

## Solutions to selected problems at the Micro 3 exam, 2017 edition (in no particular order)

Note: if after reading this you come to a conclusion that the exam was unfairly packed with tricky non-standard problems, recall **it's precisely a selection of the less-standard problems**. The remaining ones were very similar to those you could find in the problem sets and recommended textbooks.

1. Which of the following is presumably a good reason to make public transportation free on the days of particularly low air quality (as compared to other attempts at its improvement, focused on the long-run effects)?
  - a) Days of free public transportation will encourage more people to buy monthly or 3-month passes
  - b) All other answers provide good reasons
  - c) People should ideally stay at home on such days
  - d) The impact of the use of cars on air quality and/or the impact of air quality on health is nonlinear
  - e) Poor average air quality is a serious threat to human health

Solution: a) does not make sense. When it's sometimes free, it's a reason NOT to buy long-term tickets (because you need them a bit less). c) likewise: in fact, free transportation will make MORE people move. So b) is bad as well. d) makes a lot of sense: if one of these is not linear (in particular: 1) when air quality is bad, then any extra emission has a larger marginal impact on this quality than when it's good and 2) when air quality is bad, then any further worsening has a larger marginal impact on health than when it's good) it means we may especially want to reduce emissions on the days of particularly bad air quality (encouraging people to switch from cars to buses by making the latter free) rather than some other days. e) is not too stupid but is too general – it does not seem to provide any reason why you may want to use days with free public transport “*as compared to other attempts at its improvement, focused on the long-run effects*”. On the contrary. So d) is the best answer

2. Will a majority vote applied to determine the choice between two options deliver an efficient outcome?
  - a) No, because the vote may result in a tie and then it is necessary to draw lots
  - b) In such a situation every outcome is efficient
  - c) No, because the vote does not reflect the intensity of preferences
  - d) Yes
  - e) No, because some voters will presumably vote for their less preferred option

Solution: To begin with, there is no reason to vote insincerely when only two options are provided, so e) makes little sense. Now, efficiency may be defined in terms of Pareto optimality or maximization of sum of surpluses. For a binary vote with no side payments possible, Pareto optimality is not very helpful though, because it only indicates that an option should be picked if nobody prefers the other (in which case the latter it is not efficient, so b) is not a very good answer). A sum of surpluses is a more useful measure and you can easily construct an example when the option most preferred according to this criterion is NOT elected. E.g. two people have  $WTP(A)-WTP(B)=1$  and one person  $WTP(A)-WTP(B)=-100$ . Clearly, B maximizes the sum of surpluses but A will be preferred by majority. So c) makes sense and d) does not. Again, b) is wrong of course. As for a), there may be a tie of course, but again it's the intensity of preferences, not random selection in case of a tie per se that is driving inefficiency.

3. A firm bought a production line for 10 million zloty. The firm expects that this will allow to produce ca. 100 000 units of the final product, which it can sell for 300 zloty per unit, and then the

line becomes completely useless (there is no alternative use). For what maximum unit price would the firm be willing to buy factors required for the production of 1 unit of output?

- a) 0 zloty
- b) None of the remaining answers is correct.
- c) 200 zloty
- d) 100 zloty
- e) 300 zloty

Solution: A classic case of sunk cost bias in the context of moral hazard. So pretty standard in the end. Yet, many people chose c), which is a condition for a non-negative total profit. But this only matters ex ante. And now the firm has **ALREADY BOUGHT THE PRODUCTION LINE**, which has no alternative use. From this point onwards you are choosing between zero and  $100k \cdot (300 - \text{price})$ . So e).

4. A publisher holding the exclusive right to distribute a given book operates under decreasing linear demand. To publish the book the publisher must bear a fixed cost of 10 000 zloty and a marginal cost of 12 zloty, where the latter includes the costs of printing which amount to 3 zloty. The publisher's profits would be maximized with sales at the level of X copies. The ministry decided to cover the fixed costs requiring, however, that the publisher prints 1.5X copies. In such situation:
- a) the publisher's profits will fall
  - b) it may turn out that it is profitable for the publisher to print more than 1.5X copies
  - c) the price will fall by exactly 3 zloty
  - d) the book will be offered at a lower price, not necessarily lower by 3 zloty
  - e) the price will not change

Solution: the ministry requires to print more copies than the firm would normally like to sell. So if the firm takes that deal, its fixed cost goes up but its marginal cost goes down (because the copy is already printed), presumably by 3 zloty (although you could argue by how much exactly). Anyway, "exclusive rights" strongly suggests that the firm is a monopolist. We're looking for a point at which marginal cost is crossed by marginal revenue. With decreasing linear demand, marginal revenue is also linearly decreasing, so a lower marginal cost means a larger quantity sold (a subtlety: the ministry requires 1.5X copies to be **PRINTED** not **SOLD**; no publisher can guarantee to actually sell the print run). But not larger than 1.5X because the MC then jumps back up. With a larger quantity sold, under decreasing demand, price must be lower. But not exactly by 3 zloty, even if MC goes down by exactly 3 zloty, because demand function and marginal revenue have different slopes. Take any specific parameters and verify. Thus c) is wrong. Also, v. easy to find an example in which profit goes up. E.g. with  $X=200$ , the gov. gives you 10k and imposes extra costs of printing of just 300, so e.g. continuing to sell 200 copies increases your profit (a lot). So a) is clearly wrong. Anyway, d) wins.

