Data Structures and Algorithms

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1 Introduction

These seminar notes contain my overview of the Data Structures and Algorithms course held at University of Bucharest. Because the course is based on heavy theoretic lectures, I tried a more practical approach to present some of the notions by discussing problems which arise natural from the main course.

Most of the problems come from a romanian website specialized on programming contests as well as codeforces or topcoder [1–3]. Of course, there are more interesting problems to tackle, but unfortunately I limit to the course material although sometimes I will talk about some ad-hoc problems.

2 Seminar I

Synthesise first 2 courses:

- Basic notions of time and memory complexity.
- Stacks and Queues.

2.1 Sketch

What is an algorithm? How can we measure the time complexity of a program? Examples (Choosing every pair of elements and erathosthene sieve). Introduction to stacks and queues. Details about their implementation and a short tutorial in STL. Can also talk about circular queues and double ended queues.

2.2 Partial Sums without subtracting

2.3 Checking if an expression is has brackets in right order

2.4 Emulate a queue using 2 stacks

2.5 Editor [4]

2.6 Alee [5]

2.7 Trompeta [6]

2.8 Tsunami [7]

2.9 Take-Out [8]

2.10 Devices

You are given a row of n devices, each consuming some subset of k¡=8 different resources when turned on, and producing some amount of energy when turned on. For each l from 1 to n you need to find the smallest r such that it's possible to turn on some devices from the segment [l;r] such that no two devices turned on consume the same resource, and that the total energy of the devices turned on is at least z [9].

3 Seminar II

- Divide and conquer, merge-sort, estimating complexity
- Binary search, fast exponentation and matrix multiplication

References

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4. WebSite: Editor https://www.infoarena.ro/problema/editor.
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7. WebSite: Tsunami https://www.infoarena.ro/problema/tsunami.
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