## Introduction to CS 16

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cs16.net

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Introduction to CS 16 (v. 1.3)

#### Roberto Tamassia

- Call me "Roberto"
- Made in Italy
- Ph.D. from University of Illinois
- At Brown since 1988
- Teaching CS16 and CS166 (Computer Systems Security)

#### Research Interests

- Data structures
- Algorithms
- Information security
- Geometric computing
- Visualization
- Educational technology

## Why Take CS 16?

Algorithm: step-by-step procedure for performing a task with a computer

- Data Structure: systematic way of organizing and accessing data
- Algorithms and data structures are an essential component of software systems
- Better algorithms make faster programs
  You will learn how to design, analyze and implement fundamental algorithms and data structures

## Topics

- Analysis of algorithms
- Basic data structures
- Searching
- Sorting
- Graphs
- Text processing
- Information security

## Analysis of Algorithms

Mathematical methods for evaluating the performance of algorithms and data structures Theoretical analysis without implementation



#### **Basic Data Structures**



# Searching and Sorting

- Data structures for fast searching (databases)
  - Search trees
  - Hash tables
- Sorting algorithms
  - Elementary algorithms
  - Efficient algorithms





## Graphs

- Network of nodes connected by links
- Systematic exploration (maze)
- Path finding (flight booking)
- Identification of bottlenecks (telecommunications)



### **Information Security**

Encryption attack at dawn Decryption Digital signatures feed the cat Authentication (https / SSL) Numerical attack at dawn algorithms

## **Course Organization**

- Lectures
- Help sessions
- Office hours
  - Roberto
    - TAs
- cs16.net
  - Public area
  - Protected area
- Newsgroup
- Reading
  - Textbook
  - Slides

Five homeworks (30%)

- Collaborative
- May include mini-programs
- Worst homework worth 3%
- Two in-class exams (20%)
  - Non-collaborative
  - Sample exam questions distributed one week before the exam
- Five programs (50%)
  - Non-collaborative
- Late Policy
  - Homework deadline is firm
    - Late hours to extend program deadline

### Textbook

 Data Structures & Algorithms in JAVA.
 M. T. Goodrich and R. Tamassia.
 Wiley, 2006.
 datastructures.net



## **Collaboration Policy**



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#### Prerequisites

- Courses
  - CS 15 passed in 2003, 2004 or 2005, or
  - Written permission from Roberto
- What you need to know
  - Elementary math (algebra, functions, exponents, logarithms, exponentials, binary representation)
  - Programming in Java

#### Participation and Feedback

Ask questions in class What are the applications? Can you give an example? Can you show a picture? Give feedback on the course Too easy? Too difficult? Boring? Interesting? Coherent? Disorganized?