

# ÜBUNGEN ZU Numerische Verfahren der restringierten Optimierung

<http://www.math.uni-konstanz.de/numerik/personen/volkwein/teaching/>

Sheet 3

Submission: 10.12.2012, 9:45 o'clock

## Exercise 7 (Homework)

(2 Points)

Consider the following linear program, which contains free variables denoted by  $y$ :

$$\min c^\top x + d^\top y \quad \text{subject to} \quad A_1 x + A_2 y = b, x \geq 0$$

Write down optimality conditions for this problem in an analogous fashion to (2.3) and transform them into the form (2.4). Further, derive the system (2.7) for this problem and modify the *primal-dual method* (Algorithm 2.1) accordingly.

## Exercise 8

Verify, that

$$r_b^{k+1} = (1 - \alpha_k^{\text{prim}}) r_b^k \quad \text{and} \quad r_c^{k+1} = (1 - \alpha_k^{\text{dual}}) r_c^k$$

holds for the steplength  $\alpha_k^{\text{prim}}$  and  $\alpha_k^{\text{dual}}$ , and the residuals  $r_b^k = Ax^k - b$  and  $r_c^k = A^\top \lambda^k + \mu^k - c$ .

## Exercise 9

Prove that the coefficient matrix in (2.7) is nonsingular if and only if  $A$  has full row rank.