Albert-Ludwigs-Universität, Inst. für Informatik
Prof. Dr. Fabian Kuhn
H. Ghodselahi, Y. Maus

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Algorithm Theory, Winter Term 2014/15
Problem Set 3

hand in (hard copied) by Thursday, 10:00, November 13, 2014, either before the lecture or in the box corresponding to your group in building no. 51.

Exercise 1: A Greedy TSP Approximation (6 points)

Consider a symmetrical ($d(u,v) = d(v,u)$ for all $u, v \in V$) TSP instance where all weights are either a or b, ($0 < a < b$).
Prove that the nearest neighbor greedy algorithm from the lecture produces a ($\frac{a+b}{2a}$)-approximation of an optimal TSP-tour.

Exercise 2: Matroids (3+1 points)

a) For a graph $G = (V, E)$, a subset $F \subseteq E$ of the edges is called a forest iff (if and only if) it does not contain a cycle. Let $\mathcal{F}$ be the set of all forests of G. Show that $(E, \mathcal{F})$ is a matroid.

Hint: A forest with k edges and n nodes has $n - k$ connected components.

b) For a matroid (E, I), a maximal independent set $S \in I$ is an independent set that cannot be extended. Thus, for every element $e \in E \setminus S$, the set $S \cup \{e\} \notin I$.

What are the maximal independent sets of the matroid in a)?