

Exercise Sheet 9

Exercise 9.1:

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

Hint: Use the Lemma of Mömke and Svensson.

(3 + 5 points)

Exercise 9.2:

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 a better approximation ratio than 2 for this algorithm.
- (iii) What is the best approximation ratio that holds for the above algorithm?

(2 + 2 + 2 points)

Please return your solutions before the lecture on Tuesday, **June 18th, 2:15 PM**.

Exercise P.2:

Implement the algorithm from Exercise 9.2. Details, specifications, examples as well as the deadline can be found on the separate programming exercise sheet.

(16 points)