Research Institute for Discrete Mathematics
Approximation Algorithms
Summer Term 2014

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Exercise Sheet 11

Exercise 11.1:
Consider the Traveling Salesman Problem on subcubic graphs (i. e. graphs with maximum degree 3). Propose a $\frac{4}{3}$-approximation algorithm for this problem.

Hint: Use the Lemma of Mömke and Svensson.

Exercise 11.2:
Consider the Graph-TSP and the (unweighted) Minimum 2-edge-connected spanning subgraph problem (2ECSSP) from the lecture. Prove for $\alpha \geq 1$:

(i) If there is an α-approximation algorithm for Graph-TSP, then there is a $\frac{3}{2}\alpha$-approximation algorithm for 2ECSSP.

(ii) If there is an α-approximation algorithm for 2ECSSP, then there is a $\frac{2}{3}(1+\alpha)$-approximation algorithm for Graph-TSP.

Hint: Use the Lemma of Mömke and Svensson.

Exercise 11.3:
Consider the following algorithm for the 2ECSSP on 2-vertex-connected graphs: Compute an ear-decomposition H for which the internal vertices of 2-ears are not endpoints of any non-trivial ears and form a stable set. Delete all trivial ears from H and return the remaining edges.

(i) Show that the above algorithm can be implemented to run in linear time and is a 2-approximation algorithm.

(ii) Prove that the approximation ratio of this algorithm is less than 2.

(iii) What is the best approximation ratio that holds for the above algorithm?

Please hand in your solutions before the lecture on Tuesday, **July 8th, at 2:15 PM**.