METU Department of Computer Engineering  
CENG798 Quantum Computing  
Spring 2023

Hours & Location: Friday 13:40-16:30 BMB2 (online)  
(To join the Zoom meeting, you need to login to Zoom via your @metu.edu.tr account)

Instructor: Murat Manguoğlu  
Email: manguoglu@ceng.metu.edu.tr  
Office hours: Thursday 14:00 (online)

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

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

Grading:
- Project (proposal) %20  
- Project (presentation) %30  
- Project (paper) %50

Projects will have three components: proposal, paper and presentation. We will post a list of possible topics but you can choose a different topic as well. The proposal and paper should be written using LaTeX. The proposal should contain a title, a paragraph or two describing your planned paper and a preliminary list of references. We will devote last few days of the class for presentations. The presentation should be done at level that is understandable by a person who has only a basic knowledge of quantum computing. After the presentation of your results, you will have time until the end of finals to finalize your paper.

Coverage (Tentative):
- Introduction, history and motivation, basic operations with 1 qubit and Elitzur-Vaidman bomb  
- Multi qubit systems, bell states, and teleportation and superdense coding  
- Quantum parallelism, Deutsch’s, 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  
- Grover’s search algorithm  
- Quantum counting  
- Quantum algorithms for linear systems and their application in machine learning  
- Quantum computational complexity classes