

Operations Research

Homework 2

Due on September 21, 2021

Note: Your homework must be submitted via moodle (see the link on the class website) on the due day BEFORE THE TUTORIAL, i.e., before 20:45.

Problem 1 [10 points]

Find all solutions for the underdetermined linear system $A\mathbf{x} = \mathbf{b}$, where

$$A = \begin{pmatrix} 2 & 2 & -1 & -4 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & -1 \\ 1 & 1 & 3 & 5 \end{pmatrix} \quad \text{and} \quad \mathbf{b} = \begin{pmatrix} -5 \\ 2 \\ -1 \\ 8 \end{pmatrix}.$$

Problem 2 [5 points]

Reconsider Problem 1 above: State at least two different basic solutions. Make sure that at least one of these is a basic *feasible* solution, i.e., a solution where all components are non-negative.

Problem 3 [5 points]

Reconsider Problem 1 from Homework Sheet 1: *Minimize*

$$Z = 8x_1 + 12x_2$$

subject to

$$5x_1 + 2x_2 \geq 20,$$

$$4x_1 + 3x_2 \geq 24,$$

$$x_2 \geq 2,$$

$$x_1, x_2 \geq 0.$$

Introduce slack variables to write this linear programming problem in the standard form: *Minimize*

$$Z = \mathbf{c}^T \mathbf{x}$$

subject to

$$A\mathbf{x} = \mathbf{b}$$

$$\mathbf{x} \geq 0$$

where the coefficients \mathbf{b} , \mathbf{c} , and the decision variables \mathbf{x} are written as column vectors, and A is a matrix of matching dimension.