

Spring 2024

**MATH:7830 Topics in Applied Mathematics  
Mathematics of Quantum Computing**

**Time and location.** 9:30A - 10:45A TTh 217 MLH

**Instructor.** WEIMIN HAN; weimin-han@uiowa.edu, 335-0784, 25D MLH

Office hours: 10:50 - 11:40 am (T), 1:00 - 2:40 pm (Th), and by appointment

**DEO Contact Information:** Prof. Ryan Kinser, 14 MLH, ryan-kinser@uiowa.edu

**Objectives and Goals of the Course:** Quantum computing is becoming a focal point of interest and it represents the next leap forward for computing. It enables to process massive and complex datasets more efficiently than classical computers. It has the potential to revolutionize computation by making certain classically intractable problems solvable.

This course focuses on basic mathematics that are useful to understand quantum computing and to develop theoretical tools needed for research and applications of quantum computing in future career. The prerequisite of the course is solid knowledge on linear algebra/matrix theory and some degree of math maturity.

**Textbooks.** The main textbook is

Wolfgang Scherer, *Mathematics of Quantum Computing: An Introduction*, Springer, 2019.

You can download a free PDF file of the textbook from the website of UI libraries.

Many good books are available on quantum computing for additional reading. A very popular and comprehensive textbook is (not required for this course)

M. A. Nielsen and I. L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, ISBN-13: 978-1107002173, 2011.

**Grading.** There will be several sets of homework problems; solutions to the homework problems can be found at the end of the textbook. If you have questions on the homework problems, feel free to ask me during the office hours. We may discuss some of the problems during the class. There will be a take-home final exam at the end of the semester. This course uses the plus/minus grading system.

Students are expected to attend the classes, and are responsible for changes to the syllabus. Collaboration on the homework is permitted. No collaboration on the final exam is allowed.

The final course grade will be based on class attendance, the homework, and the final exam:

Attendance 40%

Homework 30%

Final Exam 30%

Grades will be assigned according to the following scale:

0	50	53	57	60	63	67	70	73	77	80	90	99
F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A	A+

**Academic Honesty and Misconduct:** All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty. Undergraduate academic misconduct must be reported by instructors to CLAS according to these procedures. Graduate academic misconduct must be reported to the Graduate College according to Section F of the Graduate College Manual.

**Student Complaints:** Students with a complaint about a grade or a related matter should first discuss the situation with the instructor, and then with the Department Chair. Students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

**Drop Deadline for this Course:** You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a “W” will appear on your transcript. The mark of “W” is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar’s website. Undergraduate students can find policies on dropping CLAS courses here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

**Attendance and Absences:** You are required to attend all lectures and discussions. Attendance will be taken regularly. If you must miss a class, you are still responsible for the material discussed in class and for all the announcements made in class.

University regulations require that students be allowed to make up examinations that have been missed due to illness, religious holy days, military service obligations (including service-related medical appointments), or other unavoidable circumstances or University-sponsored activities. Such circumstances do not include attendance at a wedding, a family vacation, obligations related to work or other such matters. Students with UI-authorized activities must discuss their absences with the instructor as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

**Communication:** Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community. For the privacy and the protection of student records, UI faculty and staff can only correspond with UI email addresses.

**Mental Health Resources and Student Support:** Students are encouraged to be mindful of their mental health and seek help as a preventive measure or if feeling overwhelmed and/or struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, includ-

ing resources and how to schedule an appointment, can be found at [counseling.uiowa.edu](http://counseling.uiowa.edu). Find out more about UI mental health services at [mentalhealth.uiowa.edu](http://mentalhealth.uiowa.edu).

**Student Care and Assistance** provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at [basic-needs.uiowa.edu/resources/](http://basic-needs.uiowa.edu/resources/). Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, [dos-assistance@uiowa.edu](mailto:dos-assistance@uiowa.edu), or 319-335-1162) for support and assistance with resources.

**Accommodations for Students with Disabilities:** The University is committed to providing an educational experience that is accessible to all. If a student has a diagnosed disability or other disabling condition that may impact the student's ability to complete the course requirements as stated in the syllabus, the student may seek accommodations through Student Disability Services (SDS). SDS is responsible for making Letters of Accommodation (LOA) available. The student must provide an LOA to the instructor as early in the semester as possible, but requests not made at least two weeks prior to the scheduled activity for which an accommodation is sought may not be accommodated. The LOA will specify what reasonable course accommodations the student is eligible for and those the instructor should provide. Additional information can be found on the SDS website.

Classroom Expectations

Free Speech and Expression

Non-discrimination

Absences for Religious Holy Days

Sexual Harassment/Misconduct and Supportive Measures