

Version: A

# Examination in Microeconomics A

## Spring Term 2011

### Handling of the exam

- Please check carefully whether your exam sheets are complete and correct, objections after the exam cannot be considered:
  - There are 2 **versions** of this exam, which are denoted by A and C respectively. Please check carefully, whether the version on the question sheet corresponds to the one on the solution sheet.
  - The **question sheet** (including the pages with the general remarks) consists of 8 pages. In addition there is a **solution sheet**, which consists of 3 pages.
- The use of resources other than a non-programmable calculator and at most one dictionary is not allowed. The use of other resources (e.g. programmable calculators, your own concept paper) leads to the disqualification from the exam.
- You have 120 minutes to solve the exam.
- The **exam** consists of 5 True- / False questions, each consisting of 5 subquestions, and 3 Text Problems again each consisting of 5 subquestions.
- For the True- / False- questions you have to decide whether a statement is true or false. For *each* subquestion you have to mark on the solution sheet whether the statement is true (T) or false (F). You will be awarded points according to the following rule: If your answer is correct, you will obtain *3 points* per statement. If your answer is wrong or if both answers are marked, you will obtain *0 points*. If no answer is given, then you will get *1 point*. For the True- / False- questions you can therefore obtain at most obtain 75 points.
- The **Text Problems** have, on the one hand, Multiple-Choice-subquestions (MC) with 5 answers provided for each question, where *exactly one of these answers is correct*. On the other hand, there are numerical subquestions (N), where you have to fill in a number on the solution sheet in encoded form. For each subquestion you get 5 points if answered correctly and 0 otherwise. For the Text Problems you can therefore at most obtain 75 points. Here is an example on how to encode integers in the numerical subquestions: Suppose the solution to the question is **503**. Then this number has to be filled in as follows:

Zahl Frage	100er	10er	1er
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Figure 1:

**Important:** Mark the zero in the first column if the solution is a two-digit number. Similarly, mark the zero in the first and in the second column if the solution is a single-digit number.

- You will have passed the exam with certainty, if you obtain at least *70 points* or if you are among the 75% best participants of the exam.

Handling of the solution sheet:

- You **only** have to hand in the solution sheet at the end of the exam. Answers on concept sheets or on the question sheet will not be considered. We recommend that you fill in the solutions at the **end of the exam** in order to avoid corrections. Please start to fill in your answers **at least 5 minutes before the end of the exam**. The supervisors have orders to collect the solution sheets, even if you have not yet filled in your answers.
- *Please fill in the whole circle, do not mark answers with a cross! Only unambiguously legible solutions can yield points. Please do not use TippiEx to correct your answers!*
- You must sign your solution sheet at the bottom, otherwise your exam is not **valid**.
- If you do not wish that we publish your registration number, your points and your expected mark on our homepage, you have to mark the respective field on the solution sheet. If you mark this field, you have to wait for your grade until it is announced by the "Studienbüro", which may take some time.

Concerning the content of the exam

1. Assume that the "Ceteris-Paribus" condition holds. This means that all variables that are not explicitly changed remain constant. If we ask for example about the effects of the change of one variable (e.g.  $p_1$ ), you have to assume that the other variables (e.g.  $p_2$ ) remain constant, unless explicitly stated otherwise.
2. If we say that a variable (e.g.  $p_1$ ) is changed, we mean a marginal change that is strictly different from zero, unless explicitly stated otherwise.
3. Assume infinitely divisible goods, unless explicitly stated otherwise.
4. Assume strictly positive and finite prices and income.
5. Assume that consumers maximize their utility and firms maximize profit.
6. Market demand functions are always weakly decreasing, market supply functions are weakly increasing.

Good luck!

# 1 True-/False questions

1.1 Consider an exchange economy with two agents and two goods. Each agent is endowed with a strictly positive quantity of both goods. Which of the following statements are true?

- a** In the Walrasian equilibrium, there exists no exchange opportunity that is advantageous for both agents.
- b** If the agents have the same quantity of good 1 and the same quantity of good 2 as an endowment, then there is no benefit from trade.
- c** Each element of the contract curve is Pareto efficient.
- d** Consider a situation where one agent can destroy parts of her endowment before the agents interact in the competitive market. Statement: If one agent destroys parts of her endowment, then she can be better off compared to the situation where she does not destroy parts of her endowment.
- e** Consider a Walrasian equilibrium. Statement: If all prices are doubled, then it can be that at least one agent purchases strictly less of at least one good than in the original Walrasian equilibrium.

