CS 331: Algorithms and Complexity (Spring 2024)
Unique Number: 52765, 52770

Assignment 2

Due on Thursday, 1 Febrauary, by 11.59pm

Problem 1: Short Answers Section

For this section, restrict answers to no more than a few sentences. Most answers can be expressed in a single sentence. Unless otherwise stated, briefly justify. No proofs are necessary for this section.

(a) True, since at first there is a root node with no edges. Every subsequent node adds one edge.

(b) True

(c) True, BFS would iterate every edge set of every vertex, so $\mid V \mid \cdot \mid V \mid$ edges.

(d) True

(e) False, DFS will in general output deeper trees, but not always.

(f) True, if there were multiple paths, then that means there's a cycle. Trees have no cycles.

Problem 2

(a) True, we can alternate the colors in each layer of the tree. Then, every edge in the tree will be touching a node on layer_n and one on layer_{n+1}, which are different colors.

(b) Nodes can't connect to other nodes on the same layer, as that would create an odd length cycle. However, they can connect to nodes on different layers, so we can multiply the count of nodes per layer together.

Problem 3

I would run a breadth-first search, which has $O(| V | + | E |)$.

Proof. □