# CSE 373: Section 9

Graphs

November 30th

## Dijkstra's Algorithm

Use Dijkstra's algorithm to find the costs of the shortest paths from vertex $a$ to the other vertices. Show your work at each step and indicate the order which vertices are added to the known set. In the case of a tie, add the vertex that comes first alphabetically.

*Note: the edge (c,d) has negative weight. Run Dijkstra's and observe if this has an effect on the correctness of the output*
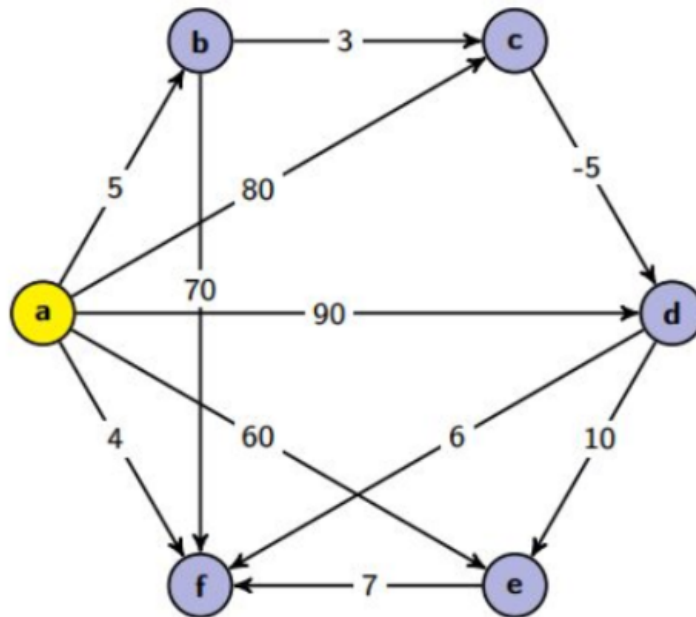
# Minimum Spanning Trees

For the following graph, find the minimum spanning tree using (a) Prim's algorithm and (b) Kruskal's Algorithm.

For Prim's, break ties by choosing the vertex that comes first alphabetically.

For Kruskal's, provide *an* ordering of the edges before running the algorithm. Notice there are multiple possible orderings. Do these orderings create different MSTs?
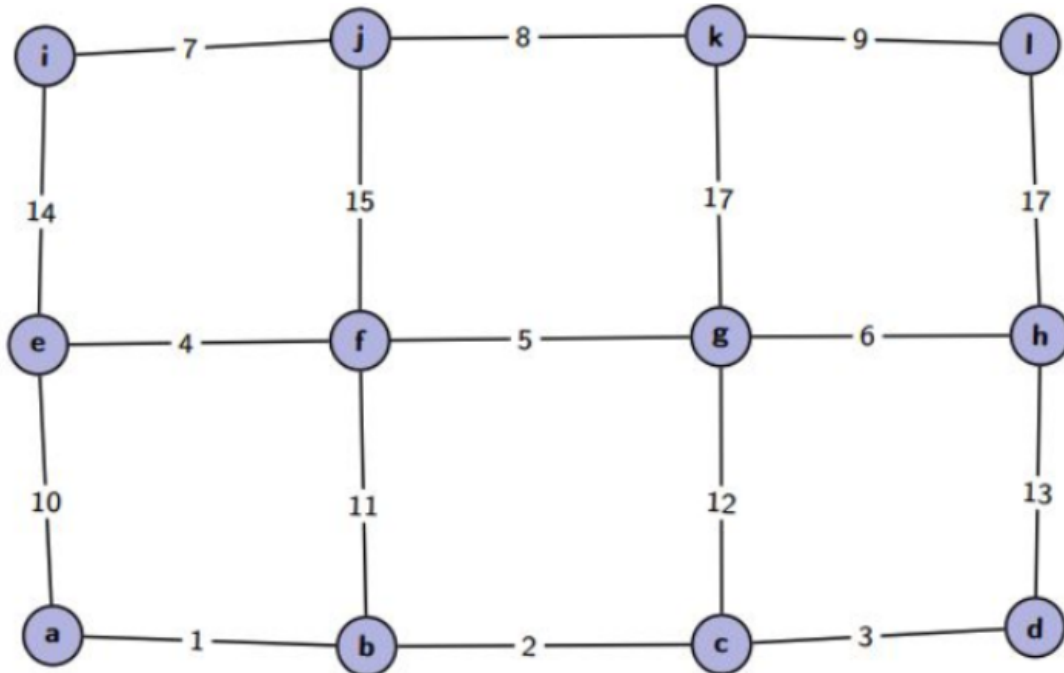
Continue your work here

# Uptrees and Union Find

Given the following up-tree, answer the following questions. Assume that the up-tree implements both weighted unions and path compression.
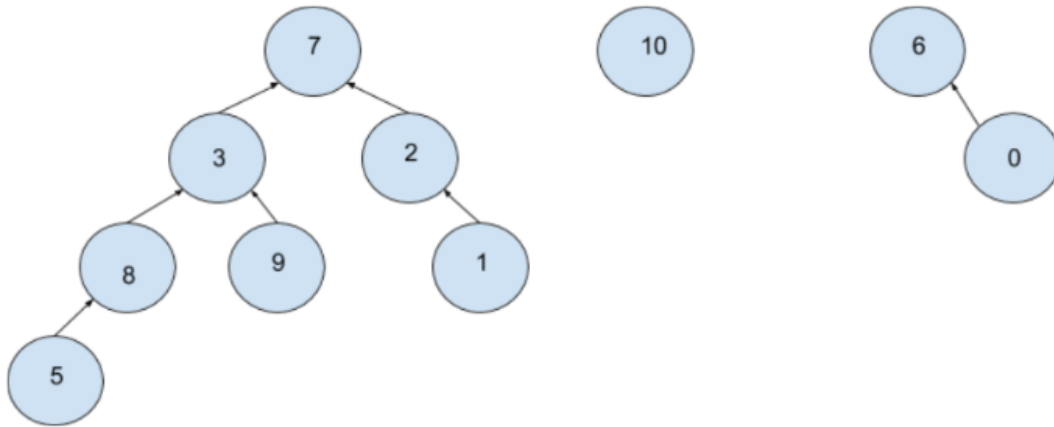


1. Draw the resulting trees after a call to `find(5)`. Also, indicate what will be returned by the call.

2. Give the array representation of the up-tree data structure from part 1 after a call of `union(1,5)`

# Short Answer

1. Suppose you have data from an undirected social network for some people.

   (a) How would you represent this social network in a graph? Consider all graph properties? What factors of the "social network" impact your choices?

   (b) Given two people, how would you determine if they have any mutual friends?

   (c) How would you find the person with the most friends?

   (d) Propose a method to find an individual's degree-of-separation from Paul Erdős.

2. Given a graph $G$ propose a method to find if it has a cycle if it is:

    (a) Undirected

    (b) Directed

    (c) How might the Union-find ADT be helpful for finding cycles in a graph?