Research Institute for Discrete Mathematics
Approximation Algorithms
Summer Term 2013

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Exercise Sheet 11

Exercise 11.1:
Show that the problem of finding a minimum-cost s-t-path in an undirected graph G with edge costs $c : E(G) \to \mathbb{R}_{\geq 0}$ can be regarded as a special case of the Survivable Network Design Problem. Does Jain's Algorithm solve it optimally?

(3 points)

Exercise 11.2:
Show that in a slight variant of Jain's Algorithm the number of iterations in which we have to solve an LP can be bounded by

(a) $2n^2$

(b) $2n$

where $n := |V(G)|$. For this we set $x_e := x_e + \lfloor y_e \rfloor$ for all e if some $y_e \geq 1$, otherwise we update x as before.

Hint:

(a) Conclude from Lemma 20.32 that in the second case all but $2n - 2$ edges can be deleted.

(b) Delete one more edge in each iteration.

(3 + 2 points)

Exercise 11.3:
Let $PCP'(\log n, 1)$ be defined as $PCP(\log n, 1)$ but with error probability (*soundness*) $1 - \frac{1}{size(x)}$ for input x instead of $\frac{1}{2}$. Prove that $NP \subseteq PCP'(\log n, 1)$.

Note: You may not use the PCP-Theorem.

(4 points)

Please return your solutions before the lecture on Tuesday, **July 2nd, 2:15 PM**.