Week 3

Data Structures

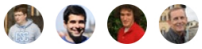
Week 3

Discuss and ask questions about Week 3.

Go to forum

267 threads · Last post a day ago

Priority Queues and Disjoint Sets



We start this module by considering priority queues which are used to efficiently schedule jobs, either in the context of a computer operating system or in real life, to sort huge files, which is the most important building block for any Big Data processing algorithm, and to efficiently compute shortest paths in graphs, which is a topic we will cover in our next course. For this reason, priority queues have built-in implementations in many programming languages, including C++, Java, and Python. We will see that these implementations are based on a beautiful idea of storing a complete binary tree in an array that allows to implement all priority queue methods in just few lines of code. We will then switch to disjoint sets data structure that is used, for example, in dynamic graph connectivity and image processing. We will see again how simple and natural ideas lead to an implementation that is both easy to code and very efficient. By completing this module, you will be able to implement both these data structures efficiently from scratch.

Less

Learning Objectives

- Describe how heaps and priority queues work
- Describe how disjoint set union data structure works
- Analyze the running time of operations with heaps
- List the heuristics that speedup disjoint set union
- Apply priority queues to schedule jobs on processors
- Apply disjoint set union to merge tables in a database

Less

Coursera Lab Sandbox BETA

- Easily launch Coursera's preconfigured environment for C++, Java, and Python 3 programming
- Get access to all dependencies (libraries and packages) for VSCode—no local software installation required
- Practice C++, Java, and Python 3 programming, run test cases, and work on assignments from your browser

Open Lab Sandbox

Priority Queues: Introduction

Video: Introduction 6 min Resume

Video: Naive Implementations of Priority Queues 5 min

Reading: Slides 10 min

Priority Queues: Heaps

Video: Binary Trees 1 min

Reading: Tree Height Remark 10 min

Video: Basic Operations 12 min

Video: Complete Binary Trees 9 min

Video: Pseudocode 8 min

Reading: Slides and External References 10 min

Priority Queues: Heap Sort

Video: Heap Sort 10 min

Video: Building a Heap 10 min

Video: Final Remarks 4 min

Quiz: Priority Queues: Quiz 6 questions Due Aug 16, 1:59 AM CDT

Reading: Slides and External References 10 min

Disjoint Sets: Naive Implementations

Video: Overview 7 min

Video: Naive Implementations 10 min

Reading: Slides and External References 10 min

Disjoint Sets: Efficient Implementation

Video: Trees for Disjoint Sets 7 min

Video: Union by Rank 9 min

Video: Path Compression 6 min

Video: Analysis (Optional) 18 min

Quiz: Quiz: Disjoint Sets 4 questions Due Aug 16, 1:59 AM CDT

Reading: Slides and External References 10 min

Programming Assignment 2

Practice Quiz: Priority Queues and Disjoint Sets 3 questions

Programming Assignment: Programming Assignment 2: Priority Queues and Disjoint Sets 2h Due Aug 16, 1:59 AM CDT

Survey

Survey 10 min