CSE 599d - Quantum Computing

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Course Website:
`http://www.cs.washington.edu/cse599d`
Mailing List:
`tba`

Lectures: Monday, Friday 1:30-3:00 p.m. and Wednesday 1:00-2:30pm in CSE 503
Dates: 20 Lectures from Jan. 4 through Feb. 17.
Instructor Office Hours: By appointment in 460 CSE

Useful Supplementary Material
Good textbook:
Quantum Computation and Quantum Information by Michael Nielsen and Isaac Chuang

Good lecture notes:
John Preskill's lecture notes
`http://www.theory.caltech.edu/people/preskill/ph229/`
David Mermin's lecture notes
`http://people.ccmr.cornell.edu/~mermin/qcomp/CS483.html`

Course Description: An introduction to and survey of the field of quantum computing. Quantum computation is an emerging field whose goal is to design effectively atomic sized computers which exploit the parallelism of the quantum mechanical laws of the universe. While this sounds futuristic, quantum computers are fast becoming a reality, and have the potential to revolutionize computation over the next twenty years. Topics include quantum algorithms, quantum error correction, and quantum cryptography. This course will give you the knowledge to understand why quantum computers can break certain public key cryptosystems, the engineering challenges in building a physical quantum computing device, and the level of security assured by quantum crytopgraphic devices. Prior knowledge of quantum theory is not necessary.

Format: This course will be taught with mostly blackboard lectures (some powerpoint may also be used.) Lecture notes will be available on the course website.

Homework: There will be three homework assignments which will be due Jan 20, Feb 3, and Feb 17.

Reading: Supplementary reading material from classic papers of the field will be posted on the website as the class progresses.

Academic Accommodations: To request academic accommodations due to disability, please contact disabled Student Services, 448 Schmitz, (206) 543- 8924 (V/TTY). If you have a letter from Disabled Student Services indicating that you have a disability that requires academic accommodations, please present the letter to me so we can discuss the accommodations you might need in this class.

Course Outline:

Lecture 1-5: Brief history, the postulates of quantum theory, Dirac notation, the quantum circuit model
Lecture 6-7: Simple quantum protocols: teleportation, superdense coding, Deutsch's algorithm Lecture 8: The Deutsch-Jozsa Algorithm and the Bernstein-Vazirani Algorithm
Lecture 9-10: Simon's algorithm and Shor's algorithm for factoring/discrete log
Lecture 11: Grover's algorithm for searching
Lecture 12-13: Entanglement and Bell's theorem
Lecture 14-15: Open quantum systems
Lecture 16-19: Quantum error correction
Lecture 20: Quantum cryptography