

Written Exam for the B.Sc. in Economics 2010-II

Micro 3

Final Exam

June 1st, 2010

(2-hour closed book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students’ self-service system.

PLEASE ANSWER ALL QUESTIONS BELOW. PLEASE EXPLAIN YOUR ANSWERS.

1. (a) Find *all* Nash equilibria in the following game

	L	R
T	2, 3	4, 2
B	3, 1	1, 2

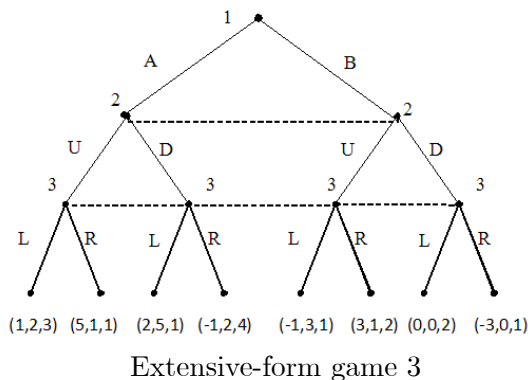
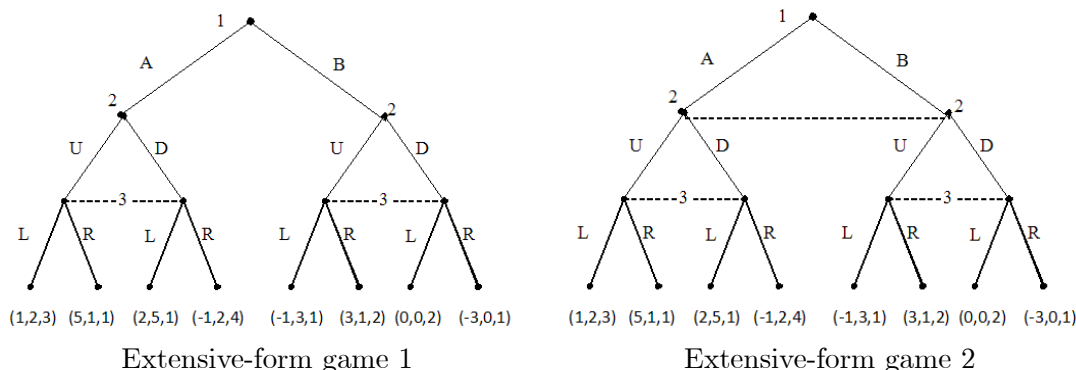
- (b) Consider the following non-cooperative *simultaneous-move* game between 3 players: Player 1 chooses the game matrix (between matrixes (A) and (B) below), and Players 2 and 3 play the respective game. The first number in each cell is the payoff of Player 1, the second number - the payoff of Player 2, and the third one - of Player 3.

		Player 3	
		L	R
Player 2	U	1, 2, 3	5, 1, 1
	D	2, 5, 1	-1, 2, 4
(A)			

		Player 3	
		L	R
Player 2	U	-1, 3, 1	3, 1, 2
	D	0, 0, 2	-3, 0, 1
(B)			

(*)

- i. Solve this game by iterated elimination of strictly dominated strategies.
- ii. Consider the extensive-form games 1, 2 and 3 below. Which of them (if any) corresponds to the (normal-form) game of subquestion (b)? Explain.



- (c) Now assume that *first* Player 1 chooses between the game matrixes (A) and (B) in (*), and *then* Players 2 and 3 observe her choice and *simultaneously* play the respective game.
- i. Which of the extensive-form games 1,2 or 3 (above) corresponds to this scenario? Explain.
 - ii. How many subgames are in the game that you chose in (c.i)? Find all its subgame perfect Nash equilibria.
 - iii. In the SPNE that you found in (c.ii), does Player 1 choose the strategy that was dominant for her in the game of subquestion (b)? That is, is the dominance relation "preserved" under the transformation of the game from a simultaneous-move one in (b) to the sequential-move one in (c)? Explain why or why not.

(d) Can a cooperative game have an empty core? If yes, provide an example and show that the core in your example is empty, if no, explain why.