5. Does negative correlation between the number of speed cameras and the number of accidents in a given country (both variables per km of road) constitute evidence of the effectiveness of speed cameras?
- a) No, most likely this is just an effect of the so-called regression to the mean
  - b) No, because governments may react to a higher number of accidents by increasing the number of speed cameras
  - c) No, because other factors correlated with the number of speed cameras can influence the number of accidents
  - d) Yes
  - e) No, because other factors uncorrelated with the number of speed cameras can influence the number of accidents

Solution: The only tricky answer was e). But c) is better. It is precisely when factors **CORRELATED** with the number of speed cameras make a difference when we may wrongly take this as the impact of speed cameras. For example, in densely populated countries you may observe more speed cameras and more accidents than in sparsely populated countries. So if you disregard population density (correlated with the number of speed cameras) you may (wrongly or at least prematurely) conclude that speed cameras actually cause accidents. Now suppose that driving on the left hand side is associated with

more accidents. But countries that follow this weird habit do not have systematically more or less speed cameras (an uncorrelated factor). If you disregard sidedness in your analysis, in some cases it will make speed cameras look better (in right-hand side traffic countries with many speed cameras and left-hand side traffic countries with few cameras), in other cases it will make cameras look worse (in right-hand side traffic countries with few cameras and left-hand side traffic countries with many cameras). Because there is no systematic link between sidedness and cameras, these will cancel out. You don't need to know it yet, but in econometrics it's called omitted variables bias: the impact of  $X_1$  on  $Y$  may be wrongly estimated when you omit some  $X_2$  correlated with  $X_1$  and also affecting  $Y$ .

6. The so-called network externalities arise, when a given product becomes more useful as more people (besides oneself) use it (e.g. telecommunications, software)
- Exactly two of the remaining answers are correct.
  - Network externalities are particularly common in food markets.
  - The existence of network externalities will generally contribute to market monopolization.
  - Network externalities are a particular case of positive consumption externalities.
  - Network externalities consist in trapping irrational consumers in a marketing net.

Solution: when it's more useful when others use it, it's clearly positive consumption externality. Thus d) is clearly right. by contrast, b) makes little sense of course. I don't care too much about specific grocery choices of my neighbour – it's their call. Also the examples given are very different – it's the markets when you in one way or another interact with other users, e.g. by making phone calls and exchanging files, where externalities naturally arise. e) – not necessarily. It's often totally rational that a larger network makes the product more useful. c) is also reasonable. When the producer can limit access to the network to consumers of other products, market entry is very difficult. And then you get Microsoft. Thus a) is the best answer.

7. The owner of a high quality car asks at least 2000 zloty for it, while an owner of a low quality car 1000 zloty. The buyers would be willing to pay 1700 for a low quality car and 2200 zloty for a high quality one. There are many more potential buyers than sellers. Cars are distinguishable only for the sellers. Let us denote the share of high quality cars in the population by  $x$  (the share of low quality ones is  $1-x$ ). The average price observed in the market will be:
- some number independent of  $x$
  - None of the remaining answers is correct.
  - some number from the interval  $[1000, 1700]$
  - 1700 when  $x < 60\%$ , 2000 when  $x > 60\%$ , and not known for  $x = 60\%$
  - 1000 when  $x < 60\%$ , 2000 when  $x > 60\%$ , and not known for  $x = 60\%$

Solution: If  $x > 60\%$ , then high quality cars may sell and the price will be  $2200x + 1700(1-x)$  (the weighted WTP of buyers, which are many, so that sellers will get all the surplus) which is larger than 1700, so b) is the correct answer. Btw, if  $x < 60\%$ , then buyers' weighted WTP is lower than 2000, so high-quality cars won't sell.

8. Statistically, men live shorter than women. The High Court of Injustice prohibits differentiating the conditions of life insurance based on gender. In effect of that, presumably:
- At least three of the remaining answers are correct.
  - the total number of insured persons will increase
  - insurers will more often advertise in Elle, and not as much during the break in football games
  - average prices of purchased insurance will increase
  - the number of insured men will increase

Solution: Men live shorter (die sooner), so if the price must be uniform, on average the life insurance (a death-contingent payment) is a relatively good deal for men rather than women. So women will probably drop out from the market, and men will enter the market. So e) is probably correct. But of

course, from the viewpoint of insurer men are bad risks. So if insurers now gets relatively many bad risks, average prices must go up, so d) is probably correct. Also for the same reason the insurers will try to attract women rather than men. So c) makes sense. Sorry, if for some of you the association of Elle with females and watching games on TV with males was not obvious. In the end, a) is the best answer. b) is probably wrong btw. – negative selection usually reduces rather than expands markets.