Linear and Integer Programming (ADM II)

Martin Skutella   Torsten Ueckerdt
Axel Werner   Jannik Matuschke

Exercise sheet 1
Deadline: Mon, 22 Oct 2007, **12:15 in MA 041**

Exercise 1.   **14 points**

Campus Liquids Inc. (CLI) is engaged in the production and sale of two kinds of
hard liquor. CLI purchases intermediate-stage products in bulk, purifies them by
repeated distillation, mixes them, bottles the product under its own brand names
and sells it. One product is a bourbon, the other a blended whiskey. The problem
is to decide how many bottles of each should be produced in the next production
period.

As the company's products are very popular on the market, the production capacity
is inadequate to produce all that CLI might sell. The bourbon requires 3 machine
hours per bottle, while the blended whiskey requires 4 hours of machine time per
bottle. There are 20,000 machine hours available in the production period. The
direct operating costs, which are mainly for labour and materials, are \$3.00 per
bottle of bourbon and \$2.00 per bottle of blended whiskey. The working capital
available to finance these costs is \$4400; however, 40% of the sales revenues will
be collected during the production period and made available to finance ongoing
operations.

The selling price is \$5 for a bottle of bourbon and \$4.50 for a bottle of blended
whiskey.

a) Set up a linear program in two variables x_1 and x_2 that maximizes CLI's profit in
   the production period to come, subject to limitations on machine capacity and
   working capital.

b) Sketch the set of feasible solutions in the plane and give the coordinates of the
   vertices.

c) What is the optimal production mix to schedule and how large is the company's
   profit with this schedule?

d) Suppose CLI could spend some money to repair machinery and increase its avail-
   able machine hours by 2000 hours (before production starts). Should the invest-
   ment be made and if so, up to which price?
   Hint: How does this change affect the linear program and your sketch?