2. Two firms $i = 1, 2$ are producing differentiated products and competing in prices. Both firms have constant marginal costs of production c . Before they set prices, they can spend resources on the advertisement, which increases demand by attracting consumers from the competing firm's market. More precisely, if firm i chooses the level of advertisement to be x_i , $i = 1, 2$, then the market demands of both firms become

$$q_1(p_1, p_2, x_1, x_2) = a + \underbrace{x_1}_{\substack{\text{increase} \\ \text{from own} \\ \text{advertisement}}} - \underbrace{x_2}_{\substack{\text{decrease} \\ \text{from other firm's} \\ \text{advertisement}}} - p_1 + \frac{p_2}{2},$$

$$q_2(p_1, p_2, x_1, x_2) = a + x_2 - x_1 - p_2 + \frac{p_1}{2}$$

where p_1 and p_2 are the prices set by firms 1 and 2, respectively. An advertisement level of x_i costs $\frac{8}{25}x_i^2$ to firm i . Each firm maximizes its market profit less the advertisement cost

$$\Pi_i = (p_i - c)q_i(p_1, p_2, x_1, x_2) - \frac{8}{25}x_i^2, \quad i = 1, 2.$$

The timing of the game is as follows: in the first period both firms simultaneously choose the advertisement levels x_1 and x_2 . In the second period firms observe the outcome of the first period and simultaneously set price levels p_1 and p_2 , production takes place and the profits get realized.

- (a) Consider firms' behavior in the second period of the game. Given the advertisement decisions of the first period, what is the price level $p_i(x_1, x_2)$ that each firm chooses in the NE of the second period? Show that the profit levels of the firms, as functions of x_1 and x_2 , are given by

$$\Pi_1 = \left(\frac{2a - c}{3} + \frac{2}{5}(x_1 - x_2) \right)^2 - \frac{8}{25}x_1^2$$

and

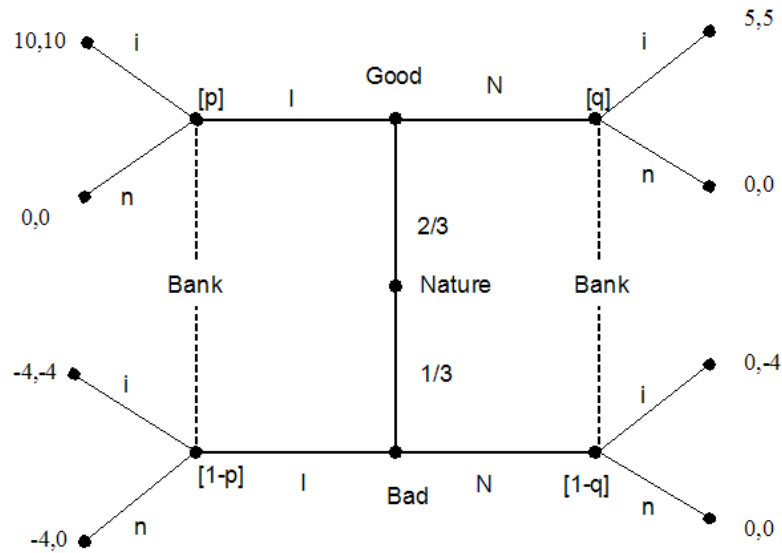
$$\Pi_2 = \left(\frac{2a - c}{3} + \frac{2}{5}(x_2 - x_1) \right)^2 - \frac{8}{25}x_2^2,$$

respectively.

- (b) Now consider the decisions of the firms in the first period and find the equilibrium advertisement levels of both firms. What are the resulting profit levels of the firms in this equilibrium?
- (c) Assume that the firms agreed not to advertise (i.e. to set $x_1 = x_2 = 0$).
- If they stick to this agreement, are they better off or worse off than in (b)? Provide intuition behind your answer.
 - Is this agreement credible (i.e. is any firm willing to deviate, if it assumes that the other one sticks to the agreement)? Explain and provide intuition behind your answer.

3. A firm is considering starting a new project. Its own capital is not sufficient to finance the project, so it goes to a bank and offers it to be a co-investor on the project. The project is either good (with probability $2/3$) or bad (with probability $1/3$) and only the firm knows its quality. The timing of the game is as follows: first, nature draws the quality of the project. The firm learns it and decides whether to invest its own money (I) or not (N). Then the bank

observes investment decision of the firm and decides whether to invest (i) or not (n). If both firm and bank invest and the project is good, they receive high profits. If only bank invests and the project is good, both the firm and the bank receive moderate profits. The investment of the firm only is not sufficient to yield profits. So, if the firm is the only investor, it gets zero profit in the case of good project. A bad project implies losses for all investors (if any). The following game tree represents the game, where the first number is the firm's payoff and the second number is the bank's one



- Find all pooling PBE of this game.
- Find all separating PBE of this game.
- Formulate signalling requirement 5 and check whether the PBE you found above satisfy requirement 5. Explain your reasoning.