Technische Universität Berlin
Institut für Mathematik

Wintersemester 11/12

Computational Integer Programming

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Exercise sheet 6

Deadline: Thu, 01 Dez. 2011, by email to `borndoerfer@zib.de`

Exercise 1. **10 points**

Let $G = (V, E)$ be a connected graph, $R \subseteq V$ a set of terminals, $\delta(V_1, V_2)$ a Steiner cut (i.e., $V_1 \cup V_2 = V$, $V_1 \cap V_2 = \emptyset$, $V_i \cap R \neq \emptyset$, $i = 1, 2$), $x(\delta(V_1, V_2)) \geq 1$ the associated Steiner cut inequality, and $P(\text{STG}) := \{x \in \mathbb{Z}_+^E : x \text{ satisfies all Steiner cut inequalities}\}$ the undirected Steiner tree polyhedron. Show:

- $\delta(V_1, V_2)$ is minimal (with respect to inclusion) if and only if $G[V_1]$ and $G[V_2]$ are connected.
- If $\delta(V_1, V_2)$ is not minimal, $x(\delta(V_1, V_2)) \geq 1$ is not a facet of $P(\text{STG})$.

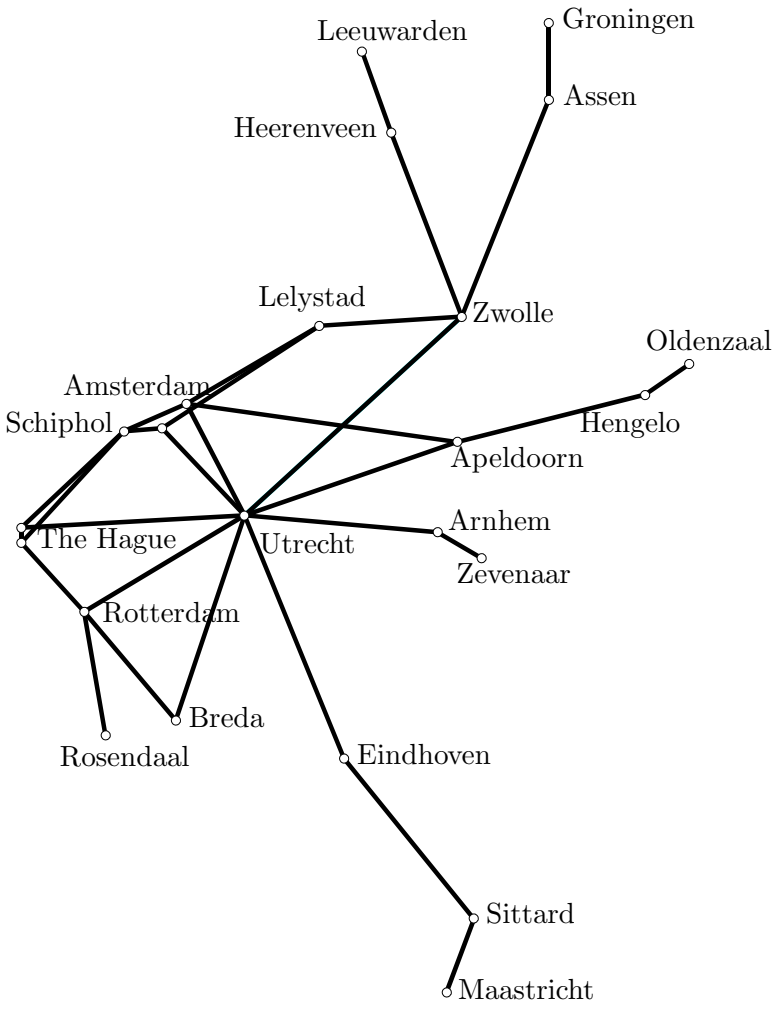
Exercise 2. **10 points**

Use ZIMPL to model the directed Steiner tree problem. The file `dst-skeleton.zpl`, posted on the website, gives you a start.

Exercise 3. **10 points**

Use your ZIMPL model from exercise 2 to solve the directed Steiner tree problem described by the data in the files `edges.dat`, `cap.dat` (see back side for an illustration) posted on the website. Connect the terminals Amsterdam, Rotterdam, Utrecht, Maastricht, Oldenzaal, and Groningen via the root Amsterdam.

Note: Do some manual preprocessing first. Each group should email their ZIMPL model for exercise 2 their computational results for exercise 3, inlcuding some preprocessing documentation, to `borndoerfer@zib.de` by Thu, 01 Dez 2011.



Ah	Arnhem
Apd	Apeldoorn
Asd	Amsterdam CS
Asdz	Amsterdam Zuid WTC
Asn	Assen
Bd	Breda
Ehv	Eindhoven
Gn	Groningen
Gv	Den Haag HS
Gvc	Den Haag CS
Hgl	Hengelo
Hr	Heerenveen
Lls	Lelystad Centrum
Lw	Leeuwarden
Mt	Maastricht
Odzg	Oldenzaal Grens
Rsdg	Rosendaal Grens
Rtd	Rotterdam CS
Shl	Schiphol
Std	Sittard
Ut	Utrecht CS
Zl	Zwolle
Zvg	Zevenaar Grens