AIDAN ROY, D-Wave Systems, Inc.
Mixed-integer linear programs and graph minors for quantum annealing

Quantum annealing (QA) is a type of computation which exploits quantum mechanical effects to solve discrete optimization problems, potentially faster than any classical algorithm. D-Wave Systems has developed a QA processor that optimizes over a restricted problem class, namely quadratic pseudo-boolean optimization problems, which allows scaling to many more qubits than is currently possible with gate-model quantum computers. However, the ability to solve real-world problems is still limited by issues of noise, connectivity, and size.

In this talk, I will present some interesting problems in discrete mathematics that arise from attempting to circumvent those limitations. First, I'll describe how noise and finite temperature in QA lead to mixed-integer linear programs for finding QUBOs, and I'll present new solution methods using SMT solvers. Second, I'll explain how sparse processor connectivity leads to a search for graph minors, and I'll describe a heuristic algorithm for finding them.