Private Reading: Quantum Computing

Phys 995F, 4 Credits

Spring 2025

Instructor

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Student

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Meetings

- Time: Fridays, 12:30 pm
- Location: Wright 103

Textbook

"Quantum Computer Science: An Introduction" by N. David Mermin

Course Description

This private reading consists of an introduction to quantum computation, developing the basic elements of the field from a computer-science perspective. Since quantum computers are finite-state systems, we can ignore much of the complexity of quantum mechanics in dealing with continuous systems, focusing on abstract models that allow us to solve computational problems.

Learning Goals

- To become familiar with how one can use the theory of quantum mechanics to perform computations;
- To see famous applications of quantum computing and examples of speed-ups; and
- To get experience with the implementation and execution of quantum-computing protocols.

Assignments

- **Weekly Presentations:** At every meeting, Iago will present on the topic of the week's reading. These presentations will be between 30 minutes and 1 hour in length. In preparation, Iago will write presentation notes that will serve as a summary for future reference.

- **Coding Projects**: After Spring Break, Iago will focus on the parts of the textbook about protocols that use just a few Qbits. At that time, Iago's preparation will also involve implementing these protocols in code and potentially running them in quantum computers from IBM's free-access platform.

Evaluation

The final grade will be determined on a Pass / No Pass basis. The completion of 80% of the assignments listed above will result in a passing grade.

Tentative Schedule

Week	**Topic**	**Reading**
1 (02/04)	Course overview	–
2 (02/14)	Cbits and Qbits	Ch. 1
3 (02/21)	General features and examples	Ch. 2
4 (02/28)	Breaking RSA encryption	Ch. 3
5 (03/07)	Searching with a quantum computer	Ch. 4
6 (03/14)	Quantum error correction	Ch. 5
– (03/21)	*Away for a conference*	–
– (03/28)	*Spring break*	–
7 (04/04)	Project: Bells state	Sec. 6.1
8 (04/11)	Project: Quantum cryptography	Sec. 6.2
9 (04/18)	Project: Bit commitment	Sec. 6.3
10 (04/25)	Project: Quantum dense coding	Sec. 6.4
11 (05/02)	Project: Teleportation	Sec. 6.5
12 (05/09)	Project: The GHZ puzzle	Sec. 6.6