Algorithmic Methods for Mathematical Models (AMMM)

Integer Linear Programming Solving Exercises.

1. Consider the following IP:

$$\begin{array}{ll} \textbf{min} & -5x_1 - 8x_2 \\ & x_1 + x_2 \leq 6 \\ & 5x_1 + 9x_2 \leq 45 \\ & x_1, x_2 \geq 0 \qquad\qquad x_1, x_2 \in \mathbb{Z} \end{array}$$

   (a) Represent geometrically the set of feasible solutions of the IP and its relaxation.

   (b) What is the optimal solution of the relaxation, and the optimal value?

   (c) What is the integer rounding of the optimal solution of the relaxation? Is it a feasible solution? If not, what is the nearest possible feasible solution, and its value?

   (d) What is the optimal solution of the IP, and the optimal value?

   (e) Solve the IP with Branch & Bound.

2. Consider the following MIP:

$$\begin{array}{ll} \textbf{min} & 3x_1 + 2x_2 - 10 \\ & x_1 - 2x_2 + x_3 = \frac{5}{2} \\ & 2x_1 + x_2 + x_4 = \frac{3}{2} \\ & x_1, x_2, x_3, x_4 \geq 0 \qquad x_2, x_3 \in \mathbb{Z} \end{array}$$

   Solve it with Branch & Bound.

3. Consider the same MIP as in Exercise 1. Compute Gomory cuts using the optimal tableau of the relaxation.

4. Consider the same MIP as in Exercise 2. Compute Gomory cuts using the optimal tableau of the relaxation.