

# CS 3500: Introduction to the Theory of Computation

Summer 2003

Instructor: Yan Zong Ding, ding@cc.gatech.edu

## Introduction

This course introduces the Theory of Computation, which is the study of mathematical laws governing computation. The course has two parts. The first part is on Automata, Languages, and Computability, where we study various models of computation, and what can be and what cannot be computed by each model. The second part is on Efficient Algorithms and Computational Complexity, where we study what can be and what cannot be computed *efficiently*. Here the word efficient means using a small amount of computational resources, such as time.

## Topics to Be Covered

1. Automata, Languages, and Computability:
  - (a) Deterministic and Non-deterministic Finite Automata. Regular Languages.
  - (b) Context-Free Languages and Pushdown Automata.
  - (c) Turing Machines. The notion of an Algorithm. Decidability and Undecidability.
2. Algorithms:
  - (a) Important algorithm design techniques such as Divide and Conquer, the Greedy Method, Dynamic Programming, and Randomization.
  - (b) Efficient algorithms for sorting, searching, and basic graph problems.
3. Computational Complexity:
  - (a) The classes P and NP.
  - (b) NP-Completeness.

## Textbooks

1. Michael Sipser. Introduction to the Theory of Computation. PWS Publishing Company, 1997.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford D. Stein. Introduction to Algorithms, 2nd Edition. MIT Press, 2001.

## Prerequisites

- CS 1050 or equivalent.

## Grading

- Problem Sets: 40%
- Midterm Quiz: 20%
- Final Exam: 40%

## Late Homework Policy

Each student has 7 late days for the course. After the late days are used, late homeworks will not be accepted.

## Collaboration Policy and Academic Honesty

Students are encouraged to discuss homework problems in *small groups* of 2-3. However, collaboration in homework is limited to discussion of ideas only, and students **must write solutions completely on their own**. Solutions copied from classmates or the Internet will receive 0 point, and such incidents, if found, will be reported to the Dean. For each problem in each assignment, a student must acknowledge his/her collaborators if any, and cite any reference used other than the textbooks or lecture notes.