

Quantum Computing (量子計算) 2025

Lecturer: 江振瑞

Teaching Assistants (TAs): 黃文翰 林橋毅

Time: 週二 14:00~16:50

Place: 週二 工五館 E6-A210

Goal: Leading students to understand the basic principles of quantum computing and the developments and the applications of the latest quantum computing technologies. (帶領學生了解量子計算基本原理及最新量子計算技術之發展與應用)

Scoring :

midterm project (programming) (30%)

oral report in class (20%)

term project (programming) (30%)

homework, reports and in-class participation (20%)

Textbooks:

江振瑞, 輕鬆學量子程式設計 -- 從量子位元到量子演算法, 碁峰資訊
(ISBN: 9786263242715, 2022/08)

Reference Books:

張元翔, 量子電腦與量子計算, 碁峰資訊, 2020.

莊永裕(譯), 圖解量子電腦入門, 臉譜, 2020.

林志鴻, 張仁瑀, 徐育兆, 林橋毅, 劉子睿, 林侑恆, 量子電腦應用與世界級競賽實務, 2021.

M. A. Nielsen, and I. L. Chuang, Quantum Computation and Quantum Information, 2002.

Syllabus:

1. Introduction to quantum computing -- From quantum bit to quantum algorithm (qc-talk.pptx)
2. Quantum programming for the first time to differentiate classical bits from qubits (with superposition and entanglement), Dirac notation, qubit state vector and Bloch sphere
3. Quantum gates, unitary matrices, quantum teleportation, and quantum circuits
4. Introduction to quantum algorithms: Deutsch, Deutsch-Jozsa, Grover's, and Shor's algorithm
5. Oral reports on papers discussing quantum algorithms (1)
6. Oral reports on papers discussing quantum algorithms (2)
7. Oral reports on papers discussing quantum algorithms (3)
8. Midterm Project
9. Introduction to quantum annealing algorithms (1)
10. Introduction to quantum annealing algorithms (2)
11. Introduction to hybrid classical-quantum optimization algorithms
12. Introduction to quantum cryptography and post-quantum cryptography
13. Oral reports on papers discussing quantum algorithms (4)
14. Oral reports on papers discussing quantum algorithms (5)
15. Oral reports on papers discussing quantum algorithms (6)
16. Term Project