
Efficient Algorithms and Datastructures II

Aufgabe 1 (10 Punkte)

- (a) Observe that the dual (and hence the primal) linear program above can be solved efficiently, given a polynomial time separation oracle for the dual in the last question of previous assignment. (Note that the number of constraints in the dual is exponential in the problem size.)
- (b) Construct a polynomial time separation oracle for the dual program. (*Hint*: Use an algorithm for solving the shortest path problem as the separation oracle.)

Aufgabe 2 (10 Punkte)

Consider the following linear program:

$$\begin{array}{ll} \text{minimize} & \sum_{e \in E} c_e x_e \\ \text{subject to} & x(\delta(v)) = 2 \quad \forall v \in V \\ & x(\delta(U)) \geq 2 \quad \forall U \subset V, 2 \leq |U| \leq |V| - 2 \\ & x_e \leq 1 \quad \forall e \in E \\ & x_e \geq 0 \quad \forall e \in E \end{array}$$

where c_i is the cost of the i -th edge, $\delta(U)$ denotes the set of edges with exactly one end-point in U and $x(F) = \sum_{f \in F} x_f, \forall F \subseteq E$. Show how to solve this LP by the ellipsoid method. (*Hint*: The min-cut problem can be solved in polynomial time.)