Dr. Gunnar W. Klau
Abdelhalim Larhlimi
Institut für Mathematik II
AG Mathematik in den Lebenswissenschaften

Freie Universität Berlin

Discrete Mathematics WS 07/08
Homework 6 (due 07/12)

Exercises 2 and 3 were proposed last year by Andreas Döring. You will probably need an LP solver to solve the relaxed LPs.

Exercise 1:
Solve the following integer programming problem using the Branch and Bound Method

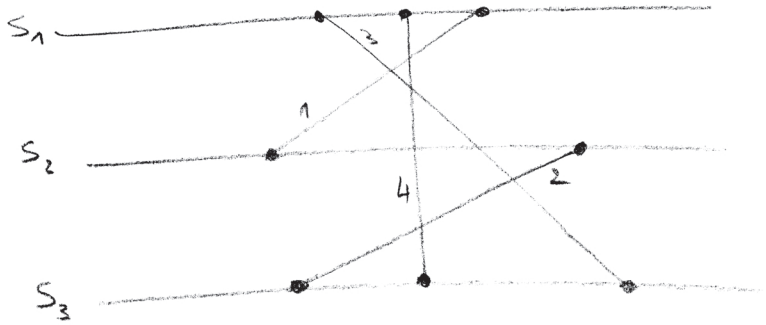
$$\begin{aligned} &\text{Maximize } z = 13x + 8y \\ &\text{subject to} \\ &\quad x + 2y \leq 10 \\ &\quad 5x + 2y \leq 20 \\ &\quad x, \quad y, \geq 0, \text{ integral.} \end{aligned}$$

Exercise 2:
Given two sequences $S_1 = ACC$ and $S_2 = CACA$,

a) Draw the complete alignment graph and the pair graph

b) Compute an optimal alignment of S_1 and S_2 where a match scores 1 and a mismatch or gap scores 0. Start with the trivial relaxed LP and add clique inequalities. You will probably need an LP solver to slove the relaxed LPs.

Exercise 3: Given the following alignment graph:



All edges have weight 1.

a) Try to solve the alignment problem by using branch-and-cut: Add mixed ycle inequalities (see the 'shortest path' method in the script, page 18) to the corresponding (relaxed) LP. Can you reach an optimal solution for the ILP without branching?

b) Now use branching to solve the problem.

c) Instead of branching, just add the inequality

$$x_1 + x_2 + x_3 + x_4 \leq 2$$

Can you solve the ILP now?

d) Prove that the inequality in (c) is facet-defining.