1.2 Which of the following statements are true?

- a** If the preferences of a consumer are not complete, then it is impossible to find a utility function which represents her preferences.
- b** If the preferences of a consumer are not monotonic, then it is impossible to find a utility function which represents her preferences.
- c** If the preferences of a consumer are not transitive, then it is impossible to find a utility function which represents her preferences.
- d** If the preferences of a consumer are not monotonic, then her indifference curves can intersect.
- e** If the indifference curves of a consumer in a  $(x_1, x_2)$ -diagram are always strictly monotonically increasing, then it must be true that, ceteris paribus, for one of the goods the consumer prefers less to more.

1.3 Which of the following statements are true?

- a** If for a firm all inputs that this firm uses have a decreasing marginal product, then this firm's marginal cost curve is first strictly decreasing and then strictly increasing.
- b** Suppose a firm's cost function is differentiable. At the quantity that minimizes the firm's average costs, the marginal costs are equal to average costs.
- c** If for each firm in an industry the average variable cost curve is U-shaped and does not have kinks, then the aggregate supply function also does not have kinks.
- d** The residual demand  $D_i^r(p)$  that firm  $i$  faces indicates how much firm  $i$  can sell if it sets the price  $p$  while the other firms charge the equilibrium price.
- e** Consider a market equilibrium with the equilibrium price  $p^*$ . The residual demand  $D_i^r(p)$  that firm  $i$  faces is more elastic at  $p = p^*$  the more elastic market demand is at  $p = p^*$ .

1.4 Mr. Reckless and Mrs. Careful are both expected utility maximizers, but Mr. Reckless is risk loving and Mrs. Careful is risk averse. Each of them has an initial wealth of 5000 Euros. A share yields 1000 Euros with probability 0.25, else 360 Euros. Which of the following statements are true?

- a** The standard deviation of the share's value is equal to 160.
- b** At a price of 500 Euro, Mr. Reckless would buy at least one share.
- c** We need to have more information about Mrs. Careful's preferences to decide whether she would buy this share at a price of 520.
- d** If Mrs. Careful buys one share at a price  $p$ , then she is also willing to buy two of these shares.
- e** Suppose Mrs. Careful's money utility function is differentiable. Statement: The first derivative of her money utility function is decreasing.

1.5 Which of the following statements are true?

- a** A production function  $f(x_1, x_2)$  exhibits constant returns to scale if for all  $t > 0$  it holds that  $f(tx_1, tx_2) = tf(x_1, x_2)$ .

- b** The production function  $f(x_1, x_2) = x_1^a + x_2^{\frac{1}{a}}$ , with  $0 < a < 1$ , has everywhere decreasing returns to scale.
- c** If the production function is  $f(x_1, x_2) = x_1^a + x_2^{\frac{1}{a}}$ , with  $0 < a < 1$ , then the marginal product of good 1 is decreasing.
- d** If a firm's production function is  $f(x_1, x_2) = \min(x_1, 2x_2)$ , then the isoquant is not differentiable at  $(x_1, x_2) = (4, 2)$ .
- e** If a firm's production function is  $f(x_1, x_2) = \min(x_1, 2x_2)$  and the price of input 1 is twice the price of input 2, then the firm minimizes its cost of producing a given quantity by using the same quantity of the two inputs.

## 2 Text Problems

**Problem 2.1** Consider a market with  $n = 10$  firms. Each of the firms has the supply function  $q = p^2$ . The market supply is  $Q^s$ . The market demand is  $Q^d = \frac{10}{p^2}$ . There are no fixed costs.

2.1.1 (N) Compute the quantity that is traded in the market equilibrium and state it rounded to the nearest integer.

2.1.2 (N) Compute the profit of a single firm in the market equilibrium and multiply this number by 60. State the resulting number rounded to the nearest integer.

2.1.3 (MC) Exactly one of the following statements is correct.

- a** The price elasticity of market supply is strictly monotonically increasing in  $Q^s$ .
- b** There exists a  $Q$  such that the absolute value of the price elasticity of market demand at  $Q^d = Q$  is strictly larger than the price elasticity of market supply at  $Q^s = Q$ .
- c** The price elasticity of market demand is strictly monotonically decreasing in  $Q^d$ .
- d** The price elasticity of market supply at  $Q^s = 5$  is equal to the price elasticity of market supply at  $Q^s = 10$ .
- e** None of the above four statements is correct.

