CSCI 3104 Fall 2021
Instructors: Profs. Grochow and Waggoner

Midterm 2- Standard 22

Due Date ..... TODO
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Contents

1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to LaTeX.
- You should submit your work through the **class Canvas page** only. Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.
- You **must** virtually sign the Honor Code (see Section 2). Failure to do so will result in your assignment not being graded.

2 Honor Code (Make Sure to Virtually Sign)

Problem 1.

- My submission is in my own words and reflects my understanding of the material.
- I have not collaborated with any other person.
- I have not posted to external services including, but not limited to Chegg, Discord, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

Agreed (john blackburn). □

3 Standard 22- DP: Write Recurrence

Problem 2. A *transmission* on n seconds (where $n \geq 0$ is an integer) is an ordered sequence of signals, drawn from s_1 and s_2, where s_1 takes one second to send and s_2 takes two seconds to send. Assume there is no delay between signals. Construct a recurrence to count the number of distinct transmissions we can send in n seconds. Make sure to include your base cases. Justify your recurrence.

Answer. Let $T(n)$ denote the recurrence.

when $n = 0$ the only transmission we can send is no transmission so $T(0) = 1$. When $n = 1$ $T(1) = 2$ because we can send no message and a message using only s_1. As for when $n > 1$ we have two cases that it breaks down to:

Case 1: s_1 is our first signal sent, the rest of our sequence is now of length $n - 1$, therefore it is the same problem as $T(n - 1)$ with s_1 in front if it. And there are $T(n - 1)$ ways to choose this.

Case 2: s_2 is the first signal sent, the rest of our sequence is now of length $n - 2$, therefore it is now the same problem as $T(n - 2)$ with s_2 in front of it. And there are $T(n - 2)$ ways to select this.

Therefore the entire recurrence is:

$$T_n = \begin{cases} 1 & : \text{n=0,} \\ 2 & : \text{n=1,} \\ \text{T(n-1)+T(n-2)} & : n > 1. \end{cases}$$

□