CSCI2100: Special Exercise Set 11

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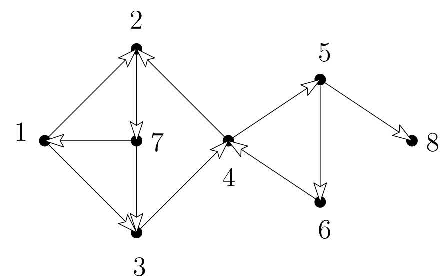
Problem 1. Consider the directed graph below.



Suppose that we perform DFS on this graph by obeying the following rules:

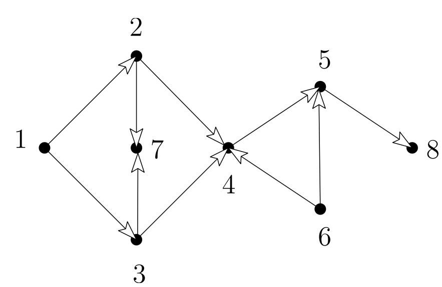
- Start from vertex 1.
- At every vertex, process its out-neighbors in ascending order of id.
- Whenever we need to restart, do it from the white vertex with the smallest id.

Show the resulting DFS forest. Furthermore, for every vertex, indicate its discovery time and finish time.

Problem 2. Consider the DFS you performed in Problem 1. Classify every edge into: a (i) forward edge, (ii) back edge, or (ii) cross edge. Identifies the edge that indicates the presence of a cycle.

Problem 3. Suppose that we perform a DFS on a directed graph $G = (V, E)$. We want to store with each vertex u its level in the DFS tree it belongs to (i.e., root at level 0, its children level 1, and so on). Describe how to adapt DFS for this purpose, while still ensuring that the total running time is $O(|V| + |E|)$.

Problem 4. Consider the directed acyclic graph below.



Give a topological order of the vertices that can be computed by DFS.