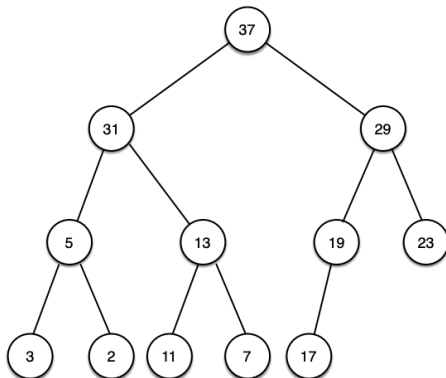


Data Structures and Algorithms



cs130a Data Structures and Algorithms

- Focus of the course
 - Data structures and related algorithms
 - Correctness and (time and space) complexity
- Prerequisites
 - CS 16: stacks, queues, lists, binary search trees, ...
 - CS 32: object oriented computing
 - CS 40: functions, recurrence equations, induction, ...
 - PSTAT 120A or ECE 139

Introduction

- A famous quote: Program = Algorithm + Data Structure
- All of you have programmed; thus you have already been exposed to algorithms and data structures
- Perhaps you didn't see them as separate entities
- Perhaps you saw data structures as simple programming constructs (provided by STL—standard template library)
- However, data structures are quite distinct from algorithms, and very important in their own right

Objectives

- The main focus of this course is to introduce you to a systematic study of algorithms and data structures
- The two guiding principles of the course are: abstraction and formal analysis
- Abstraction: We focus on topics that are broadly applicable to a variety of problems
- Analysis: We want a formal way to compare two objects (data structures or algorithms)
- In particular, we will worry about “always correct”-ness, and worst-case bounds on time and memory (space)

Material

- Mark Allen Weiss. *Data Structures and Algorithm Analysis in C++*, 4th Edition, Addison Wesley, 2014.
- Material from other books and research papers will also be used
- The ultimate source is the lectures and the material posted on the course web site

Course Outline

- Algorithm Analysis (Ch. 2)
- Sets with insert/delete/member: Hashing (Ch. 5)
- Sets in general: Balanced search trees (Ch. 4)
- Sets with priority: Heaps, priority queues (Ch. 6)
- Graphs: Shortest-path algorithms (Ch. 9.1 – 9.3.2)
- Sets with disjoint union: Union/find trees (Ch. 8.1–8.5)
- Graphs: Minimum spanning trees (Ch. 9.5)
- Sorting (Ch. 7)