TEXAS A&M UNIVERSITY

SYLLABUS

Course title and number	CSCE 440/640: Quantum Algorithms
Term	Spring 2019
Meeting times and location	M/W 5:45 – 7pm HRBB 126
Course webpage	https://fangsong.info/teaching/s19_4640_qc/
Piazza	https://piazza.com/tamu/spring2019/csce440640/home

Course Description and Prerequisites

The law of quantum physics enables quantum computing, a new paradigm of computation. It allows for solving certain problems that are intractable on classical computers. In this course, we will study the basic principles and techniques of quantum computing, and discuss some exciting applications. The goal is to equip you with the essential tools to appreciate and further pursue in this advancing area.

Previous knowledge in quantum mechanics is NOT required. This course will be theory-oriented involving reading and writing a lot of mathematical proofs. Maturity in algorithm analysis, linear algebra, and basic probability theory will be essential.

Instructor Information

Name	Fang Song
Telephone number	979-458-1904
Email address	fang.song@tamu.edu start subject line with “S19-QC”
Office hours	T 3 – 5 pm and by appointment
Office location	HRBB 427B

Textbook and/or Resource Material

No text required. We will primarily follow online lecture notes.

Recommended texts (online access available via TAMU library. Print copies on reserve at Evens library):

- [KLM] Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing, Oxford University Press (2007)*.
- David Mermin, *Quantum Computer Science: An Introduction, Cambridge University Press (2007).*
- Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, *Cambridge University Press (2000)*.

Grading Policies

Homework: 40%. 5 assignments. Late homework is accepted, subject to penalty of 20% (<1 day), 40% (1-2 days), 60% (2 – 3 days), and 100% (> 3days).
Collaboration on homework problems is highly encouraged, but you must write up solutions entirely on your own and clearly indicate who you worked with for each problem.

Project: 30%. Proposal (5%), in-class presentation (15%) and final report (10%).

Mid-term exam: 20%.

Participation: 10%.

Grading Scale: A = 90-100 B = 80-89 C = 70-79 D = 60-69 F = <60

Course Topics, Calendar of Activities, Major Assignment Dates*

Week	Topic	Reading
1 – 3	Math background review; quantum information basics: qubit, measurement, tensor product, entanglement etc. ; simple quantum circuits and protocols: e.g., teleportation.	Watrous lecture notes 1 - 4 Supp: KLM Chapter 2 - 5
4 – 8	Fundamental quantum algorithms: Deutsch, Deutsch-Josza, Simon, Phase estimation, Order findning, Shor's quantum factoring algorithm, Grover's quantum search algorithm.	Watrous lecture notes 5 – 13 Supp: KLM Chapter 6 - 8
9 – 12	Quantum information theory: mixed state, density matrix, entropy, compression, Holevo bound, quantum error correction and fault tolerance.	Watrous lecture notes 14 – 17 Supp: KLM Chapter 10
13	Selected Advanced Topics: e.g., quantum supremacy, quantum-safe cryptography.	Research papers: AarosonChen'CCC17, BFNV'ITCS19
14 – 15	Group project presentations	

* Check course webpage for details and updates

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit http://disability.tamu.edu.

Academic Integrity

For additional information please visit: http://aggiehonor.tamu.edu

"An Aggie does not lie, cheat, or steal, or tolerate those who do."