Quantum Computing

CS 333
About Me

• Shelby Kimmel (call me Professor Kimmel, Professor)
• **My research:** quantum algorithms and complexity
• **Academic Background:** Williams undergrad, MIT grad school, University of Maryland postdoc
• **Non-academic Background:** internships at Raytheon, Fulbright (English Teaching Assistant) South Korea
Find a partner or two, and brainstorm as many responses as you can to the following question:

• What do you know about quantum computing?
This Class:

We will learn how quantum mechanics can give advantages in computer science applications from communication, cryptography, and algorithms.

Learning Goals

• Apply linear algebra and other mathematical tools to describe, analyze, and solve problems related to quantum information and computation protocols.
• Build intuition about quantum mechanics and its properties that lead to advantages over standard computation.
• Appreciate the limits of quantum computation.
Learning from biological perspective

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- New connections are created by repeatedly practicing new behavior. By practicing any task, you can rewire your brain to become “smart” at that skill.

- Trying to do a task for the first time can sometimes feel unpleasant… but this is when the most learning happens.
Take-aways

- Embrace that feeling of difficulty when you are learning something new.
  - Don’t give up
  - This is NOT a sign of inability/failure.
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  – Don’t give up
  – This is NOT a sign of inability/failure

• Give you brain time to form new connections
  – Don’t cramming for tests
  – Don’t do the problem set the night before it is due.
Take-aways

• Practice the skills you need (for exams)
  – Don’t read over your notes
  – Practice as many problems as possible
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• You might not be able to change your mindset immediately, but keep practicing this new approach, and it will become easier, and make you a better learner.
Active Learning

• In class, I will often ask you to solve problems and answer questions. (This helps you to build new connections in your brain.)

• Because you are learning, I don’t expect you to answer correctly. Won’t be graded on response (other than for participation)

• Opportunity for you to get feedback on whether you understand.

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Syllabus – with a partner:

- Each person reads one page, then explains key points to partner.
- What are 3 questions you have about the syllabus?
Syllabus – with a partner:

Questions similar to quiz questions:

• What is the purpose of the problem set reflection?
• How should you use the Discussion section of Canvas?
• If you have difficulty with a problem set problem, which of the following options are acceptable?
  o go to office hours
  o e-mail me
  o discuss with a classmate
  o look online for solutions
  o do the best you can, write on your problem set what you tried, look at my solution when doing the self-grade, write about why you had difficulty in your reflection, and then try to solve the problem or similar problems from scratch
Website tour!

go/CS333
Announcements

• Fill out questionnaire
• PreQuiz due Wednesday at midnight
• Quiz Monday on syllabus
• First problem set due next Wednesday
• Not registered – come talk to me.