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### **Complexity of the Quantum Adiabatic Algorithm**

The Quantum Adiabatic Algorithm (QAA) has been proposed as a mechanism for efficiently solving optimization problems on a quantum computer. Here, we discuss several applications of the algorithm and analyze its efficiency by considering several hard problems. This is done mainly by studying the size dependence of the typical minimum energy gap of the Hamiltonian using quantum Monte Carlo methods. While for most problems we find that the minimum gap decreases exponentially with the size of the problem, indicating that the QAA is not more efficient than existing classical search algorithms, for other problems there is evidence to suggest that the gap may be polynomial near the phase transition.