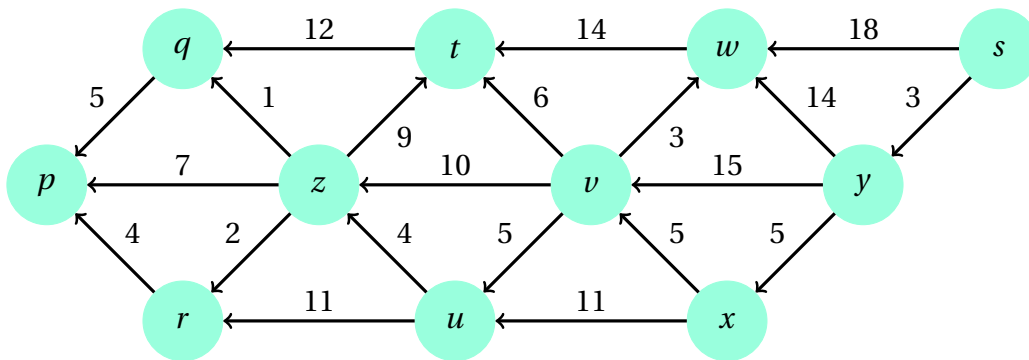


Week 6 Preparation

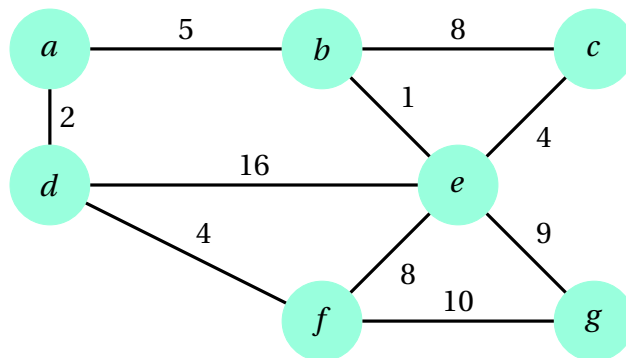
Instructions to the students: The preparation problems are not assessed, but we strongly recommend that you try to solve them before your applied class this week. These preparation problems test your basic knowledge of the contents taught in the seminar of the previous week. The problems in the applied class assume that you have this basic knowledge and will build on top of it. You might find it helpful to try these problems before doing the quiz that is due this week.

Problems

Problem 1. Use Dijkstra's algorithm to determine the shortest paths from vertex s to all other vertices in this graph. You should clearly indicate the order in which the vertices are visited by the algorithm, the resulting distances, and the shortest path tree produced.



Problem 2. Show the steps taken by Prim's and Kruskal's algorithms for computing a minimum spanning tree of the following graph. Use vertex a as the root vertex for Prim's algorithm. Make sure that you indicate the order in which edges are selected, not just the final answer.



Problem 3. Consider the following state of a union-find data structure, using the union by size heuristic, as described in lectures.

ID	0	1	2	3	4	5	6	7	8
Parent	-1	2	-3	4	7	-1	7	-4	2

Determine the state of the array after each the following operations are executed (in order). If two trees are the same size, assume the first argument to `union()` will be chosen as the root:

1. `union(3, 6)`

2. `union(0, 5)`
3. `union(5, 3)`