CSCI 332, Fall 2025

Homework 5

Due Monday, September 29 Anywhere on Earth (6am Tuesday)

Submission Requirements

- Type or clearly hand-write your solutions into a PDF format so that they are legible and professional. Submit your PDF on Gradescope.

- Do not submit your first draft. Type or clearly re-write your solutions for your final submission. If your submission is not legible, we will ask you to resubmit.

- Use Gradescope to assign problems to the correct page(s) in your solution. If you do not do this correctly, we will ask you to resubmit.

Academic Integrity

Remember, you may access *any* resource in preparing your solution to the homework. However, you *must*

- write your solutions in your own words, and

- credit every resource you use (for example: "Bob Smith helped me on this problem. He took this course at UM in Fall 2020"; "I found a solution to a problem similar to this one in the lecture notes for a different course, found at this link: www.profzeno.com/agreatclass/lecture10"; "I asked ChatGPT how to solve part (c)"; "I put my solution for part (c) into ChatGPT to check that it was correct and it caught a missing case.") If you use the provided LaTeX template, you can use the `sources` environment for this. Ask if you need help!

1. (1 point) Choose any graph or graph algorithm property we have discussed in class, on a quiz, in a Prairie Learn or written homework and we have not proved *via induction* (okay if we have proved some other way!) and state it formally. (This should probably start with something like "for all graphs of some type,...") You will prove it by induction in problem 2. Here are some examples of graph properties and algorithms we have discussed:

   - BFS visits every vertex reachable from the source.
   - DFS visit every vertex reachable from the source.
   - The index of the layers produced by BFS are the shortest path distances of nodes in that layer from the source.

   You should be able to find more! Or if there is something you want to prove about graphs or graph algorithms but we didn't discuss yet in this course, feel free to ask and I will likely say yes.

2. (8 points) Prove the property or algorithm you stated in problem 1 by induction. No points if you do not use the exact boilerplate we covered in class and on the Prairie Learn assignment (universal declaration, induction hypothesis, base and inductive case, and wrap up sentence).

3. (1 point) What resources did you use for this assignment? (If you only used the textbook, lecture notes, and office hours, you can say "none".)