

Math 486: Game Theory  
Assignment 7  
Due Thur 28 Feb

*Your solutions should be written so-as to be clear to an audience of fellow game theory students.*

1. Recall that the game *Big Numbers* is a 2-player game, played as follows. Player A picks an integer  $a$ , and player B picks an integer  $b$ . Then the players are awarded the payoffs

$$\begin{aligned}\pi_A(a, b) &= a - b \\ \pi_B(a, b) &= b - a.\end{aligned}$$

Show that *Big Numbers* has no maximin payoff for either player, hence no maximin strategy for either player.

2. Sketch the probability spaces

$$P_2 = \{(p_1, p_2) \in \mathbf{R}^2 \mid p_1 + p_2 = 1, p_1 \geq 0, p_2 \geq 0\}$$

and

$$P_3 = \{(p_1, p_2, p_3) \in \mathbf{R}^3 \mid p_1 + p_2 + p_3 = 1, p_1 \geq 0, p_2 \geq 0, p_3 \geq 0\},$$

and use your sketches to explain why  $P_2$  and  $P_3$  are convex sets.

3. Sketch the convex hull of the set

$$S = \{(-1, -1), (-1, 1), (1, -1), (1, 1), (2, 2)\}.$$

4. Let  $S \subset \mathbf{R}^n$  and  $T \subset \mathbf{R}^m$  be convex sets. Show that

$$S \times T = \{(\vec{s}, \vec{t}) \mid \vec{s} \in S, \vec{t} \in T\} \subset \mathbf{R}^{n+m}$$

is a convex set.