

## Final Exam

October 5, 2018

### 1. General information:

- a. Make sure that your final exam is complete. The final exam consists of 4 problems.
- b. Only use the paper provided to you. Write your student ID number immediately and clearly on each page!
- c. Please do not remove the staples from the provided sheet of paper.
- d. Items allowed at your workplace: Student ID, writing utensils, ruler, set square, non-programmable calculator, food and drinks.
- e. Items not allowed at your workplace: Red pen, ink eraser, pencil case
- f. Use a permanent pen (no pencil).
- g. Mobile phones have to be turned off and removed from your place!

### 2. Hints about doing the exam:

- a. Read each task carefully. The tasks could be extended over several pages.
- b. Please complete all tasks. Begin each one on a new page. Please write your answers in a readable way.
- c. You may write your answers in English or in German.
- d. Label the axes of your illustrations.
- e. The exam must be completed within 90 minutes!

Good luck and much success!

## Problem 1 - Price Discrimination (30P)

A homogenous good is purchased by two consumers  $A$  and  $B$ , whose demand for the good can be described by the functions  $q_A(p) = 150 - p$  and  $q_B(p) = 130 - p$ , respectively. The good is produced by a profit-maximizing monopolist. Marginal costs are  $c = 10$ .

- a) Suppose the monopolist practices third-degree price discrimination. What prices would the monopolist charge and what would be the ensuing profit?
- b) If the monopolist is forced to charge a uniform price, what would price would the monopolist charge? Is it optimal to serve both groups?
- c) The monopolist is now able to design a two-part tariff  $(p, t)$ , where  $t$  is a fixed fee. If the monopolist can identify the consumers, what prices  $p_A$  and  $p_B$  would he charge, what would be the optimal tariffs  $t_A$  and  $t_B$ , and what would be the ensuing profits?
- d) Assume now that the monopolist cannot identify the consumers and offers a single tariff  $(p, t)$ . Calculate the optimal price, the optimal fixed fee. Is it optimal to serve both groups?
- e) Assume again that the monopolist cannot identify the consumers. The monopolist now decides to offer two menus consisting of a quantity  $q_i$  and a fixed fee  $t_i$  to both consumers  $i \in \{A, B\}$ . Show that for the menu  $q_A = 140, q_B = 100, t_A = 9200, t_B = 8000$  consumer  $B$  will buy the good and consumer  $A$  has no incentive to choose the menu designed for consumer  $B$ . Interpret your results and explain why these tariffs yield the highest profits for the firm if it cannot identify the types

## Problem 2 - Entry Deterrence (25P)

Consider an incumbent firm that produces homogenous goods. The demand for the good can be described by the function  $p(q) = 20 - 2q$ . Production of the good entails constant marginal costs of  $c = 4$ . There is a potential entrant whose marginal costs of production are identical to those of the incumbent. However, entry into the market requires (sunk) investment costs  $F$ . In case of entry the firms compete in quantities. The incumbent acts as a first-mover.

- a) Calculate the equilibrium quantities, prices and profits for  $F \rightarrow \infty$ , i.e., for the monopoly case.
- b) Suppose investments costs are  $F = 2$ . Calculate the incumbent's output that would be necessary in order to deter entry. What would be the incumbent's ensuing profit?
- c) What would be the incumbent's profit if entry is accommodated? Does it pay off for the incumbent to deter entry when  $F = 2$ ?
- d) Suppose fixed costs are  $F = 18$ . What would be the incumbent's optimal output for which entry is deterred? Comment on the differences to your solution in b).
- e) Discuss briefly the importance of commitment in this setup.

### Problem 3 - Vertical Product Differentiation (15P)

Suppose a monopolist sells two vertically differentiated goods L and H to a total of  $N = 100$  costumers. The marginal costs for producing these goods are  $c_L = 0.1$  and  $c_H = 0.4$ , respectively. The quality of the goods can be indicated by  $s_H = 2$  for good H and  $s_L = 1$  for good L. Consumers' net utility can be described by the function  $U = \theta s_i - p_i$ ,  $i \in \{L, H\}$ , where  $\theta$  is a parameter measuring preference for quality of consumer  $\theta$  and  $p_i$  being the price of good  $i$ . The parameter  $\theta$  is uniformly distributed with support  $[0,100]$ .

- a) Determine the demand functions for each of the two goods.
- b) Derive the profit maximization problem of the firm and determine the optimal prices. Calculate the maximum profit.
- c) Is the market covered given the profit maximizing strategy of the monopolist? Explain your result verbally in at most 2 sentences.

### Problem 4 - Fundamentals of Competition (20P)

Answer **both questions** verbally. You can support your answers with figures if necessary.

- i) Explain the fundamental differences in the assumptions of the Cournot and the Bertrand model, when  $n$  symmetric firms supply a homogenous good. Also address verbally the differences between the equilibrium prices, quantities, profits and welfare in the two models.
- ii) Suppose 2 firms supply a homogenous good and compete in prices. Although production is costless, both firms' production is subject to capacity constraints. Explain why there not always exists a pure strategy equilibrium where both firms' capacities are fully utilized.