Game theory

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Exercise Sheet 6

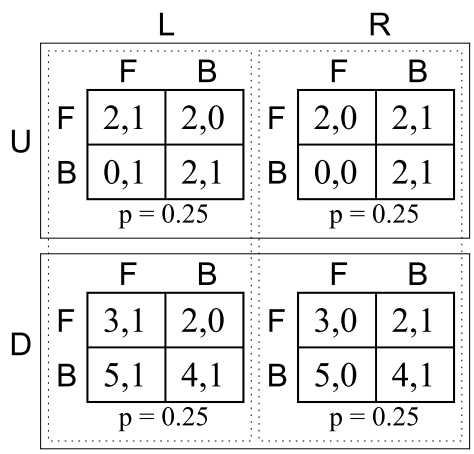
Due: Monday, June 10, 2013

Exercise 6.1 (Bayes-Nash equilibria and induced normal form, 2+1+2+1 points)

A Bayes-Nash equilibrium[1] is defined as follows:

A *Bayes-Nash equilibrium* is a mixed-strategy profile s that satisfies $\forall i, s_i \in BR_i(s_{-i})$, with BR_i denoting the *best response* in a Bayesian game.

Let $B = (N, G, P, I)$ be a Bayesian Game with $N = \{1, 2\}, G = \{g_1, g_2, g_3, g_4\}$. The common prior over all four games $P \in \prod(G)$ and the tuple of partitions $I = (U, D, L, R)$ over the games G are given as follows:



(a) In order to compute the Bayes-Nash equilibria of B, first, transform it into its corresponding 4×4 normal-form game NG. (In NG the payoffs are the expected payoffs in the individual games, given the agents' common prior beliefs. Check Chapter 6.3.3 in the MAS book.)

(b) Analyze the induced normal form NG for best responses. For example, what is player one's best response to player two playing strategy RL? How about player two's best responses to player one's strategies?

(c) Consider the above definition of Bayes-Nash equilibria. Which Bayes-Nash equilibria of B can you derive from NG and why?

[1] See Chapter 6.3 of the Multiagent Systems book by Shoham & Leyton-Brown for further helpful information

(d) Finally, analyze each single game of B (g_1, g_2, g_3, and g_4) for their respective Nash-equilibria. Explain their connection to the Bayes-Nash equilibria of B. Are similar connections guaranteed exist for Bayes-Nash equilibria? Explain.

Exercise 6.2 (Nash equilibria in zerosum games, 2+2 points)

Let G be a zerosum game with the following payoff matrix:

	L	C	R
T	$-2, \ 2$	$3, -3$	$-4, \ 4$
M	$4, -4$	$-1, \ 1$	$1, -1$
B	$-3, \ 3$	$1, -1$	$-2, \ 2$

(a) Specify both linear programs that have to be solved to find the strategies for Nash equilibira of this game.

(b) Use the tool `lp_solve`[2], to solve the linear programs. Report here the input to `lp_solve` together with its output. Which mixed strategy Nash equilibrium did you find?

[2] `http://sourceforge.net/projects/lpsolve`