Martin Gairing
Flávia Alves

Handout: 9.11.2018
Turnin by:

Tutorials
Optimisation
2018
Exercise Sheet 7

Exercise 12:
Consider the following linear program:

$$\begin{array}{lccccccccccc}
\min & x_1 & + & 2x_2 & + & 5x_3 & + & 2x_4 & & \\
s.t. & 2x_1 & + & x_2 & + & x_3 & + & x_4 & = & 10 \\
& 2x_1 & + & 5x_2 & + & x_3 & & & = & 6 \\
& x_1 & + & x_2 & & & & & = & 1 \\
& & & x_2 & + & x_3 & + & x_4 & \geq & 5 \\
& & & & & x_1, & x_2, & x_3, & x_4 \geq & 0
\end{array}$$

(a) Construct the dual (D) of this LP.

(b) Verify that $x^* = (0, 1, 1, 8)$ is optimal, using complementary slackness.

Exercise 13:
Consider the example discussed in the lecture (slides 61 – 66).
`http://cgi.csc.liv.ac.uk/~gairing/COMP557/board/20181011.pdf`
`http://cgi.csc.liv.ac.uk/~gairing/COMP557/board/20181016.pdf`

(a) Compute B^{-1} of basis 2 (module slide 62) and give the associated dual basic solution.

(b) Do the same for basis 3.

Exercise 14:
Consider the following linear program:

$$\begin{array}{rrcrcrcrcr}
\min & 9x_1 & + & x_2 & + & 3x_3 & & & & \\
s.t. & 2x_1 & + & 3x_2 & - & x_3 & + & x_4 & = & 3 \\
 & 4x_1 & + & & + & 4x_3 & - & 2x_4 & = & 4 \\
 & -x_1 & - & 2x_2 & + & 2x_3 & + & x_4 & = & -1 \\
 & & & & & x_1, & x_2, & x_3, & x_4 \geq & 0
\end{array}$$

(a) Construct the dual (D) of this LP.

(b) Verify that $x^* = (\frac{1}{3}, 1, \frac{2}{3}, 0)$ is optimal using complementary slackness.

(c) Let B be the basis consisting of columns 1,2, and 4.

- Compute B^{-1}.
- Use B^{-1} to compute the associated primal and dual basic solutions (cf. Observation 5.7, slide 155) and state (and provide an argument) whether they are feasible or not.