Math 5370   **GAME THEORY**   Spring 2019
Dr. Duval   **Homework**
                              Monday, February 4
   Follow the separate general guidelines for Parts A,B,C. Be sure to include and label *all*
four standard parts (a), (b), (c), (d) of Part A in what you hand in.

Two-person zero-sum games: Examples
Section 2.1

A: Reading questions. Due by 2pm, Sun., 10 Feb.

1. Describe the differences and similarities between the games in Chapter 1 (combi-
   natorial games) and the games in Chapter 2 (two-person zero-sum games).

2. Identify some points on the graphs in Figure 2.2, and explain what those points
   mean. Pick at least one point *not* highlighted in red. Why is that point not
   highlighted in red?

3. Define the **value** of a game, as precisely as possible, but without using any math-
   ematical symbols, and a minimum of mathematical language. (How would you
   describe the value of a game to someone who does not like mathematics?)

B: Warmup exercises. For you to present in class. Due by the end of class Mon., 11 Feb.

Draw diagrams like those in Figure 2.2 for the zero-sum games given by the matrices
below, and find the value of each game.

1. $\begin{pmatrix} 2 & 4 \\ 6 & 3 \end{pmatrix}$ 2. $\begin{pmatrix} 2 & 4 \\ 3 & 5 \end{pmatrix}$ 3. $\begin{pmatrix} 2 & 3 & 6 \\ 5 & 4 & 2 \end{pmatrix}$ 4. $\begin{pmatrix} 2 & 3 & 6 \\ 5 & 1 & 4 \end{pmatrix}$

Definitions; Minimax Theorem
Sections 2.2, 2.3

A: Reading questions. Due by 2pm, Tue., 12 Feb.

1. In the definition of Δ_m, the conditions on $\mathbf{x}$ are given as $x_i \geq 0, \sum_{i=1}^{m} x_i = 1$.
   Why are these the conditions? Why is $\mathbf{x} \in \mathbb{R}^m$, but $\mathbf{y} \in \mathbb{R}^n$? What are m and n?

2. Explain the displayed equation above equation (2.2):

$$\mathbf{x}^T A \mathbf{y} = \sum_i \sum_j x_i a_{i,j}, y_j.$$

   Why is this the expected gain of player I?

3. What is the difference between a **safety strategy** and an **optimal strategy**?

B: Warmup exercises. For you to present in class. Due by end of class Wed., 13 Feb.

Demonstrate the minimax theorem on the zero-sum games given by the first two ma-
trices of the previous warmup exercises (above on this page).