EPFL

MATH-646

Reading group in quantum computing

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Cursus	Sem.	Type
Mathematics		Opt.

Language of teaching	English
Credits	3
Session	
Exam	Oral presentation
Workload	90h
Hours	**56**
Lecture	28
Practical work	28
Number of positions	**18**

Frequency

Every year

Summary

Quantum computing has received wide-spread attention lately due the possibility of a near-term breakthrough of quantum supremacy. This course acts as an introduction to the area of quantum computing. After the course, the students will have an basic understanding of quantum algorithms.

Content

In this reading group, we will explore quantum computing. We will begin by introducing basic linear algebra concepts such as the Bra-Ket notation, tensor products, and unitary operators. Next, we will present the framework of quantum mechanics, including quantum states, time-evolution of a closed system, composite systems, measurement, and mixed states. We then proceed with quantum circuits, superdense coding, quantum teleportation, and quantum algorithms, such as the Deutsch algorithm, Simon's algorithm, and the quantum Fourier transform.

After the first lecture, the attendees will take turns to prepare and give a lecture. This will be the main form of examination.

The lecture will closely follow the book "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca. Other ressources include the lecture notes of Lin Lin (https://math.berkeley.edu/~linlin/qasc/).

Note

The conditions to get credits is to attend at least 75% of the lectures and give one lecture (or more depending on the nr of participating students).

Keywords

Quantum computing, linear algebra, quantum mechanics

Learning Prerequisites

Required courses

The students should have a solid understanding of basic linear algebra concepts such as inner products, outer products, Kronecker products, the spectral theorem, orthogonal projectors.

Learning Outcomes

By the end of the course, the student must be able to:

- Develop a basic understanding of quantum mechanics, measurements, and quantum algorithms.

Resources

Bibliography

The lecture will closely follow the book An Introduction to Quantum Computing by Phillip Kaye, Raymond Laflamme, and Michele Mosca. Other reseources include the lecture notes of Lin Lin (https://math.berkeley.edu/~linlin/qasc/).

Ressources en bibliothèque

- An Introduction to Quantum Computing / Kaye

Moodle Link

- https://go.epfl.ch/MATH-646