Algorithms and Complexity

CS 302
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 questions:

- What makes an algorithm good?
- What algorithms or algorithmic approaches have you studied in classes?
- What other algorithms have you heard of?
This Class:

Algorithms are important from a practical perspective (when creating programs or software), but they are also crucial for addressing some of the BIG questions of computer science: what can computers do, and what resources do they need to do it?

Learning Goals

• Ability to apply standard algorithmic paradigms to create, analyze runtime, and prove the correctness of algorithms for common, real-world problems.
• Appreciation of the creativity and beauty involved in algorithm design.
• Appreciation of the connection between algorithms and data structures.
• Awareness of the limits of efficient algorithms.
My goal: Help you to learn about algorithms and complexity

• One of the best ways to become a better learner is to develop a growth mindset. [Dweck]
Learning from biological perspective

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• Trying to do a task for the first time can sometimes feel unpleasant…
# 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>
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<tr>
<td></td>
<td><strong>Growth Mindset Reaction (1 pt each)</strong></td>
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<tr>
<td>------------------------</td>
<td>----------------------------------------</td>
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<tr>
<td><strong>Challenges</strong></td>
<td>Embrace</td>
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<tr>
<td><strong>Effort</strong></td>
<td>Progress</td>
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<tr>
<td><strong>Criticism</strong></td>
<td>Helpful</td>
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<tr>
<td><strong>Failure</strong></td>
<td>Temporary</td>
</tr>
<tr>
<td><strong>Success of others</strong></td>
<td>Inspiring</td>
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</table>
Take away

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

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

• What are 3 questions you have about the syllabus?
• Questions similar to quiz questions:
  • What is the purpose of Part 2 of the problem set?
  • What is my policy on technology in the classroom?
  • 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, then for Part II write a reflection about what you had difficulties with, and why.
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    - discuss with a classmate
    - look online for solutions
    - do the best you can, then for Part II write a reflection about what you had difficulties with, and why. Try to solve the problem from scratch once you’ve seen a sample solution
Website tour!

go/cs302
Announcements

• Fill out questionnaire
• Quiz Friday on syllabus
• First problem set due Monday
• Not registered – come talk to me.