Game Theory
Tutorial 2
Questions

Exercise 1 (Minimax problem) *Three linear functions y_1, y_2 and y_3 are defined as follows:*

$$\begin{aligned} y_1 &= 2 - x_1, \\ y_2 &= x_1 - 1, \\ y_3 &= 2x_1 - 6. \end{aligned}$$

Find

$$\min_x \max_{i=1,2,3} \{y_i\}. \tag{1}$$

Exercise 2 (Minimax problem again) *Find x_1, x_2 satisfying*

$$\begin{aligned} x_1 + x_2 &\leq 2, \\ x_1, x_2 &\geq 0, \end{aligned} \tag{2}$$

and having the maximum of

$$\begin{aligned} 3x_1 - &\ x_2 \\ -x_1 + &\ x_2 \end{aligned} \tag{3}$$

as small as possible.

Exercise 3 (Duality Theory 1) *Given the primal L.P. problem:*

$$\begin{aligned} \max_{x} \quad & c^t x \\ s.t. \quad & Ax \leq b \\ & x \geq 0, \end{aligned} \tag{4}$$

and its dual pair:

$$\begin{aligned} \min_{y} \quad & b^t y \\ s.t. \quad & A^t y \geq c \\ & y \geq 0, \end{aligned} \tag{5}$$

show that the dual of (5) is (4).

Exercise 4 (Duality Theory 2) *Find the dual problem of the following L.P. problem:*

$$\begin{array}{llrl} \max & x_0 = & 3x_1 + 2x_2 & \\ s.t. & & 5x_1 + 2x_2 & \leq 0 \\ & & 4x_1 + 6x_2 & \leq 24 \\ & & x_1 + x_2 & \geq 1 \\ & & x_1 + 3x_2 & = 1 \\ & & x_1 & \geq 0. \end{array} \tag{6}$$