CSCI 5020 External Memory Data Structures: Assignment 2

Due Day: Nov 27, 2014

Please write down your solution in latex, and submit a pdf. Grading will be done based on:

1. Whether your solution is correct.
2. The quality of your writing.

Problem. Let $\mathcal{I}$ be a set of N intervals in $\mathbb{R}$ that do not *partially intersect* each other. That is, for any two intervals s_1, s_2 in $\mathcal{I}$, exactly one of the following can happen:

- they are disjoint;
- s_1 is covered by s_2 (i.e., $s_1 \subseteq s_2$);
- s_2 is covered by s_1.

Given a value in $\mathbb{R}$, an *order-sensitive stabbing query* reports all the intervals of $\mathcal{I}$ covering q in ascending order of their left endpoints. Describe a fully dynamic structure to index $\mathcal{I}$ such that the structure consumes $O(N/B)$ space, answers a query in $O(\log_B N + K/B)$ I/Os (where K is the number of intervals reported), and supports each insertion and deletion in $O(\log_B N)$ amortized I/Os. You may assume $M \geq B^2$ if necessary.