620-261 Introduction to Operations Research

TUTORIAL 8

1. Write the dual of the following linear programming problem by first writing it in standard form.

$$\begin{aligned} \max \quad & 3x_1 + 2x_2 - x_4 \\ \text{subj to} \quad & 4x_1 + 3x_2 + x_3 = 10 \\ & 5x_1 - 6x_2 + x_3 \leq 12 \\ & 6x_1 + 7x_2 \geq 11 \\ & x_1 \geq 0,\ x_3 \geq 0,\ x_4 \geq 0, x_2\ urs \end{aligned}$$

2. Write the dual of the following linear programming problems.
   (a)

$$\begin{aligned} \min \quad & yb \\ \text{subj to} \quad & yA = -c \\ & y \geq 0. \end{aligned}$$

   (b)

$$\begin{aligned} \max \quad & cx \\ \text{subj to} \quad & Ax \geq -b \\ & x \geq 0. \end{aligned}$$

   (c)

$$\begin{aligned} \min \quad & (c+d)x \\ \text{subj to} \quad & Ax \geq b \\ & x \geq 0. \end{aligned}$$

   (d)

$$\begin{aligned} \min \quad & 3x_1 + 3x_2 - x_4 \\ \text{subj to} \quad & 2x_1 + x_2 + 3x_3 \geq 2 \\ & 2x_1 - 3x_2 \leq 4 \\ & 2x_1 + 4x_2 = 5 \\ & x_1 \geq 0,\ x_3 \geq 0,\ x_4 \geq 0, x_2\ urs \end{aligned}$$