

State University of New York Polytechnic Institute

CS 538 : Innovative Technologies Seminar

Instructor: Dr. Chen-Fu Chiang
Term: Fall 2019
Time: M 2:00 pm -3:15 pm
Location: Kunsela Hall C104
Office Hours: MW: 10:30 am - 11:30 am | 3:30 pm - 4:30 pm
F: 10:40 am - 11:50 am | by appointment
Office: Kunsela C225
Email: chiangc@sunypoly.edu
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Recommended Text

Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction
Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder

An Introduction to Quantum Computing
Phillip Kaye, Raymond Laflamme and Michele Mosca
Oxford, ISBN-10: 019857049X

Quantum Algorithm Implementations for Beginners
arXiv:1804.03719v1

IBM Qiskit documentation

Note

1. Students are encouraged to work together in study groups, up to size of 3.
2. It is preferred that the students have taken CS 528 Quantum Computing.

Course Description

This course aims at equipping our students with knowledges regarding blockchain technology and quantum technology. Students are expected to come to class prepared by finishing the reading assignments in order to participate in the seminar. Reading assignments will be given at the end of each class. This will be an implementation oriented class. At the end of the semester, each team will be expected to implement at least one blockchain system and one near term quantum algorithm using software.

Student Learning Outcomes

Upon completion of this course the student should be able to:

- Describe the foundations of Blockchain systems
 - Simulate a blockchain network on a small scale
 - Exploit the translations of a quantum algorithm into 1-qubit or 2-qubit gates (universal gate set) from the quantum gate model perspective
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- Implement the near-term quantum algorithms on Qiskit

Topics

- Blockchain Technology
 1. Bitcoin || Consensus protocols || Proof of work || Proof of stake
 2. Ethereum || Solidity
 3. Mining attack || Cross-chain transactions || Scaling blockchains
- Quantum Algorithms and Their Implementations
 1. Quantum Walk (QW, both discrete and continuous) based algorithms
 2. Quantum Approximation Optimization (QAOA) based algorithms
 3. Variational Quantum Eigensolver (VQE) based algorithms
 4. From QAOA to QW and back. What is the catch?

Grading (Tentative)

The lecture format will be the basic mechanism used in the course. Computer demonstrations in the classroom will be used whenever appropriate. Assessment of student performance will use a criterion-referenced model which will include written assignments (50%) and project (50%). **Late assignment will not be accepted unless you have made prior arrangements with me.** The acceptable format of your solution will be specified in the assignment. All examinations are closed-book. A typical grading scale will be as follows:

Percent	Grade
[89.5 - 100]	A
[79.5 - 89.5)	B
[69.5 - 79.5)	C
[59.5 - 69.5)	D
Below 59.5	F

(+/- modifiers will also be used ; for instance, [95.5-100]: A+, [92.5-95.5): A, [89.5-92.5): A-)

Attendance Policy

Attendance and active class participation are required. Be prepared to participate by asking and answering questions during class meetings. Please send me an email if you know you have to miss a class.

Academic Integrity/Policy

Plagiarism and Cheating of any kind on an examination, quiz, or assignment will result at least in an F for that assignment (and may, depending on the severity of the case, lead to an F for the entire course).

I will assume for this course that you will adhere to the academic creed of this University and will maintain the highest standards of academic integrity. In other words, do not cheat by giving answers to others or taking them from anyone else. The code of academic conduct is detailed in the SUNY Poly student handbook. Make-ups are only given under extreme circumstances. I will adhere to the standards of academic integrity, so please do not ask me to change (or expect me to change) your grade illegitimately or to bend or break rules for one person that will not apply to everyone.

Accommodations for Students with Disabilities registered at SUNY Polytechnic Institute

Academic Adjustments for Students with Disabilities In compliance with the Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act, SUNY Polytechnic Institute is committed to ensuring comprehensive educational access and accommodations for all registered students seeking access

to meet course requirements and fully participate in programs and activities. Students with documented disabilities or medical conditions are encouraged to request these services by registering with the Office of Disability Services. For information related to these services or to schedule an appointment, please contact the Office of Disability Services using the information provided below.

Evelyn Lester, Director
Office of Disability Services
lestere@sunypoly.edu
(315) 792-7170

Utica Campus
Peter J. Cayan Library, L145
Albany Campus
Suite 309, Students Services Office
NanoFab South