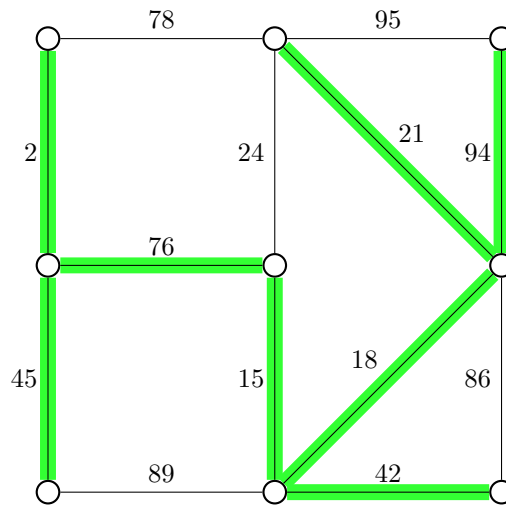**CS 163**
Midterm – Solutions
Paweł Pszona, 2012-06-08

1

Edges forming minimum spanning tree:

2

Jarník was the first to invent the Prim-Dijkstra-Jarník algorithm.

3

Using adjacency matrix in place of adjacency list, Tarjan's strongly connected components algorithm runs in time $O(n^2)$ (it takes $O(n)$ time to find all neighbors of a vertex in an adjacency matrix, and the algorithm needs to list neighbors of each vertex).

4

When all edges have equal (positive) weights, shortest path from s to t is the one that has the fewest edges. It can be found by BFS starting at s, in time $O(n + m)$.
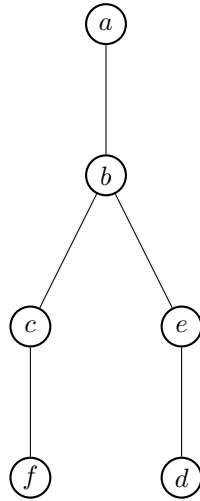
5

Schulze voting method might be preferable to the instant runoff method, because if there is a Condorcet winner, he/she will always win when using

Schulze method to determine winner, while it is not always true for the instant runoff method.

6

DFS tree:

Topological ordering found based on the above tree: a, b, e, d, c, f (reverse of postorder).

7

The smallest possible number of layers for the graph is 5 (because the longest path, $a \rightarrow b \rightarrow e \rightarrow c \rightarrow f$ has length 4).