

Operations Research

Homework 2

Due via Moodle on Tuesday, September 15, 2020

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

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

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

$$z = 8x + 12y$$

subject to

$$5x + 2y \geq 20,$$

$$4x + 3y \geq 24,$$

$$y \geq 2,$$

$$x, y \geq 0.$$

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.