6.851 Advanced Data Structures (Spring'14)

Prof. Erik Demaine   TAs: Timothy Kaler, Aaron Sidford

| Problem 2 | *Due: Monday, Feb. 24*

Be sure to read the instructions on the assignments section of the class web page.

Fast Interval Stabbing in Linear Space

Given a set of n intervals $[a_1, b_1], [a_2, b_2], \ldots, [a_n, b_n]$ in one dimension, describe and analyze a static data structure that supports the following query operation:

- `stab(x)`: Return all intervals $[a_i, b_i]$ such that $a_i \leq x \leq b_i$.

Each call to `stab(x)` should take time $O(\log n + k)$ where k is the number of intervals returned by `stab(x)`. The total space used by your data structure should be $O(n)$ and the total preprocessing time needed to initialize your data structure should be $O(n \log n)$.

Technical Notes

- Your data structure should work in the comparison model. The a_i, b_i, and x belong to an arbitrary partially ordered set X and in $O(1)$ time you can compute the relative order of any two elements in X.

- By "return an interval" we mean output the index and endpoints of the interval, i.e., return the tuple (i, a_i, b_i) for the interval i which starts at a_i and ends at b_i.