

**Homework assignment on Behavioral Game Theory**

1. Consider the following two-player, two-action game:

	L	R
T	-1,3	1,0
B	0,1	-2,2

(a) Find all the Nash equilibria of this game (note that these equilibria may be in mixed-strategies).

(b) Assume  $L(0)$  for this game chooses one of his two actions at random. For each player, find the actions that  $L(1)$ ,  $L(2)$ ,  $L(3)$  and  $L(4)$  would choose.

2. Consider the following game. There are two players, Player 1 and Player 2. Each player has four cards: Ace, two, three and a Joker. Each player selects a card from his hand and places it face down on the table. The two cards are then revealed. If there is a match of Jokers (two Jokers were chosen) or a mismatch of number cards (two and three, for example), then Player 1 wins a point and Player 2 wins nothing. In all other circumstances, Player 2 wins a point and Player 1 wins nothing.

(a) Describe this game in matrix form. What are the Nash equilibria?

(b) Assume  $L(0)$  for both players chooses Ace with probability  $a > \frac{1}{4}$ , Joker with probability  $j > \frac{1}{4}$  and splits the remaining probability equally between the two number cards, 2 and 3. Assume that  $3j - a < 1$  and  $a + 2j < 1$ . For each player, find the actions of  $L(1)$ ,  $L(2)$  and  $L(3)$ .

3. Consider the following competition in quantities between two firms. Each firm chooses a quantity  $q$  from the interval  $[0, 1]$ . Firm  $i$ 's payoff (where  $i = 1, 2$ ) when it chooses  $q_i$  and its opponent chooses  $q_j$  is  $k_i q_i (1 - q_i - q_j)$ , where  $k_1 = 1$  and  $k_2 = 0.5$ .

(a) Find a pure-strategy Nash equilibrium in this game.

(b) Assume a firm of type  $L(0)$  simply chooses at random a value between 0 and 1. What are the best responses of types  $L(1)$ ,  $L(2)$  and  $L(3)$ .

(c) Assume that each firm initially does not know the upper and lower bounds from which it can choose a quantity (i.e., it does not know that its actions need to lie between zero and one). In addition, firm  $i$  also does not know the value of  $k_i$ . Suppose we could

observe the information that each firm looks for and in the order it looks for it. Assume each type of firm looks only for the minimal information it needs to calculate its best response. What is the information that each type of firm,  $L(0)$ ,  $L(1)$  and  $L(2)$ , will look for?