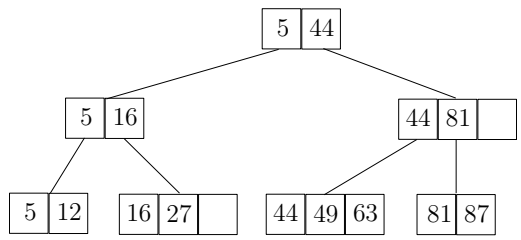
COMP3506/7505: Special Exercise Set 10

Prepared by Yufei Tao

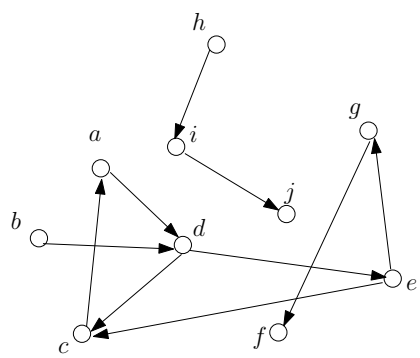
Problem 1. Consider the (2,3)-tree below:



Show the (2,3)-tree after inserting 50.

Problem 2. Show the (2,3)-tree after deleting 27 from the tree in Problem 1.

Problem 3. Consider the following directed graph.



Show a BFS-tree that can possibly produced by running the BFS algorithm starting from a.

Problem 4. Consider the graph in Problem 3. Is the following a possible order of the vertices visited (i.e., discovered) by any BFS execution?

$$d, e, c, g, f, a$$

Problem 5. Consider the graph in Problem 3. Show the DFS-trees obtained by running the DFS algorithm starting from a, and even a restart is needed, from h.

Problem 6. Consider the graph in Problem 3. Is the following a possible order of the vertices visited (i.e., discovered) by any DFS execution?

$$j, i, f, g, e, c, a, d, h, b$$

Problem 7. Let $G = (V, E)$ be a directed graph, given in the adjacency list format. Define a directed graph $G' = (V, E')$ where an edge $(u, v) \in E'$ if and only if $(v, u) \in E$ (namely, G' reverses the direction of each edge in G). Describe an algorithm to obtain an adjacency list representation of G' in $O(|V| + |E|)$ time.