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## Exam "Industrial Organization"

(February 2007)

Please answer all of the following questions. Do not expect all numerical results to be integers. Please explain all your answers briefly, so that calculations and derivations can be fully accounted for. The use of calculators is permitted in accordance with the regulations of the faculty's examination office.

### Task 1

Bill, a clever innovator and billionaire, has created a meaning-of-life-solver based on the Monty Python's movie "The Meaning of Life." This incredible little black box enables users to solve all of their meaning-of-life questions. Bill provides the two firms *Lambency inc.* (L) and *A Moment in Eternity ltd* (A) with the secret construction plan of the solver, so that they can produce and sell it to all the unsettled souls in need of help. The unit cost of production for both firms is  $c = 11$  and the fixed cost is  $f = 20000$  (no capacity constraints). The demand for the solver is  $q = 1001 - 0.5 \cdot p$ .

1. Assume that the firms A and L compete in a price-setting scenario:
  - (a) Discuss the equilibrium strategies in this setting. Derive prices, quantities, and profits of both firms in equilibrium.
  - (b) Bill is an altruistic person who wants the solver to be sold as much as possible. Discuss the possibilities he may have to increase the sales by the firms.
  - (c) What if Bill is not altruistic but wants to maximize his own income? Describe briefly a structure of license fees that he could use to maximize income.
2. Consider a quantity-setting scenario:
  - (a) Calculate the equilibrium outcomes (price, quantities, and profits) for the case that *Lambency inc.* is always first in making the quantity decision and the quantity choice of *A Moment in Eternity ltd.* follows later.
  - (b) Explain briefly whether and in which way outcomes may be different, if firm A makes a decision first and firm L follows.
  - (c) Explain briefly whether and in which way outcomes may be different, if firm A and firm L make their decisions simultaneously.
3. Consider a scenario in which the innovator does not give away the secret construction plan for free, but instead offers the firms a license contract that specifies a license fee of  $\alpha$  to be paid by the firms to the innovator for each sold unit.
  - (a) Derive the best response functions in the Cournot competition between the two firms for the case that the license fee is  $\alpha$ .
  - (b) Use the results in (3a) to derive the equilibrium outcomes (price, quantities, and profits) in the Cournot competition between the two firms for the case that the license fee is  $\alpha$ .
  - (c) Specify the innovator's profit function and calculate the optimal  $\alpha$  that maximizes the innovator's profit.
  - (d) Calculate the equilibrium outcomes (price, quantities, firm profits, and the profit of the innovator).



## Task 2

A monopolist produces handheld DVD-Players that allow you to watch your favorite movie any time, any where. However, since the DVD-format will be modified by 2009, consumers know that this device will be useful only the years 2007 and 2008. The inverse demand function in each year  $t$  is  $p_t = 1000 - 0.5 \cdot q_t$ . Note, however, any one consumer can at most use only one unit at any time. The monopoly's production cost for a unit equals  $c = 8$ .

1. Remember that users, who buy the device in 2007, can actually use it in both periods, while users, who buy the device in 2008, can only use it for one period.
  - (a) Assume the quantity  $q_1$  has been sold in the first period. Specify the formula for the inverse demand in the second period as a function of  $q_1$ .
  - (b) Using your answer in (1a), specify the objective function of the monopoly for the second period and calculate the optimal second period quantity  $q_2$  and price  $p_2$  as a function of  $q_1$ .
  - (c) Consider the marginal buyer, who is indifferent between using the device only in the second period and using the device in both periods. Remember that every consumer's benefit from usage is reflected in the inverse demand function (willingness-to-pay), while the consumer's cost is equal to the price. Specify the first period price  $p_1$  as a function of the first period quantity  $q_1$  for the case of the marginal buyer.
  - (d) Use the function describing the marginal buyer to derive the monopoly's optimal first period quantity choice by maximizing the total payoff (of both periods together).
  - (e) Given the results of (1a) to (1d) calculate the optimal quantity and price for each period and the optimal total payoff.
2. Assume the monopolist decides to give away the handheld DVD-players for free to any user who pays a license fee. The license can only be obtained on a yearly basis and it enables the usage of the device exactly for one calendar year. Consumers can buy a license for the year 2007 at the price  $r_1$  and/or for the year 2008 at the price  $r_2$ . If a license runs out and is not renewed, the user is required to return the device to the monopoly.
  - (a) Specify the objective function of the monopoly for the second period and calculate the optimal second period quantity, price and profit.
  - (b) Using the results in (2a), specify the two-period objective function of the monopolist and calculate the optimal first period quantity, price and profit.
  - (c) Compare the outcomes of the licensing approach to those of the direct sales approach.