Final Exam

March 3, 2016

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 <u>not</u> 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 (35P)

Consider a homogenous goods market with *n* competing, profit-maximizing firms. Market demand can be described by the function $q(p) = \frac{a-p}{b}$ where q denotes aggregate output and p the market price. The variables *a* and *b* are positive real numbers. The cost functions are of the form $C_i(q_i) = c_i \cdot q_i$ with $c_i < a \; \forall \; i \in \{1, \dots, n\}$.

a) Assume that $c_i = c \; \forall \; i$, i.e., the firms are symmetric. Moreover, the firms compete in quantities (Cournot competition). Determine the profit function of firm i and determine the equilibrium quantities, prices and profits. (7P)

b) Assume now that the *n* symmetric firms compete in prices (Bertrand competition). Determine the equilibrium prices and profits for each firm and describe verbally the mechanism that leads to your result (*max. 3 sentences*). (3P)

c) Given the model setup of a) and b), comment on the differences between the Bertrand- and Cournot-results with regard to the market outcomes and the relationship of the strategic variables. What does the 'Bertrand Paradox' state? How do both models relate to the model of perfect competition. *Your answer should not be longer than ¼ of a page*. (5P)

Assume now that *n*=2. And *a*=100, *b*=1, $c_1=10$ and $c_2=20$. Firm 1 (indexed by 1) can now set its quantity first. Firm 2 (indexed by 2) observes the quantity choice of firm 1 and reacts accordingly (Stackelberg competition).

d) Determine the equilibrium quantities, prices and profits of firms 1 and 2. (7P)

e) Interpret your results and explain why the Stackelberg-leader has an advantage in this setup. (3P)

Consider again the case of *n*=2 firms that compete in prices. The values of the demand parameters are *a*=100 and *b*=1. Now, the firms have the same marginal costs $c_1=c_2=20$ and they are capacity constrained, i.e., none of them can supply a quantity higher than $\bar{q}_i$ with $\bar{q}_1 = \bar{q}_2$. Assume that costumers book in the order of their reservation prices (efficient rationing).

f) Given $\bar{q}_1 = \bar{q}_2 = 20$, firm 1 charges a price $p_1 = 100 - \bar{q}_1 - \bar{q}_2$. Show that for firm 2 it is not optimal to charge a price that yields quantities $q_2 \leq \bar{q}_2$ and interpret your results. Explain briefly what would happen if the capacities were $\bar{q}_1 = \bar{q}_2 = 50$ (no calculations required). (10P)

Problem 2 (25P)

A profit-maximizing monopolist sells a homogenous good to two distinct customer groups 1 and 2. Both customer groups are of the same size. The willingness to pay of group 1 is $q_1(p) = 20 - p$, that of group 2 is $q_2(p) = 10 - p$, where q denotes quantities and p prices. There is no arbitrage between the groups. The cost function of the firm takes the form $C(q) = q$.

a) Determine the optimal linear prices with price discrimination. (4P)
b) Determine the optimal uniform price, i.e., without price discrimination. Will both groups be served? (6P)

Now, assume that the monopolist charges a two-part tariff (f, p) where f denotes a fixed fee and p the price.

c) Suppose the monopolist can perfectly identify each consumer. Derive the optimal menu $(f_i^*, p_i^*), i \in \{1,2\}$. (3P)
d) Now, the monopolist cannot identify the consumers. Determine the optimal menu (f^*, p^*) given the monopolist only offers one single price and serves both groups. (7P)
e) Describe how the monopolist can do better than charging a single menu when she cannot identify the consumers? Address the constraints she has to take care of when determining the optimal menu. Give a qualitative answer on at most ¼ of a page. (5P)

Problem 3 (25P)

Describe the basic concepts of horizontal and vertical product differentiation? Give examples. Describe one basic model for each type that is used to analyze product differentiation. In doing so, answer the following questions.
How does the concept of transport costs help economists to model product differentiation? Comment on the *competition effect* and the *market size effect* of product differentiation. How do they determine whether competing firms supply (rather) homogeneous or more differentiated products?
How do economists model consumers' preferences for product quality? Under what conditions would a monopolist offer a higher quality product to customers with a high willingness to pay for such products? In other words, what might influence the introduction of new variants in a market?