Written Exam for the B.Sc. or M.Sc. in Economics summer 2015

Microeconomics C

Final Exam

August 12, 2015

(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.

This exam consists of 3 pages in total, including the current page.

1. Two firms, 1 and 2, are producing a homogenous good and simultaneously decide on quantity. The price is given by

$$P = 20 - q_1 - q_2,$$

and both firms have a marginal cost of 5.

   (a) Find the Nash Equilibrium quantities, under the assumption that both firms are profit-maximizers. What are the profits of the firms in equilibrium?

   (b) Continue to assume that Firm 2 wants to maximize profits, but now suppose that Firm 1 is 'irrational' and produces quantity $q_1 = q'$, regardless of what it expects Firm 2 to produce. Suppose furthermore that Firm 2 does not realize that Firm 1 is 'irrational' and instead continues to believe that Firm 1 is a profit-maximizer. What level of irrationality is optimal for Firm 1 (i.e. what value of q' leads to the highest profits for Firm 1)? Describe how Firm 1's quantity and profits at this optimal level compare to those from part (a). Briefly explain the intuition for any similarities or differences (2-3 sentences).

   (c) Now assume that Firm 1 is 'irrational' as in part (b), and suppose Firm 2 understands that Firm 1 is irrational. What level of irrationality is optimal for Firm 1 (i.e. what value of q' leads to the highest profits for Firm 1)? Describe how Firm 1's quantity and profits at this optimal level compare to those from parts (a) and (b). Briefly explain the intuition for any similarities or differences (3-4 sentences).

2. Now consider the infinitely-repeated game $G(\infty)$, with stage game G given by:

		Player 2	
		M	F
Player 1	M	$4, 4$	$-1, 6$
	F	$5, -1$	$0, 0$

   Suppose that both Player 1 and Player 2 have discount factor δ. Let (π_1, π_2) denote the average payoff of Player 1 and Player 2 respectively in a particular Subgame Perfect Nash Equilibrium (SPNE). Recall that in particular, player i's average payoff will be π_i in a situation where he obtains a payoff of π_i in every period.

   (a) Show for which values of $\delta \in [0, 1)$, if any, a SPNE exists where $(\pi_1, \pi_2) = (4, 4)$.

   (b) Show for which values of $\delta \in [0, 1)$, if any, a SPNE exists where $(\pi_1, \pi_2) = (0, 0)$.

   (c) Show for which values of $\delta \in [0, 1)$, if any, a SPNE exists where $\pi_1 = -1$.

   (d) Describe the set of all possible average payoffs (π_1, π_2) that can be obtained in some SPNE, in the limit as δ approaches 1.

3. Consider a signaling game G' where Nature draws the Sender's type $t \in \{t_1, t_2\}$, the Sender then sends a messages $m \in \{m_1, m_2\}$, and the Receiver responds with an action $a \in \{a_1, a_2\}$. Suppose that from an ex ante perspective, each Sender type is equally likely.

   (a) Briefly explain whether G' is a game of complete or of incomplete information (1 sentence)

   (b) Describe informally the meaning of Signaling Requirements 5 and 6 when applied to G' (3-4 sentences).

(c) **Please answer either part (c) or part (d) in question 3, but not both.** Suppose that a Perfect Bayesian Equilibrium exists in G' where t_1 sends message m_1 and t_2 sends message m_2, both with probability 1. Without any further information, is it possible to say whether this equilibrium satisfies Signaling Requirement 5? Why or why not? (2-3 sentences)

(d) **Please answer either part (c) or part (d) in question 3, but not both.** Suppose that a Perfect Bayesian Equilibrium exists in G' where t_1 and t_2 both send message m_1 with probability 1. Suppose furthermore that G' is a cheap-talk game. Without any further information, is it possible to say whether this equilibrium satisfies Signaling Requirement 5? Why or why not? (2-3 sentences)

(e) Describe a hypothetical real-world situation where Signaling Requirement 6 might give insight into strategic behavior (3-5 sentences).

4. Consider a game of incomplete information with Consumer 1 and Consumer 2, where each consumer's type θ_i is independently drawn from a uniform distribution on $[-1/2, 1/2]$. Consumers must simultaneously choose whether to buy one unit of a good. For each consumer i, buying gives a payoff $u_i = \theta_i + \lambda - p$ if consumer j also buys, and a payoff $u_i = \theta_i - p$ if consumer j does not buy, where $\lambda \geq 0$ and $p \geq 0$ are constants. Not buying always gives a payoff of zero.

(a) Show that a Bayesian Nash equilibrium exists where both consumers buy with probability 1 if and only if $p \leq \lambda - 1/2$.

(b) Consider a symmetric Bayesian Nash equilibrium where each consumer i buys if and only if his type exceeds a cutoff value: $\theta_i \geq \theta^*$. Show that $\theta^* = (p - \frac{\lambda}{2})/(1 - \lambda)$, and write down the resulting expected total demand from the two consumers.

(c) Now interpret p as the price set by a seller. What is the value of p that maximizes the seller's expected revenue if $\lambda = 1/2$? What about if $\lambda = 2$?

(d) What do your answers in parts (a-c) suggest about the relationship between price and expected demand in the presence of network externalities? (3-4 sentences).