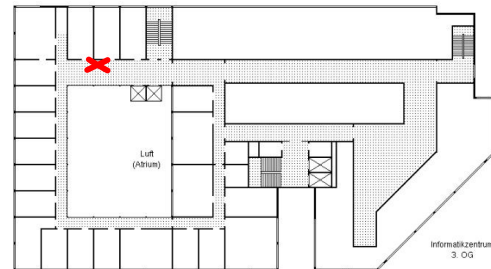


Prof. Dr. Sándor Fekete
Dr. Christiane Schmidt

Approximation Algorithms Homework Set 5, 27. 06. 2012

Solutions are due Wednesday, July 11th, 2012, until 13:00 in the cupboard for handing in practice sheets. **Please put your name on all pages!**



Exercise 1 (Greedy for $(0, 1)$ -Knapsack):

Show that the greedy algorithm, which sorts the objects by decreasing order of the ratio profit to size and then greedily picks objects, can be arbitrarily bad for the $(0, 1)$ -knapsack problem, in which an object can only be chosen as an entire object or be neglected completely.

(20 Punkte)

Exercise 2 ($4/3$ -approximation for $(1, 2)$ -TSP):

Consider a complete undirected graph G in which all edges have length either 1 or 2 (G satisfies the triangle inequality!). Give a $4/3$ -approximation for this special TSP variant. Hint: Start with a minimum 2-matching in G . A 2-matching is a subset M_2 of edges so that every vertex in G is incident to exactly two edges in M_2 . Note: a 2-matching can be computed in polynomial time.

(20 Punkte)

Exercise 3 (Bottleneck TSP):

Take a graph G with edge costs that satisfy the triangle inequality. We want to find a Hamiltonian cycle C for which the maximum cost edge in C is minimized.

- Give a 3-approximation algorithm for this problem.
Hints: (i) Consider the MST of G . (ii) Think about “appropriate” shortcuts.
- Apply your algorithm to the graph H from Figure 1, using the given MST.

(15+5 Punkte)

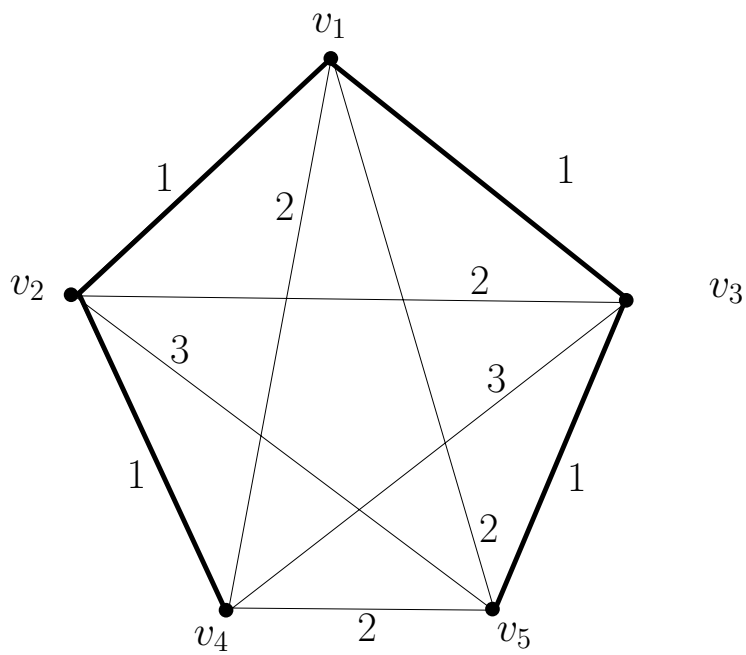


Abbildung 1: Graph H . An MST rooted in v_1 is shown in bold.