2.1.4 (N) Compute the price elasticity of residual demand in the market equilibrium and state it rounded to the nearest integer.

2.1.5 (N) Assume that the number of firms in the market is  $n$ . How many firms have to be in the market, i.e. what is  $n$ , such that the quantity that is traded in the resulting market equilibrium is equal to 40?

**Problem 2.2** Consider a village that exists for two periods and consumes only wheat. The village knows that the harvest will be equal to 1000 bushels of wheat in the first period and 600 in the second period. The wheat can be stored, but 25% of it perishes between the periods and has to be thrown away. Let  $c_1$  and  $c_2$  denote the village's consumption in the two periods and let  $u(c_1, c_2) = c_1 c_2$  represent the preferences of the village. The village does not have any monetary income and at first, it has no connection to the rest of the world.

2.2.1 (N) If the village consumes 800 bushels of wheat in the first period, how much wheat can be consumed in the second period? State the answer rounded to the nearest integer.

2.2.2 (N) Compute the consumption plan that maximizes the village's utility. What is the optimal value of  $c_2$ ? State the answer rounded to the nearest integer.

2.2.3 (N) Assume now that in each period, a traveling salesman and a banker come to the village. This gives the village the opportunity to sell and buy wheat at a price of 10 per bushel and borrow and lend at an interest rate of  $r = 10\%$  ( $= 0.1$ ). What is the optimal value of  $c_2$  in this case? State the answer rounded to the nearest integer.

2.2.4 (MC) There is a new kind of planting technology that would allow a harvest of 1400 in the first period and 200 in the next. Exactly one of the following statements is true.

- a In the setting of question 2.2.3, with traveling salesman and banker, the village strictly prefers the new technology to the old one.
- b In the setting of question 2.2.3, with traveling salesman and banker, the village strictly prefers the old technology to the new one.
- c In the setting of question 2.2.3, with traveling salesman and banker, there is not enough information to tell which technology is preferred.

- d** In the setting with no connections to the outside world, the village is indifferent between the new technology and the old one.
- e** None of the above four statements is correct.

2.2.5 (N) Assume now that the village can again only use the old technology and that the traveling banker still charges the interest rate 0.1 for lending and borrowing. However, in this subproblem the traveling salesman buys wheat at a price of 10 per bushel and sells bushels at a price of 11. What is the optimal value of  $c_2$ ? State the answer rounded to the nearest integer.

**Problem 2.3** Heike's preferences for the consumption of two goods can be represented by the utility function  $u(x_1, x_2) = x_1^2 x_2^2$ . The prices of the goods are  $p_1$  and  $p_2$ . Heike's income is  $Y = 80$ .

2.3.1 (MC) Exactly one of the following statements is correct.

- a** Heike's preferences can also be represented by the utility function  $u(x_1, x_2) = x_1^2 + x_2^2$ .
- b** Heike's preferences can also be represented by the utility function  $u(x_1, x_2) = \ln(x_1 x_2)$ .
- c** Heike's preferences can also be represented by the utility function  $u(x_1, x_2) = -(x_1^2 x_2^2)$ .
- d** Heike's preferences can also be represented by the utility function  $u(x_1, x_2) = \frac{1}{x_1^2 x_2^2} + 1$ .
- e** None of the above four statements is correct.

2.3.2 (N) Determine Heike's demand for good 1 at prices  $p_1 = 1/2$  and  $p_2 = 1$  and state it rounded to the nearest integer.

2.3.3 (N) By how much does one have to reduce Heike's income at prices  $\hat{p}_1 = 1/8$ ,  $p_2 = 1$  for her to be as well off as at prices  $p_1 = 1/2$ ,  $p_2 = 1$  and income 80? State the result rounded to the nearest integer.

2.3.4 (N) By how much does one have to increase Heike's income at prices  $p_1 = 1/2$  and  $p_2 = 1$  for her to be as well off as at prices  $\hat{p}_1 = 1/8$ ,  $p_2 = 1$  and income 80? State the result rounded to the nearest integer.

2.3.5 (N) By how much does one have to increase Heike's income at prices  $p_1 = 1/2$  and  $p_2 = 1$  for her to be just able to afford the bundle that is optimal at  $\hat{p}_1 = 1/8$ ,  $p_2 = 1$  and  $Y = 80$ ? State the result rounded to the nearest integer.