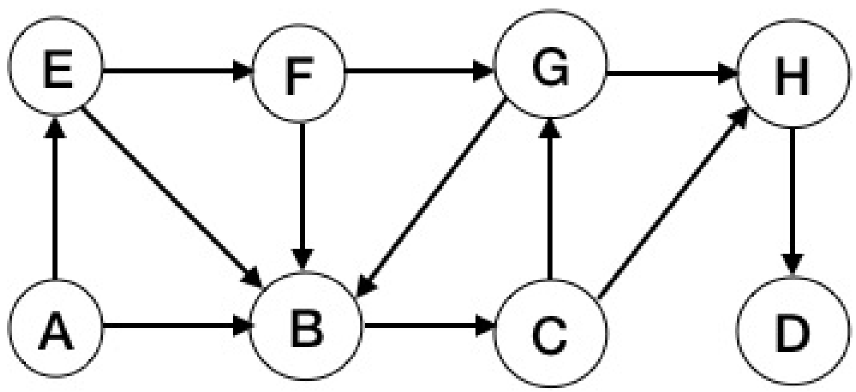
Problem 1. (a) Run BFS algorithm on the directed graph below, using vertex A as the source. Show all distances and the BFS tree.

(b) Run DFS algorithm on the directed graph below, using vertex A as the source. Compute the start time and the finish time of each vertex and draw the DFS tree. Start time of a vertex would be when you first visit it and the finish time, when you visit that last (i.e., you have already explored all the descendants of that vertex). Time for the source starts at 1 and increments by 1 when you visit a vertex.

Note: You may assume that the vertices in each adjacency list is in alphabetical order.



Problem 2. Assume you use breadth-first search to actually find your way out of a maze (consisting of rooms and hallways, which represent the vertices and edges, respectively). One room is the start room, and one room is the exit room. We want to count how many hallways you need to walk down. If you walk down the same hallway twice that counts as two. Each direction counts once, so back-and-forth across a hallway counts as two. The first time you visit a room must be in the order of breadth-first search. Other than that you can be clever.

(a) Assume the maze is one long path of n rooms where you start on one end and the exit is at the other end. How many hallways do you walk down? Justify.

(b) Assume the maze consists of a start room with n-1 other rooms directly connected to it. (In other words it is a star graph.) Assume the last room you visit is the exit room. How many hallways do you walk down? Justify.

(c) Assume the maze is a complete binary tree with $n = 2^h$ - 1 rooms. Assume that the root is the start room. To keep things simple, assume the root is also the exit room but only $after$ you have visited all of the other rooms. How many hallways do you walk down? Justify.

Problem 3. Give a linear time, depth-first-search algorithm to find the size of the largest connected component in a graph, where size is measured by the number of edges in the component. (This should very similar to the algorithm covered in class.)