6.851 Advanced Data Structures (Spring'10)

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Problem 5   *Due: Thursday, Mar. 11*

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

Cartesian trees in linear time. Show that a Cartesian tree for an array $A[1, \ldots, n]$ can be computed in $O(n)$ time.
Hint: One way to do this is adding the elements of A according to their order in A one after another.

Space requirements for integer data structures. As usual, u denotes the size of the universe. We assume that u is a power of 2.

1. Show that a van Emde Boas tree needs $O(u)$ space.

2. How many entries are stored in the hash table of an x-fast tree in the worst case after adding n elements? In the lecture we gave a brief argument for $n \log u$. However, this estimate was rough, since we overcounted the entries in the hash table. In particular, an entry in the hash table might be a prefix of different "keys", and we assume that every prefix is only stored once. Give a sharper bound for the number of elements stored in the hash table in terms of u and n.