Solving NP-Complete and Quantum- Merlin-Arthur$_1$ Problems with Quantum Circuits

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Abstract

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1 Introduction

Any computation that can be formulated as a Quadratic Unconstrained Binary Optimization (QUBO) problem [1] *Add more references for QUBO* can be carried out on an adiabatic quantum computer [2].

There are three types of problems that we would like to solve using the *D-Wave 2000Q* quantum computer [3]. Firstly, we propose a design solving the classic NP-complete problem, k- boolean/propositional satisfiability (k-SAT) problem, where $k > 2$. Secondly, we want to solve quantum- Merlin-Arthur$_1$ problems with quantum circuits. Lastly, we propose a quantum circuit to solve problems in maximum satisfiability (Max-SAT), pseudo-boolean optimization (PBO), and weighted boolean optimization (WBO) by formulating

2 Quantum SAT Solving

[1].

References

[1] Miguel F. Anjos and Jean B. Lasserre. Handbook on Semidefinite, Conic and Polynomial Optimization, volume 166 of International Series in Operations Research & Management Science. Springer Science+Business Media, LCC, New York, NY, 2012.

[2] Prateek Tandon, Stanley Lam, Ben Shih, Tanay Mehta, Alex Mitev, and Zhiyang Ong. Quantum Robotics: A Primer on Current Science and Future Perspectives, volume 10 of Synthesis Lectures on Quantum Computing. Morgan & Claypool Publishers, San Rafael, CA, January 2017.

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[3] Universities Space Research Association staff. Quantum computing – RFP. Available online from *Universities Space Research Association: Quantum Computing at USRA* at: http://www.usra.edu/quantum/rfp/; September 1, 2017 was the last accessed date, 2015.