DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
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Randomized Analytic Decision Trees

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Abstract: How many comparisons are needed to find the maximum, or the median, of n real numbers, if we allow randomization, and the free computation of any analytic real function of the inputs. Rabin (1972) proved that $n-1$ comparisons are needed to verify that a given element is the maximum if no error is allowed, and Ting and Yao (1994) gave a randomized algorithm for finding the maximum with $O(\log^2 n)$ expected number of comparisons if a small error probability is allowed. We present a new simple proof of Rabin's result and extend this to show that for all $k < n-1$, at least k comparisons are needed to verify that a given element is the maximum if the error probability is less than $1/2^k$. We further show that $\Omega(n)$ comparisons are needed to verify that a given element is the median of n real numbers if the error probability is $O(1/n^{3/2})$.

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