction Step Prove that for each i>=1, if P(i) is true, then so is P(i+1); assume P(i) is true
- Basis + Induction Step P(1) is true, i = 1 P((i+1)) is true P((i+1)+1) is true ...

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Chadd Williams

- New Computer Science Professor!
- Education
 - West Virginia University (BS)
 - University of Maryland, College Park (MS,PhD)
- Research
 - Systems
 - Runtime code patching
 - modify instructions in a running executable
 - Programming languages/Software Engineering
 - Studying software change history to learn about the source code
 CS 210, End 2005
 - CS 310 Fall 2006 Pacific University