CO 781 - Quantum Algorithms

Outline

We will discuss commonly used techniques for quantum algorithm design and some of the significant quantum algorithms developed to date. We will also cover aspects of quantum computing theory which are closely related to quantum algorithms. A tentative list of topics is as follows:

- Basic quantum subroutines
- Quantum algorithms for Hidden Subgroup Problems
- Quantum walk algorithms
- Quantum query complexity
- Quantum algorithms for Hamiltonian dynamics
- Quantum algorithm for linear systems of equations
- Limits of classical simulation of quantum computer

Resources

QIC 710: Introduction to Quantum Information Processing, course taught by J. Yard. Link

[AMC] Andrew Childs' lecture notes on quantum algorithms. Link

[NC] M. Nielsen and I. Chuang. Quantum Computation and Quantum Information, Cambridge University Press (2000).

[KSV] A.Y Kitaev, A.H. Shen, M.N. Vyalyi. Classical and Quantum Computation, American Mathematical Society (2002).

[KLM] P. Kaye, R. Laflamme, and M.Mosca. An Introduction to Quantum Computing. Oxford University Press (2007).

Prerequisites

A working knowledge of quantum computation including a familiarity with the quantum circuit model and basic quantum algorithms.