Marts 2011

MADALGO seminars by Kasper Green Larsen, Aarhus University

Talk one:
Range Selection and Median: Tight Cell Probe Lower Bounds and Adaptive Data Structures

Abstract:
Range selection is the problem of preprocessing an input array A of n unique integers, such that given a query (i,j,k), one can report the k'th smallest integer in the subarray $A[i]$, $A[i+1]$,…, $A[j]$. In this talk we consider static data structures in the word-RAM for range selection and several natural special cases thereof.

The first special case is known as range median, which arises when k is fixed to $\lfloor (j-i+1)/2 \rfloor$. The second case, denoted prefix selection, arises when i is fixed to 0. We prove cell probe lower bounds for range selection, prefix selection and range median, stating that any data structure that uses S words of space needs $\Omega(\lg n/\lg(Sw/n))$ time to answer a query. In particular, any data structure that uses $n\lg^{O(1)}n$ space needs $\Omega(\lg n/\lg\lg n)$ time to answer a query, and any data structure that supports queries in constant time, needs $n^{1+\Omega(1)}$ space. For data structures that uses $n\lg^{O(1)}n$ space this matches the best known upper bound.

Joint work with Allan Grønlund Jørgensen

Talk two:
(Approximate) Uncertain Skylines

Abstract:
Given a set of points with uncertain locations, we consider the problem of computing the probability of each point lying on the skyline, that is, the probability that it is not dominated by any other input point. If each point's uncertainty is described as a probability distribution over a discrete set of locations, we improve the best known exact solution. We also suggest why we believe our solution might be optimal. Next, we describe simple, near-linear time approximation algorithms for computing the probability of each point lying on the skyline.

Joint work with Peyman Afshani, Pankaj K. Agarwal, Lars Arge, and Jeff M. Phillips