METU Department of Computer Engineering
CENG487 Introduction to Quantum Computing
Fall 2021

Format: This class will be conducted purely face to face, except for the first two weeks when we will meet only online via zoom.

Instructor: Murat Manguoğlu
Teaching Assistant: Ercan Selçuk Bölükbaşı
Office hours: Thursdays 14:00-15:00
Office: A407
Office hours: Mondays 15:30-16:30
Office: A208

Prerequisites: Linear Algebra and Algorithms are required. A background in Physics is not required.

Textbooks:
- Quantum Computing for Computer Scientists, Yanofsky and Mannucci, 2008

Grading:
1x in class Midterm exam. : %20
1x in class Final exam. : %30
4x Homeworks : %50

Homeworks: 4 homework assignments will be implemented on a real quantum computer and/or on a simulator.

Exams: Midterm and finals are going to be on campus, closed books and notes but you can bring a handwritten A4 size cheatsheet.

Coverage (Tentative):
- Introduction, history and motivation
- Basic operations with 1 qubit and Elitzur-Vaidman bomb
- Multi qubit systems and Bell states
- Teleportation and superdense coding
- Quantum parallelism and Deutsch’s algorithm
- Deutsch-Jozsa and Simon’s algorithms
- Common and alternative physical implementations of quantum computers, quantum noise and basic quantum error correction
- Quantum Fourier transform
- Quantum phase estimation and eigenvalue solver
- Quantum order finding and Shor’s algorithm
- Grover’s search algorithm
- Quantum counting
- Quantum algorithms for linear systems and their application in machine learning and other emerging topics
- Quantum supremacy
Conduct of the lectures:

- All announcements are going to be made in odtuclass
- BMB5 Windows are going to be kept open even during the coldest days of winter so please bring your coat
- Masks are required and you are required to be away from each other at least by 1 meters indoors
- Breaks are for 20 minutes and you are required to leave the classroom during breaks
- At the end of the class I will just wait outside the building in case you have any questions after the last lecture of each day
- In an unfortunate event that forces us to switch back to online, in class exams will be then conducted as oral exams via Zoom