Math 5370 **GAME THEORY** Spring 2019
Dr. Duval **Homework**
before midterm

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.

Proof of Nash's Theorem

Section 5.1

A: Reading questions. Due by 11am, Mon., 4 Mar.

1. How are the assumptions of Theorem 5.1.1 different from what we've been studying so far? (This is why it's in Chapter 5, and not at the end of Chapter 2.) You may need to look up some definitions in chapters we haven't read.
2. Explain carefully why the gain from switching from strategy $\mathbf{x}$ to pure strategy i given by the formula $A_i\mathbf{y} - \mathbf{x}^T A\mathbf{y}$, as claimed in the middle of p. 89.
3. Explain carefully why the denominator in the formula for $\hat{x}_i$ in the bottom half of p. 89 is
$$1 + \sum_{k=1}^{m} c_k,$$
as claimed in the text.
4. Explain carefully how multiplying inequality (5.1) by $1 + S$ is equivalent to the inequality just below (5.1),
$$\sum_{i=1}^{m} (x_i + c_i) A_i\mathbf{y} > (1 + S)\mathbf{x}^T A\mathbf{y}$$
as claimed in the text.

B: Warmup exercises. For you to present in class. Due by the end of class Mon., 4 Mar.

Illustrate finding $T(\mathbf{x}, \mathbf{y})$ for the game
$$A = \begin{pmatrix} 2 & 6 \\ 4 & 3 \end{pmatrix}$$
when
$$\mathbf{x} = \begin{bmatrix} 1/5 \\ 2/5 \end{bmatrix}, \ \mathbf{y} = \begin{bmatrix} 3/4 \\ 1/4 \end{bmatrix}.$$