

Written Exam Economics Winter 2018-19

**Auctions: Theory and Practice**

Date: 12.01.2019, 10-22

This exam question consists of 5 pages in total (including this front page)

Answers only in English.

***The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. '1234.pdf') and uploaded to Digital Exam.***

**Be careful not to cheat at exams!**

Exam cheating is, for example, if you:

- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Reuse parts of a written paper that you have previously submitted and for which you have received a pass grade without making use of quotation marks or source references (self-plagiarism)
- Receive help from others in contrary to the rules laid down in part 4.12 of the Faculty of Social Science's common part of the curriculum on cooperation/sparring

You can read more about the rules on exam cheating on your Study Site and in part 4.12 of the Faculty of Social Science's common part of the curriculum.

**Exam cheating is always sanctioned by a written warning and expulsion from the exam in question. In most cases, the student will also be expelled from the University for one semester.**

## Introduction

Throughout the assignment, please show your work. Simply stating the correct answer without sufficiently explaining your calculations/reasoning is not enough to get full credit. Correspondingly, an incorrect answer that uses some of the correct argumentation may be given partial credit.

If you believe that there may be a typo in one of the questions, or if something is stated unclearly, please let us know as quickly as possible by sending an email to both Neil and Holger. Any material responses to such queries will be published on Absalon.

Good luck!

## Problem 1 (True or false)

Please state whether each of the following statements is true or false and show the arguments and/or calculations which justify your conclusion.

*1a. A "clock"-style English multi-unit auction is associated with exposure risk for bidders that have complementarity in their valuations. (a qualitative explanation is sufficient)*

*1b. First-price sealed-bid auctions are more susceptible to collusion than second-price sealed-bid auctions. (a qualitative explanation is sufficient)*

*1c. The presence of a resale market following a discriminatory sealed-bid auction will ensure efficiency. (a qualitative explanation is sufficient)*

*1d. The expected revenue of a first-price sealed-bid auction with 2 bidders whose private values are uniformly distributed between 0 and 8, with a reserve price of 2, is 4.*

*1e. A common value auction with  $N$  symmetric bidders and a diffuse prior common value component,  $v$ , where each bidder receives a signal,  $x_i$ , independently drawn from a uniform distribution on  $[v - \frac{1}{2}, v + \frac{1}{2}]$ , has a symmetric bidding strategy in a sealed-bid second-price auction equal to  $b_i = x_i + \frac{1}{2} - \left(\frac{N-1}{N}\right)$ .*

## Problem 2

Lobbying, where different interest groups compete to influence politicians, can be thought of as a type of all-pay auction. All lobbyists (i.e. the bidders) have a private value for a specific policy – e.g. lowering the corporate tax rate – and will put some effort and funds into a lobbying campaign (i.e. a bid) to tilt policy in its favoured direction. Only some lobbyists will be successful and receive a "pay-off" in the form of a concrete policy change.

Consider  $N$  risk-neutral lobbyists with valuations  $x$  independently and uniformly distributed between 0 and 1.

2a. Find the equilibrium bidding strategy for  $N$  lobbyists in a sealed-bid all-pay auction for a single unit (policy). Please also explain the intuition of your result.

2b. Is this auction efficient? (a qualitative explanation is sufficient)

Some lobbyists will face challenges when collecting funds for their lobbying campaign and will thus be budget constrained.

Now consider a specific all-pay auction with 3 bidders where 1 bidder has a budget constraint of  $\frac{2}{3}$ .

2c. Is this auction efficient? (a qualitative explanation is sufficient)

### Problem 3

Danish farmer Jens Hansen has found 5 archaeological artefacts "Guldhorn", or Golden Horns, in his field. The Horns are in pristine condition and are all identical. The Horns are so-called "Danefæ" and thus property of the Danish state. After a lengthy debate, it has been politically decided that the Horns should be allocated to Danish museums.

The main policy objective for the allocation is that the Horns should be allocated to the museums that value them the most. The politicians are not concerned with extracting revenue from the museums or with ensuring an even distribution of the Horns between the different museums (i.e. it would not be a problem if one museum were to get all the Horns).

The Danish Ministry of Culture (the Ministry) has been tasked to find the optimal mechanism to allocate the Horns and has decided to use an auction.

3a. Assuming that the various museums have private valuations for the Horns, which auction format would you recommend and why? (a qualitative explanation is sufficient)

Regardless of your recommendation, the Ministry decides to employ a Vickrey sealed-bid multi-unit auction.

The Ministry expects 3 museums to participate in the auction with the following marginal values:

Marginal values	1st horn	2nd horn	3rd horn	4th horn	5th horn
The Royal Museum	50	38	30	20	5
The Museum of Øster Hurup	60	15	10	5	2
Old-is-more (OIM)	45	32	10	5	1

3b. Find the equilibrium bids, allocation and payments. Explain qualitatively why no bidder has an incentive to deviate from their equilibrium bidding strategy.

Several of the government officials in the Ministry oppose the Vickrey format as the museums can end up paying different prices for otherwise identical Horns. One official proposes that the Ministry employs a uniform sealed-bid auction instead, since he has heard that this format will always result in the same allocation as the Vickrey format but will ensure the same price for all Horns.

3c. Is the official correct? Please also explain the intuition behind your answer. (a qualitative explanation is sufficient)

Regardless of your input, the Ministry decides to pursue with the Vickrey sealed-bid multi-unit auction.

The Ministry suspects that it might not have the full overview regarding the number of museums that will bid in the auction and their marginal values. The Ministry has therefore hired a consultancy firm, