Algorithms and Complexity

CS 302

Learning Goals (for today):

- Familiarize yourself with course basics
- Be able to describe learning
- Understand motivation for technology and group policies
- Recall Some Tools: Strong Induction, Recurrence Relations

Learning Goals (for this class):

- 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.

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Outline…

About Me

- Shelby Kimmel (call me Professor Kimmel, Professor, she/her pronouns)
- **My research:** Quantum Computing
- **Academic Background:** Williams undergrad, MIT grad school, University of Maryland postdoc
- **Non-academic Background:** internships at Raytheon, Fulbright (English Teaching Assistant) South Korea

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- Understand motivation for technology and group policies
- Describe inductive proofs at a high level

Learning from biological perspective

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Learning Take-aways

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  - No cramming
  - Start problem set early (Rough Draft!)

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- Learning is Uncomfortable (at first)
  - Don’t give up

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- Practice the skills you need
  - Practice problems are better than reading over notes to study
  - We'll do a lot of in-class problem solving (not graded for correctness!)

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- My role is not so much teacher as guide

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- Studies show students who write notes on paper learn more than those who type
- Studies show students who use laptops/phones spend up to 1/3 of their time "zoning out" (using Instagram, checking e-mail, etc) and consequently have lower exam scores
- Studies show if you use a laptop, your classmate's exam scores will be lower.

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Policy: Use technology judiciously. Avoid unless there is a good reason for it.

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What behavior should I look for in a group that is maximizing learning?

- Active listening: rephrase what a group mate said
- Ask questions if you don't understand
- Be skeptical of what others say – suggest alternate approaches.
- Encourage participation
- Make sure everyone in the group understands a point before moving forward

Website tour!

go/CS302

MergeSort

Input : Integer array A of length n
Output: Sorted array

```
   // Base Case
1  if n == 1 then
2  |  return A;
3  end

   // Divide and Conquer
4  A_1 = MergeSort(A[1 : n/2]);
5  A_2 = MergeSort(A[n/2 + 1 : n]);

   // Combine
6  p_1 = p_2 = 1;
7  for i=1 to n do
8  |  if A_1[p_1] < A_2[p_2] then
9  |  |  A[i] = A_1[p_1];
10 |  |  p_1++;
11 |  else
12 |  |  A[i] = A_2[p_2];
13 |  |  p_2++;
14 |  end
15 end
```