Applications of quantum annealing in combinatorial optimization

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Propositions

pertaining to the thesis

"Applications of quantum annealing in combinatorial optimization"

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1. The hardness experienced by quantum hardware when solving problems can be from sources other than the known complexity of said problems, and is often due to the physical constraints in the realization of quantum processors. (Chapter 3)

2. It is important to evaluate quantum hardware within the context the experimental procedure was performed; a limited set of problem instances for a certain problem class can be used to elucidate specific insights, but may not be generalizable to other problem classes. (Chapter 3)

3. Transforming real-world combinatorial optimization problems to QUBO/Ising may result in unmitigable overhead for quantum annealing hardware, and therefore, not every problem class is a good fit. (Chapter 4)

4. While hybrid algorithms can provide value in overcoming quantum hardware limitations, their quality, and therefore usefulness, is always bottlenecked by the quantum hardware. (Chapters 4&5)

5. It is important to consider multiple architectures and qubit types to implement quantum processors, as each technology has its own unique pros and cons.

6. Increasing qubit count alone is not sufficient for quantum annealers to provide practical value for combinatorial optimization.

7. Attempts to abstract quantum algorithms such that the particularities of quantum hardware are hidden from users does not help, but rather hinders, advancement towards quantum advantage in the absence of error correction.

8. The machine learning trope "a model is only as good as the data it's fed" has an analogy in optimization: "an optimization algorithm is only as useful as its optimization target".

9. Good research requires an open-minded flexibility in pursuit of well-founded research questions, regardless of the status quo in the field.