

UNIVERSITY OF SOUTHERN CALIFORNIA
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 599 — Quantum Algorithms
Fall 2012

Instructor: Ben Reichardt
EEB 528
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(213) 740-7229
office hours TBA

Lecture times: TBA

Topics: Algorithms for quantum computers, with a focus on recent developments. Quantum search, amplitude amplification. Phase estimation, factoring and the abelian and nonabelian hidden subgroup problems. Classical and quantum simulations of quantum systems. Quantum walks, learning graphs, span programs. Quantum query complexity, and limits on the power of quantum computers.

Reading: Course lecture notes, journal articles

Required preparation: Background in quantum computation, such as from EE 520

Grading: **Homework:** 40%

Scribing: 10%

Final project: project and presentation 50%

Schedule:

Week	Subjects
1	Quantum computation in the circuit model, Solovay-Kitaev theorem
2	Abelian quantum Fourier transform (QFT), Phase estimation
3	Hidden subgroup problem (HSP), Factoring and discrete logarithm
4	Nonabelian HSP, HSP in the dihedral group, Nonabelian Fourier analysis
5	Unstructured search, Amplitude amplification and applications
6	Polynomial method, Adversary lower bounds
7	Discrete-time quantum walks
8	Simulating Hamiltonian dynamics, Continuous-time quantum walks
9	Element distinctness, Glued trees traversal
10	Formula evaluation, Discrete to continuous time correspondence
11	Adversary upper bounds, State generation
12	Span programs, Learning graphs and applications
13	Adiabatic optimization algorithms and universality
14	Anyons, Quantum algorithms for estimating topological invariants
15	Student projects and presentations

Statement for Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>