DM545/DM871 – Linear and integer programming

## Exercise Sheet, Spring 2020 [pdf format]

Exercise 1*

Solve the following IP problem with Gomory's fractional cutting plane algorithm, indicating the cut inequalities in the space of the original variables

$$\begin{aligned}
\max \quad & x_1 + 2x_2 \\
& x_1 - 2x_2 \geq -2 \\
& x_1 + x_2 \leq 3 \\
& x_1, x_2 \geq 0 \text{ and integer}
\end{aligned}$$

Exercise 2 — Gomory's Cutting Plane

Consider the following integer linear programming problem

$$\begin{aligned}
\max \quad z = 4x_0 \ - \ & 2x_1 \\
\text{s.t.} \qquad x_0 \ + \ & 2x_1 \ \leq 2 \\
& 3x_1 \ \leq 2 \\
3x_0 \ - \ & 3x_1 \ \leq 2 \\
& x_0, x_1 \ \geq 0 \text{ and integer}
\end{aligned}$$
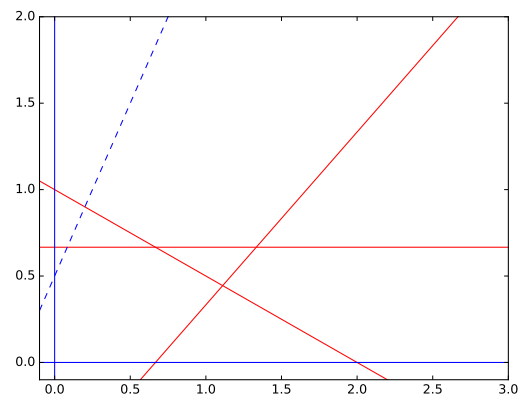
In the solution of the linear relaxation of the problem the variables x_0, x_1 and the slack variable associated to the second constraint are in basis.

Subtask 2.1

Calculate the optimal tableau using the revised simplex method.

Subtask 2.2

Find a Chvatal Gomory's cutting plane

Subtask 2.3

Show that with the cut found the optimal solution of the linear relaxation becomes infeasible.

The data in Python format:

```
from fractions import Fraction
import numpy as np
np.set_printoptions(precision=3,suppress=True)

c=np.array([4, -2])
```

```
A = np.array([[ 1, 2],
              [ 0, 3],
              [ 3, -3]])

b=np.array([2, 2, 2])
```

```
A = np.array([[ 1, 2],
              [ 0, 3],
              [ 3, -3]])

b=np.array([2, 2, 2])
```