

Nonadaptive quantum query complexity

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We study the power of nonadaptive quantum query algorithms, which are algorithms whose queries to the input do not depend on the result of previous queries. First, we show that any bounded-error nonadaptive quantum query algorithm that computes some total boolean function depending on n variables must make $\Omega(n)$ queries to the input in total. Second, we show that, if there exists a quantum algorithm that uses k nonadaptive oracle queries to learn which one of a set of m boolean functions it has been given, there exists a nonadaptive classical algorithm using $O(k \log m)$ queries to solve the same problem. Thus, in the nonadaptive setting, quantum algorithms can achieve at most a very limited speed-up over classical query algorithms.

Comments: 9 pages; v2: new title, updated with new results on learning

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