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Algorithms Theory, Assignment 6

http://lak.informatik.uni-freiburg.de/lak_teaching/ws09_10/algo0910.php

Submission: 28. Jan. 2010, 4 p.m.

- The solutions can be submitted in English or German
- You are required to submit your own solution.
- You are allowed to discuss our solutions with each other. Nevertheless, you are required to write down the answers in your own words.

Exercise 6.1 - Greedy algorithms

[Points: 2+1+2]

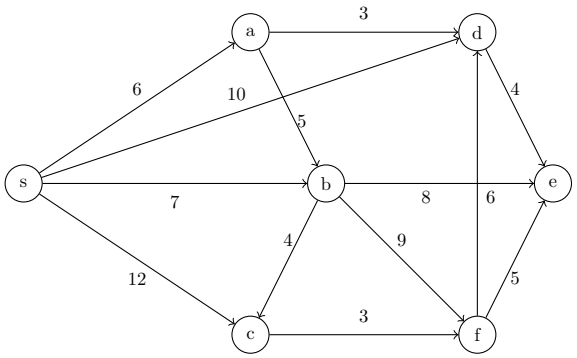
Suppose that we have a set of activities to schedule among a large number of lecture halls. We wish to schedule all the activities using as few lecture halls as possible.

- Describe a greedy algorithm to determine which activity should use which lecture hall.
- Why is your algorithm greedy?
- Show the optimal substructure of this problem.

Exercise 6.2 - Shortest path

[Points: 5]

Consider the acyclic graph $G = (V, E, c)$ bellow in which all edges have non-negative weights. By using Dijkstra's algorithm compute the shortest paths from s to all other vertices. Give the DIST value of all vertices after every iteration and show the resulting rooted tree.



Exercise 6.3 - Dijkstra's algorithm

[Points: 1+1+1+2]

Give the complexity of the Dijkstra's Algorithm if the min-priority queue is implemented by:

- List
- Binary queue
- Min heap

Suppose we change line 3 of Dijkstra's algorithm to the following. 3 while $\mid U \mid > 1$. This change causes the while loop to execute $\mid U \mid -1$ times instead of $\mid U \mid$ times.

- Is this proposed algorithm correct?. Prove your answer.

Exercise 6.4 - Minimum spanning trees [Points: 5]

Consider a graph $G = (V, E)$ with weight function $c : E \to \mathbb{R}$. Now, assume that for every cut of G, there is a unique light edge (minimale Kante) crossing the cut. Show that G has a unique spanning tree T. In addition, by means of a counterexample, show that the converse is not true.