CS 624: Analysis of Algorithms Assignment 8 Due: Monday, April 5, 2021

Note that the text uses v.d for what my notes refer to as start[v]—that is, it is the timestamp specifying the "time" at which the vertex v is first reached (and put on the stack) in the depth-first walk.

Similarly v.f in the text is what I have denoted in the notes as finish[v].

- 1. Exercise 22.4-1 (page 614).
- 2. Exercise 22.4-2 (page 614).
- 3. Exercise 22.5-2 (page 620).
- 4. Exercise 22.5-4 (page 620). (This looks complicated and confusing. It isn't.)
- 5. Give an example to show that the pre-order numbering of a DAG may not topologically sort the DAG.
- 6. Prove that if we start with a connected *undirected* graph, then the depth-first walk algorithm always yields a spanning tree (i.e., not a forest of trees).

Be careful: Remember that while the edges of the graph itself are undirected, the edges of the spanning tree are regarded as directed. This is particularly important in the next problem, as well.

7. In an undirected graph G a set of vertices C is called a *clique* iff every two vertices of C are connected by an edge. Prove that in the spanning (directed) tree resulting from a depth-first walk of G, all the vertices of C appear on one directed path. That is, there is a path of tree edges such that every element of the clique is on the path.