Math Foundations of Computer Science

CS 200
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
This Class:

You will learn about **mathematical ideas and techniques** that are **useful for computer science**. This will help you to **communicate clearly** with other computer scientists and programmers, and **understand** many of the more complex concepts in computer science.

Learning Goals

- Ability to think like a computer scientist (using the tools of mathematics).
- Ability to communicate like a computer scientist (using the language of mathematics).
- Proficiency using common mathematical tools of computer science.
Find a partner or two, and brainstorm as many responses as you can to the following question:

• What is an example of a connection between math and computer science?
Learning from biological perspective

- Learning is the process of developing new connections between neurons in your brain.
Learning from biological perspective

• Learning is the process of developing new connections between neurons in your brain.

• New connections are created by repeatedly practicing new behavior. By practicing any task, can rewire your brain to become “smart” at that skill.
Learning from biological perspective

• Learning is the process of developing new connections between neurons in your brain.

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

• Trying to do a task for the first time can sometimes feel unpleasant…
Take-aways

• Give yourself time
  – No cramming
  – Don’t start problem set the day before it is due

• Try to embrace the feeling of difficulty
  – That is when you are learning
  – Don’t give up
Take-aways

• Practice the skills you need
  – Practice problems are better than reading over notes to prepare for quiz
Learning from growth mindset perspective

<table>
<thead>
<tr>
<th>Fixed Mindset</th>
<th>Growth Mindset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task A is easy because I’m smart.</td>
<td>This is easy because my brain already has necessary connections.</td>
</tr>
<tr>
<td>Task B hard because I’m bad at this type of thinking.</td>
<td>This is hard because I need to create connections in my brain that weren’t there before.</td>
</tr>
</tbody>
</table>
## Self-test

<table>
<thead>
<tr>
<th></th>
<th>Fixed Mindset Reaction</th>
<th>Growth Mindset Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Challenges</strong></td>
<td>Avoid</td>
<td>Embrace</td>
</tr>
<tr>
<td><strong>Effort</strong></td>
<td>Problem</td>
<td>Progress</td>
</tr>
<tr>
<td><strong>Criticism</strong></td>
<td>Personal</td>
<td>Helpful</td>
</tr>
<tr>
<td><strong>Failure</strong></td>
<td>Evidence of inability</td>
<td>Temporary</td>
</tr>
<tr>
<td><strong>Success of others</strong></td>
<td>Threatening</td>
<td>Inspiring</td>
</tr>
</tbody>
</table>
Take away

- Even if you don’t have a growth mindset now, you can develop one, because the brain is malleable!
Take away

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• Developing a growth mindset will tend to increase your learning (grade) and make learning more enjoyable.
Take away

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• Developing a growth mindset will tend to increase your learning (grade) and make learning more enjoyable.

• Learning takes time and practice.
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.
- Opportunity for me to get feedback on whether you understand.
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?
  - What is my policy on technology in the classroom and why?
  - 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?
    - go to office hours
    - go to tutoring hours
    - e-mail me
    - discuss with a classmate
    - look online for solutions
    - do the best you can, write on your problem set what you tried, look at my solution when doing the self-grade, reflect on why you struggled in the reflection, and re-solve the problem or similar problems to prepare for the quiz
Syllabus – with a partner:

• Solution:
  • If you have difficulty with a problem set problem, which of the following options are acceptable?
    o go to office hours - YES
    o go to tutoring hours - YES
    o e-mail me - NO
    o discuss with a classmate - YES
    o look online for solutions – SIMILAR PROBLEMS OK, SAME NOT OK
    o do the best you can, write on your problem set what you tried, look at my solution when doing the self-grade, reflect on why you struggled in the reflection, and re-solve the problem or similar problems to prepare for the quiz - YES
Website tour!

go/CS200
Announcements

• Taken a lot of math classes? You might not need this class
• Pre-Quiz due today by midnight
• Fill out questionnaire by Friday
• Quiz Friday on syllabus
• First problem set due Monday
• Not registered – come talk to me.