CS 312: Algorithms	**Fall 2018**

Homework 4

Your Name: _____

Collaborators and sources: _____

You may work in groups, but you must write solutions yourself. List collaborators on your submission.

If you are asked to design an algorithm, please provide: (a) either pseudocode or a precise English description of the algorithm, (b) an explanation of the intuition for the algorithm, (c) a proof of correctness, (d) the running time of your algorithm and (e) justification for your running time analysis.

Submission instructions. This assignment is due by noon on Thursday, October 11 in Gradescope (as a pdf file). Please review the course policies on the course home page about Gradescope submissions.

1. **(5 points) Gradescope submission.**

   - The solutions are either typed or written neatly (with ample white-space and no scratching out, etc.).
   - The submission is a pdf.
   - The **Gradescope scanning recommendations** (see their website, which will recommend specific scanning apps) are followed to ensure the scan is high quality.
   - The pages are marked correctly during the gradescope submission.

2. **(5 points) Topological orderings.** *(Work independently.)* K&T Chapter 3, Exercise 1. Please list all of the orderings (the book problem only asks you to say how many orderings the graph has).

3. **(5 points) DAGs.** *(Work independently.)* True or false: if G is a directed graph that has a node with no incoming edges, then G is a DAG. Either prove this statement is true, or give a counterexample to show it is false.

4. **(10 points) Directed Graphs.** Given a directed acyclic graph G, give an $O(m + n)$ time algorithm to determine if the graph has a directed path that visits every vertex.

5. **(0 points).** How long did it take you to complete this assignment?