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Combinatorial Optimization with Quantum Computers*

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Abstract. Quantum computers leverage the principles of quantum mechanics to do computation with a potential advantage over classical computers. While a single classical computer transforms one particular binary input into an output after applying one operator to the input, a quantum computer can apply the operator to a superposition of binary strings to provide a superposition of binary outputs, doing computation apparently in parallel. This feature allows quantum computers to speed up the computation compared to classical algorithms. Unsurprisingly, quantum algorithms have been proposed to solve optimization problems in quantum computers. Furthermore, a family of quantum machines called quantum annealers are specially designed to solve optimization problems. This article provides an introduction to quantum optimization from a practical point of view. It introduces the reader to the use of quantum annealers and quantum gate-based machines to solve optimization problems.

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