Prof. Friedrich Eisenbrand   Discussions from: November 4, 2015
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Combinatorial Optimization

Fall 2015
Assignment Sheet 8

$\star$ exercises can be handed in for bonus points. Due date is Friday November 13.

Exercise 1
Show that the problem of computing the longest path in an undirected graph can be formulated as the intersection of three matroids.

Exercise 2 ($\star$)
Let $P \subseteq \mathbb{R}^n$ be a full dimensional polytope that contains the origin in its interior. Let $x \in \mathbb{R}^n$. Prove that x is a vertex of P if and only if $\{y \in \mathbb{R}^n | x^\top y \leq 1\}$ defines a facet of P^0.

Exercise 3
Let C be the square with corners at $(1,1),(1,-1),(-1,1),(-1,-1)$. Draw the polar of C.

Exercise 4
Let $G = (V, E)$ be a graph. The forest polytope associated with G is

$$P = \left\{ x \in \mathbb{R}_{\geq 0}^{|E|} \ : \ x(E[S]) \leq |S| - 1 \ \forall \, S \subseteq V, S \neq \emptyset \right\}$$

Assume you have access to an oracle that given an edge weighted directed graph H and two nodes $s, t \in V(H)$ finds a minimum weight directed $s - t$ cut in H. Show how to solve the separation problem for P in polynomial time.