CSCI 3104 Fall 2021
Instructors: Profs. Grochow and Waggoner

Midterm 1- Standard 2

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.

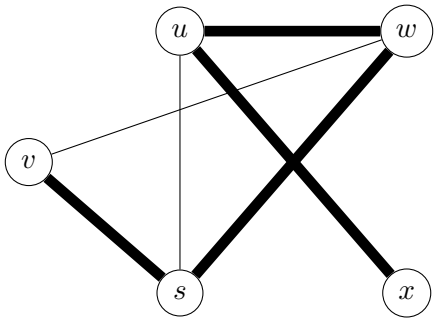
- My submission is in my own words and reflects my understanding of the material.
- I have not collaborated with any other person.
- I have not posted to external services including, but not limited to Chegg, Discord, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they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

Agreed (John Blackburn). □

3 Standard 2- BFS and DFS

3.1 Problem 2

Problem 2. Consider the undirected, unweighted graph $G = (V, E)$ with $V = \{s, u, v, w, x\}$ and $E = \{su, sv, sw, uw, ux, vw\}$, and let $T \subseteq E$ be $T = \{sv, sw, uw, ux\}$. This is pictured below with T represented by wide edges.



Carefully explain why T cannot be output by BFS with start vertex s for any choices of iteration order over neighborhoods in the algorithm.

Answer. The BFS algorithm starts at a source vertex then examines all of the unvisited neighbors of the current vertex before examining vertices further away. In order to accomplish this, we place the neighbors of the current vertex in a FIFO queue.

So the tree T cannot be output by BFS because it ignores the neighbor u when examining the neighbors of the source vertex s. BFS will examine the edges to v, u, and w every time it starts at s and add them to it's queue. No matter the order of the queue, edge su will always be added in any variation of BFS done on this graph starting at node s. T does not include this edge within its tree. Therefore, T will never be an output of BFS on this graph starting at node s because it doesn't contain an edge that should be in any variation of BFS. □