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Benchmarking the D-Wave adiabatic quantum optimizer via 2D-Ising spin glasses ZHIHUI WANG, SERGIO BOIXO, TAMEEM ALBASH, DANIEL LIDAR, Universiy of Southern California — We present results on benchmarking the D-Wave One quantum optimizer chip using random 2D Ising spin problems. Finding the ground state of the 2D Ising model with randomly assigned local fields and couplings is NP-hard. The chip attempts to find the ground state via quantum annealing, interpolating between a transverse field and the final Ising Hamiltonian. The experimentally obtained final states are checked against exact results and the performance of the chip is characterized by the probability of finding the ground state and the estimated annealing time for finding the ground state with high probability. By analyzing results for 8 to 108 spins, the scaling of the estimated annealing time as a function of the number of spins is compared with the computation time required by classical solvers. The correlation between classical and quantum hardness is also studied. Furthermore, we analyze the correlation between the experimental success probability and the minimum energy gap during the quantum annealing, as well as the interplay between the adiabatic condition and thermalization.

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