MA427 – Exercise set 4

Academic year 2018-19

Exercise 4.1 Consider the LP problem $\max\{c^\top x \mid Ax = b,\, x \geq 0\}$, where

$$A = \begin{bmatrix} 1 & 3 & 0 & 4 & 1 \\ 1 & 2 & 0 & -3 & 2 \\ -1 & -4 & 3 & 0 & 0 \end{bmatrix}, \quad b = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}, \quad c = \begin{bmatrix} -1 \\ 3 \\ 3 \\ 1 \\ -2 \end{bmatrix}$$

Solve the problem using the two-phase method, and applying Bland's pivoting rule.

Exercise 4.2 Apply Phase I of the simplex method to decide if the following system of constraints has a feasible solution

$$\begin{pmatrix} 1 & 2 & 2 & 1 \\ 2 & -1 & -3 & -1 \\ 2 & 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \\ 1/2 \end{pmatrix}$$

$$x_1, x_2, x_3, x_4 \geq 0$$

Exercise 4.3 Consider the following LP problem.

$$\begin{array}{rrrrcr} \max & -5x_1 & -2x_2 & & & \\ & -x_1 & & -x_3 & \leq & -2 \\ & -x_1 & -x_2 & +4x_3 & \leq & -1 \\ & \multicolumn{3}{c}{x_1, x_2, x_3 \geq 0} & & \end{array}$$

(a) Add slack variables x_4, x_5 to bring the problem in standard form. Observe that the basis $B = \{4, 5\}$ is dual feasible (but not primal feasible). Solve the problem to optimality by applying the dual simplex method with Bland's rule starting from B.

(b) Determine the optimal dual solution associated with the optimal basis found.

Exercise 4.4 Consider the following simplex tableau, relative to the dual feasible basis $\{3, 2, 1\}$.

0	0	0	5	1	11
0	0	1	11/2	3/2	13
0	1	0	−3/2	−1/2	−4
1	0	0	−5/2	−1/2	−7

Solve with the dual simplex method applying Bland's rule.