PHYS 7348
Theory of Quantum Computation
Spring 2022

Instructor: Prof. Mark M. Wilde, Phone number: (225) 578-4323

Time and Location: Monday, Wednesday 1:30-2:50pm, Room: Nicholson 106.

Office Hours: Monday 3pm-4pm, Room: Nicholson 447

Required Textbook: none

Recommended Textbooks: *Quantum Computation and Quantum Information*, Nielsen and Chuang.
An Introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, and Michele Mosca
Classical and Quantum Computation, Alexei Yu. Kitaev, Alexander H. Shen, and Mikhail N. Vyalyi

Prerequisites: Linear Algebra and Probability Theory. Exposure to Computer Algorithms, Theory of Computation, or Quantum Mechanics is helpful but not required.

Material: The field of quantum computation exploded in 1994 when Peter Shor published his algorithm that can break RSA encryption codes. Since then, physicists, mathematicians, and engineers have been determining the ultimate capabilities for quantum computation and many quantum algorithms have been established as well. Quantum computation has now fundamentally altered our understanding of computation and complexity theory. Furthermore, it is inevitable that Moore's law will break down, and at this point quantum mechanical effects will be unavoidable. The idea of quantum computation is to harness these effects (rather than avoid them) in order to speed up computations for certain tasks. If you take this course, you will learn about the well known quantum algorithms for factoring integers and database search and in addition you will learn how quantum computation has altered our understanding of computation. The only prerequisites necessary are a course in linear algebra and probability theory (which are standard components in any graduate education in electrical engineering, computer science, mathematics, or physics).

Grading: There will be five assignments and a final presentation. The homeworks will be worth 70% and the final presentation 30%. Homeworks will typically be due every other Wednesday in class.

Presentation: The final presentation will be a useful way for the students to become more familiar with some of the research topics in the quantum computation literature.