Course: Introduction to Quantum Computing

Instructor: Prof. Renata Wong

Why Study Quantum Computing?

Quantum computing is an emerging computing paradigm that uses the principles of quantum mechanics to process information. Although large-scale quantum computers are still under development, governments, research institutions, and technology companies are investing heavily in this field because of its potential applications in optimization, simulation, cryptography, machine learning, and scientific computing.

For students in artificial intelligence and computer science, quantum computing provides insight into alternative models of computation and serves as a foundation for future developments in quantum technologies.

This course is a prerequisite for the department's **Quantum Machine Learning** and **Quantum Information** courses.

Course Highlights

- Learn the fundamental concepts of quantum computing, including qubits, quantum measurement, superposition, interference, entanglement, quantum gates, and quantum circuits.
- Gain hands-on programming experience using Python and IBM's Qiskit framework.
- Create and simulate quantum circuits and implement fundamental quantum algorithms.
- Learn how to use modern cloud-based quantum computing platforms.
- Build the theoretical foundation required for advanced studies in quantum technologies.
- Apply core techniques including the Quantum Fourier Transform and Grover's search algorithm.

Recommended Background

Students should be comfortable with basic programming concepts (preferably Python) and high-school level mathematics, including linear algebra and complex numbers. Prior knowledge of quantum physics is helpful but **not required**.

This course is suitable for students interested in quantum information, artificial intelligence, computer science, data science, and emerging computing technologies.