Written Exam for the B.Sc. in Economics summer 2011

Industrial Organization

Final Exam

June 14, 2011

(3-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.

Attempt both questions

Question 1

This is a model of a monopoly firm that sells its good in two time periods to consumers who are forward-looking. It is identical to a model that we studied in the course, and it is related to the so-called Coase conjecture.

There are two time periods, $t = 1$ and $t = 2$. At each t, a monopoly firm is producing and selling a good. There are a continuum of consumers who differ from each other with respect to the parameter $v \in [0, 1]$, the gross utility from consuming one unit of the good during one time period. The v's are uniformly distributed on $[0, 1]$. A consumer only gets utility from consuming (a single unit of) the good *once*, and therefore never wants to consume the good in both periods. A consumer's net utility from consuming the good in period t equals $v - p_t$, where p_t is the price the firm charges in period t. Not buying the good yields the utility zero. The consumers' (common) discount factor is denoted by $\delta \in [0, 1)$. The timing of events is as follows.

1. The monopoly firm chooses its first-period price p_1.
2. The consumers observe p_1 and then (simultaneously) choose whether to buy or not.
3. The monopoly firm chooses its second-period price p_2.
4. The consumers observe p_2 and then (simultaneously) choose whether to buy or not.

The monopoly firm has a constant marginal cost of production, which is normalized to zero. The objective of the firm is to maximize its profits; however, the firm is myopic, which means that when choosing p_1 at stage 1 it does not take into account the effects on the second-period profit. The consumers maximize their net utilities, appropriately discounted.

a) Solve for a subgame perfect Nash equilibrium of the model in which consumers with $v > a$, for some $a \in (0, 1)$, consume in period 1. Find the equilibrium value of a. Also identify the equilibrium values of p_1 and p_2.

b) Explain in words what the Coase conjecture says. Also explain the intuition.

c) Define the "Herfindahl index" and the "3-firm concentration ratio". Also, consider a market with seven firms. Their market shares are 5, 5, 10, 10, 20, 20 and 30 percent. Calculate the Herfindahl index and the 3-firm concentration ratio for this market.

Question 2

The following is a model of discrimination, where this term is understood as a firm's refusal to serve members of a minority. It builds on Hotelling's linear city model, which we studied in the course.

There are two restaurants that are exogenously located at each end of Hotelling's linear city (as illustrated below).

0	– –	1
Restaurant 1		Restaurant 2

There are two groups of customers: *minority customers* (who have green hair) and *non-minority customers* (who have pink hair). Within each group, customers differ from each other with respect to their location on the Hotelling line, and for both groups the distribution of locations is uniform. The mass of all customers is normalized to one, and the fraction of minority customers equals $\gamma \in \left(0, \frac{1}{10}\right)$. All customers have so-called unit demand, meaning that they want to visit at most one restaurant. In particular, their preferences are exactly as in Tirole's version of the model. Assume that the parameters of the model are such that the market is covered (i.e., all customers who are allowed to visit at least one of the restaurants find it worthwhile to do so). As we showed in the course, for any given prices p_1 and p_2, the location of the customer who is indifferent between the two restaurants equals

$$\overline{\theta} = \frac{p_2 - p_1 + 1}{2},$$

where the parameter t in the customer's transportation cost function has been set equal to one. Each restaurant has a constant marginal cost of production, which is normalized to zero.

The timing of events is as follows.

1. The two restaurants simultaneously decide whether or not to serve the minority costumers. Denote this strategy by $x_i \in \{n, d\}$, where $x_i = d$ means that Restaurant i does not serve the minority costumers.

2. The restaurants observe x_1 and x_2 and then simultaneously choose p_1 and p_2. Price discrimination is not allowed: minority costumers, if they are served, must be charged the same price as non-minority costumers.

3. The customers observe the decisions at stages 1 and 2 and then decide which restaurant to visit. A minority customer cannot visit a restaurant that does not serve those customers. Instead such a customer must visit the other restaurant (if there is such a non-discriminating restaurant) or not visit any restaurant at all (if both restaurants refuse to serve members of the minority). The demands facing the two restaurants are therefore:

	$D_1(p_1, p_2)$	$D_2(p_1, p_2)$
$(x_1, x_2) = (n, n)$	$\overline{\theta}$	$1 - \overline{\theta}$
$(x_1, x_2) = (d, d)$	$(1-\gamma)\,\overline{\theta}$	$(1-\gamma)\left(1 - \overline{\theta}\right)$
$(x_1, x_2) = (d, n)$	$(1-\gamma)\,\overline{\theta}$	$1 - (1-\gamma)\,\overline{\theta}$
$(x_1, x_2) = (n, d)$	$1 - (1-\gamma)\left(1 - \overline{\theta}\right)$	$(1-\gamma)\left(1 - \overline{\theta}\right)$

Restaurant i's profit at stage 2, given some (x_1, x_2), can therefore be written as

$$\Pi^i = p_i D_i (p_1, p_2) .$$

a) Solve for all subgame-perfect Nash equilibria of the game described above (however, do not bother about the mixed-strategy equilibrium at stage 1).

Hint 1: The result should be that, at stage 1, the only (pure strategy) equilibria are $(x_1, x_2) = (d, n)$ *and* $(x_1, x_2) = (n, d)$*; that is, one of the restaurants discriminates whereas the other one does not.*

Hint 2: When solving for the equilibrium prices in the two symmetric subgames at stage 2, you are allowed to assume $p_1 = p_2$*.*

b) Interpret your results: what is the economic logic that explains why the restaurants at stage 1 make the choices they make in the equilibria that you derived? When explaining that logic, make sure you answer the following two questions: (i) At stage 2, are the restaurants' choice variables strategic substitutes or strategic complements, and what is the significance of this? (ii) What is the significance of the assumption that each firm can observe the other firm's decision whether to discriminate before choosing the price at stage 2?

You are encouraged to attempt part b) even if you have not been able to answer part a). You can base your answer to part b) on the suggestion in the first hint in part a).

END OF EXAM