6.851 Advanced Data Structures (Spring’12)
Prof. Erik Demaine

Problem 1  Due: Thursday, Feb. 23

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

Creationist successor. Given an ordered universe $U$ of keys, develop and analyze a fully retroactive data structure that maintains $S \subseteq U$ and supports the following operations:

- **insert($k$)**: Insert $k \in U$ into $S$
- **delete($k$)**: Remove $k \in U$ from $S$
- **successor($k$)**: Return $\min\{k' \in S \mid k' \geq k\}$

under the constraint that all insert operations must occur at time $-\infty$. All operations should run in time $O(\log m)$, where $m$ is the total number of updates performed in the structure (retroactive or not). Observe that such a structure is sufficient to answer the “rightward ray shot” queries needed for the nonoblivious retroactive priority queue.

A simple reference to the logarithmic time data structure for general retroactive successor is not a valid solution to this problem. This is a special case of that problem, and a much simpler solution is desired.