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Week 4

Discuss and ask questions about Week 4.

Go to forum

28 threads · Last post a day ago

Divide-and-Conquer



In this module you will learn about a powerful algorithmic technique called Divide and Conquer. Based on this technique, you will see how to search huge databases millions of times faster than using naïve linear search. You will even learn that the standard way to multiply numbers (that you learned in the grade school) is far from the being the fastest! We will then apply the divide-and-conquer technique to design two efficient algorithms (merge sort and quick sort) for sorting huge lists, a problem that finds many applications in practice. Finally, we will show that these two algorithms are optimal, that is, no algorithm can sort faster!

Less

Learning Objectives

- Express the recurrence relation on the running time of an algorithm
- Create a program for searching huge lists
- Create a program for finding a majority element
- Create a program for organizing a lottery

Less

Introduction

▶ Video: Intro 3 min

Resume

▶ Video: Linear Search 7 min

▶ Video: Binary Search 7 min

▶ Video: Binary Search Runtime 8 min

📖 Reading: Resources 10 min

📖 Practice Quiz: Linear Search and Binary Search 4 questions

📖 Practice Quiz: Puzzle: 21 questions game 4 questions

📖 Practice Quiz: Puzzle: Two Adjacent Cells of Opposite Colors 1 question

Polynomial Multiplication

▶ Video: Problem Overview and Naïve Solution 6 min

▶ Video: Naïve Divide and Conquer Algorithm 7 min

▶ Video: Faster Divide and Conquer Algorithm 6 min

📖 Reading: Resources 5 min

📖 Practice Quiz: Polynomial Multiplication 3 questions

Master Theorem

- ▶ **Video:** What is the Master Theorem? 4 min
- ▶ **Video:** Proof of the Master Theorem 9 min
- 📖 **Reading:** Resources 10 min
- 📖 **Practice Quiz:** Master Theorem 1 question

Sorting Problem

- ▶ **Video:** Problem Overview 2 min
- ▶ **Video:** Selection Sort 8 min
- ▶ **Video:** Merge Sort 10 min
- ▶ **Video:** Lower Bound for Comparison Based Sorting 12 min
- ▶ **Video:** Non-Comparison Based Sorting Algorithms 7 min
- 📖 **Reading:** Resources 5 min
- 📖 **Practice Quiz:** Sorting 4 questions

Quick Sort

- ▶ **Video:** Overview 2 min
- ▶ **Video:** Algorithm 9 min
- ▶ **Video:** Random Pivot 13 min
- ▶ **Video:** Running Time Analysis (optional) 15 min
- ▶ **Video:** Equal Elements 6 min
- ▶ **Video:** Final Remarks 8 min
- 📖 **Reading:** Resources 10 min
- 📖 **Practice Quiz:** Quick Sort 4 questions

Programming Assignment 4

- 🔗 **Programming Assignment:** Programming Assignment 4: Divide and Conquer 3h Due Aug 16, 1:59 AM CDT
- 📖 **Practice Quiz:** Puzzle: Local Maximum 3 questions

