

ICS 261 – Fall 2003 – Final Exam

Name:

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1. Draw a suffix tree for the string “abcabac”.

2. Suppose we are given a collection of vertical prisms (i.e. polyhedra with triangular top and bottom faces, and vertical sides), each with a priority. Each of these can be represented by 9 numbers: six coordinates in the x - y plane representing the triangular cross-section of the prism, the two z coordinates of the top and bottom faces, and the priority.

We wish to answer queries in which we are given a three-dimensional point and must find the maximum priority prism containing it.

There exists a (complicated) data structure for solving a related problem: given a collection of triangles in the plane, we can find the maximum priority triangle containing a two-dimensional query point in time $O(\sqrt{n})$ per query.

Describe how to combine the triangle data structure with segment trees to solve the prism problem. What is the time per query for your combined data structure?

3. Draw a Cartesian tree for range minima on the sequence of values 8, 10, 3, 7, 1, 5, 6, 2, 9, 4.

4. Comparison of binary search tree structures. In each of the following two questions, you may assume that you already have efficient implementations of both red-black trees and splay trees, and must choose which of the two to use in some application.

(a) Under what circumstances might it be preferable to use a red-black tree instead of a splay tree? Explain your reasoning.

(b) Under what circumstances might it be preferable to use a splay tree instead of a red-black tree? Explain your reasoning.

5. Suppose we wish to design a data structure for performing union-find operations in a partially persistent way; that is, unions are performed as before but each union creates a new version of the data structure and each find operation specifies the version in which the find should be performed. Would it work to combine the node-copying method of persistence with path compression? Why or why not?

You may use this page (or the back of the other pages) as scratch paper.