

Lecture 1

Course Overview & Introduction

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Course Overview

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<http://www.zvonimir.info/teaching/spring-2013-foundations/>

Main Goals

- ▶ Cover topics related to one's ability to understand and design correctly functioning complex systems, and clearly describe their workings
 - ▶ Mathematical logic
 - ▶ Propositional, first-order, theories, decision procedures
 - ▶ Concurrency
 - ▶ Model checking, proofs, shared memory consistency
 - ▶ Specifying systems
 - ▶ Operational semantics

Textbook

- ▶ The Calculus of Computation by Aaron R. Bradley and Zohar Manna
 - ▶ Electronic version is free through SpringerLink

Course Organization

▶ Lectures

- ▶ Discuss basic and advanced topics
- ▶ Emphasize on lasting foundations and theory

▶ Homework assignments

- ▶ Hands-on exercises accompanying presented material
- ▶ Some coding required in your programming language of choice

▶ Projects

- ▶ Focused, practical exploration of a topic related to the course (and ideally your research too!)

Course Communication

- ▶ Office hours
 - ▶ Catch me after class; find me in my office; email me
- ▶ **Email** is the king and **mailing list** the queen of communication related to this course
- ▶ Mailing list: fcs@list.eng.utah.edu
 - ▶ Subscribe at:
<https://sympa.eng.utah.edu/sympa/info/fcs>
 - ▶ Everyone enrolled must subscribe; subscribe today
 - ▶ Questions related to homework, projects, general questions...
- ▶ Email: zvonimir@cs.utah.edu
 - ▶ Questions related to your grade...

Grading

- ▶ 10% class participation
- ▶ 40% homework assignments
 - ▶ 4-5 practical homework assignments
 - ▶ Each assignment is worth the same
- ▶ 50% course project of your choice

Collaboration vs Cheating

- ▶ Discussing homework and project solutions at high-level is fine and encouraged
- ▶ Basing your code/write-up on any other code/write-up is cheating
 - ▶ do not copy solutions from another student
 - ▶ do not copy solutions from the internet
 - ▶ do not even look at solutions from another student
 - ▶ do not ask for solutions on online forums
 - ▶
- ▶ Acknowledge appropriately any outside materials you used or rely on

Late Policy

- ▶ Late homework assignments and project deliverables will not be accepted unless you contact me before the deadline and have a good excuse

Propositional Logic

- ▶ Understand propositional reasoning
 - ▶ Syntax and semantic
 - ▶ Know how to use propositional logic
 - ▶ Complexity results (NP-completeness)
- ▶ Study mechanization
 - ▶ BDDs
 - ▶ SAT
 - ▶ Understand DPLL
 - ▶ Study SAT algorithms
 - ▶ Implement your own (?)

First-Order Logic

- ▶ Understand FOL
 - ▶ (Semi-) decidability
 - ▶ FOL + theories
- ▶ Study mechanization
 - ▶ SMT solvers
 - ▶ Use solvers for
 - ▶ test generation
 - ▶ program synthesis
 - ▶ others

Operational Semantics

- ▶ Understand how to write semantic specs
- ▶ Study mechanization/tools
- ▶ Study program semantics

Concurrency

- ▶ Understand basics of model checking
- ▶ Shared memory consistency models
 - ▶ Use operational semantics to write concurrency specs

Next Time

- ▶ Propositional logic
- ▶ SAT solvers
- ▶ First homework assignment