UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Introduction to quantum computing

86R-XXXVI-IQC

Aims

Describe the main quantum algorithms, including the factorisation and search ones. Outline the physical systems to implement quantum computation.

Contents

In these lectures we present the essential mathematical tools to deal with quantum computation, its formalism and the main quantum algorithms.

- Why quantum computation?
- Binary notation and Dirac formalism for classical logic.
- Quantum bits (qubits).
- Quantum evolution and quantum circuits.
- The standard computational process.
- Deutsch, Deutsch-Josza and Berstein-Vazirani algorithms.
- Grover algorithm for quantum search.
- Quantum Fourier transform (QFT).
- Application of the QFT: the phase estimation protocol.
- Shor algorithm for factorisation.
- Physical realisation of quantum computers and quantum computation.

Detailed program

- Why quantum computation?
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Prerequisites

Basic knowledge of quantum mechanics.

Teaching form

1 CFU, 8-10 hours, language: English.

The lectures will be held using Zoom, here the link and the information to join:

https://us02web.zoom.us/j/84252763970?pwd=L1htZnM1L1d1RTUvRmtELys5amNwZz09

Meeting ID: 842 5276 3970

Passcode: 080509

For further information stefano.olivares@unimi.it

Textbook and teaching resource

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Semester

May 2021

Assessment method

The exam consists of an oral exam lasting about one hour in which the student describes some aspects of quantum computing (quantum algorithms, physical implementations of quantum computers,...) and proves to have acquired familiarity with the topics covered in the course.

Office hours

By e-mail appointment.