Day 2

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Title: Characterization of QUBO reformulations for the maximum k-colorable subgraph problem

Abstract:
Quantum annealers can be used to solve constrained combinatorial optimization (COPT) problems thanks to penalization methods that embed the COPT problem's constraints in its objective to obtain a quadratic unconstrained binary optimization (QUBO) reformulation of the COPT. However, the way in which this penalization is carried out, affects the penalty parameter values, as well as the number of additional binary variables that are needed to obtain the desired QUBO reformulation. In turn, these factors affect the ability of quantum computers to solve constrained COPT problems. Improving this ability is key towards the goal of using quantum annealers to solve constrained COPT problems more efficiently than with classical computers. Along these lines, we consider an important constrained COPT problem; namely, the maximum k-colorable subgraph (MkCS) problem , in which the aim is to find an induced k-colorable subgraph with maximum cardinality. This problem arises in channel assignment in spectrum sharing networks, VLSI design, and human genetic research. We derive two QUBO reformulations for the MkCS problem, and fully characterize the range of the penalty parameters that can be used in the QUBO reformulations. Also, we benchmark these QUBO reformulations by performing numerical tests on D-Wave's quantum annealing devices.

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