

# Optimization of Partial Search

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## ABSTRACT

Database search has many applications and used widely. Grover discovered a quantum algorithm that searches faster than any classical algorithm. It consists of repetition of the Grover iteration. I shall call it a global iteration [search in a whole database].

Sometimes it is sufficient to find an approximate location of the target item. A partial search considers the following problem: a database is separated into several blocks. We want to find a block with the target item, not the target item itself. A good example is the following: assume that exact location of the target item is given by a sequence of many bites, but we want to find only some of these bites. Another example is: A teacher has an ordered list of final grades of students in a class. The teacher only wants to know if a student is in the first 25 % of the list, in second, third or forth; not an exact number [position] of a student from the top of the list.

One can find the target block faster than the target item [trade accuracy for speed]. Quantum partial search algorithm was recently suggested by Grover and Radhakrishnan in [1]. They showed that it works faster than classical partial search. This algorithm uses several global iterations and then several local iterations. Local iteration is a Grover iteration in a block [made in parallel in every block]. Local iteration is a search in each individual block, as opposed to global iteration, which searches the whole database. The algorithm was improved and simplified in [2]. I optimized Grover-Radhakrishnan algorithm: I minimized the number of queries to the oracle in [3]. Other partial search algorithms are considered in [4], they consist of different sequences of local and global searches. The comparison led me to a conjecture that my version of Grover-Radhakrishnan algorithm is optimal in a wide class of partial search algorithms: arbitrary sequence of local and global searches. Efficiency of search algorithms is measured by number of queries to the oracle [total number of iterations]. Partial search can use the same hardware as the full search.

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