

1 Graph Representation

Represent the graph above with an adjacency list and an adjacency matrix representation.

2 Searches and Traversals

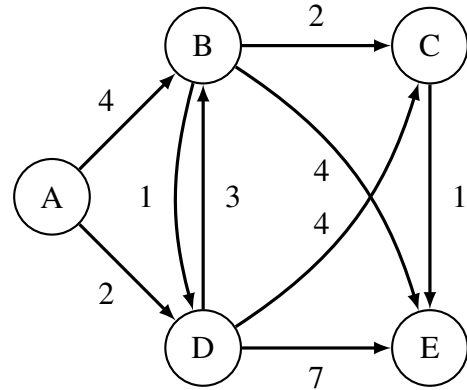
Run depth first search (DFS) and breadth first search (BFS) on the graph above, starting from node A. List the order in which each node is first visited. Whenever there is a choice of which node to visit next, visit nodes in alphabetical order.

3 Topological Sorting

Give a valid topological ordering of the graph. Is it unique?

4 Dijkstra's Algorithm

Given the following graph, run Dijkstra's algorithm starting at node *A*. At each step, write down the entire state of the algorithm. This includes the value $\text{dist}(v)$ for all vertices v for that iteration as well as what node was popped off of the fringe for that iteration.



5 Dijkstra's Correctness

What must be true about our graph in order to guarantee Dijkstra's will return the shortest path's tree to every vertex? Draw an example of a graph that demonstrates why Dijkstra's might fail if we do not satisfy this condition.