Discrete Optimisation
Exercise Session 8: Cuts

16th November 2016

After this session, you should be able to solve all exercises of Section 5.1 and Exercise 5.2.1 in the exercises book.

Exercise 1 (valid inequalities). Find a valid inequality for the following sets:

1. $X = \{x \in \mathcal{B}, y \in \mathcal{B} \mid 12\,x - 6\,y \leq 7\}$.

2. $X = \{x \in \mathbb{R}^+, y \in \mathcal{B} \mid x \leq 20\,y, \quad x \leq 7\}$.

3. $X = \{x \in \mathbb{R}^+, y \in \mathbb{N} \mid x \leq 6\,y, \quad x \leq 16\}$.

4. $X = \{(x, y, z) \in \mathcal{B}^3, s \in \mathbb{R}^+ \mid 2\,x + 3\,y + 9\,z - s \leq 32\}$.

Exercise 2 (cutting points). Find a valid inequality for X which cuts the point x^*:

$$X = \left\{(v, w, x, y, z) \in \mathbb{Z}^5 \mid 9\,v + 12\,w + 8\,x + 17\,y + 13\,z \geq 50\right\},$$

$$x^* = \left(0, \frac{25}{6}, 0, 0, 0\right).$$

Exercise 3 (covers). Find valid covers for the following X which cuts the points x^*:

1. $X = \left\{x \in \mathcal{B}^5 \mid 9\,v + 8\,w + 6\,x + 6\,y + 5\,z \leq 14\right\}$, $x^* = \left(0, \frac{5}{8}, \frac{3}{4}, \frac{3}{4}, 0\right)$.

2. $X = \left\{x \in \mathcal{B}^5 \mid 9\,v + 8\,w + 6\,x + 6\,y + 5\,z \leq 14\right\}$, $x^* = \left(\frac{1}{2}, \frac{1}{8}, \frac{3}{4}, \frac{3}{4}, 0\right)$.

3. $X = \left\{x \in \mathcal{B}^5 \mid 7\,v + 6\,w + 6\,x + 4\,y + 3\,z \leq 14\right\}$, $x^* = \left(\frac{1}{7}, 1, \frac{1}{2}, \frac{1}{4}, 1\right)$.

4. $X = \left\{x \in \mathcal{B}^5 \mid 12\,v - 9\,w + 8\,x + 6\,y - 3\,z \leq 2\right\}$, $x^* = \left(0, 0, \frac{1}{2}, \frac{1}{6}, 1\right)$.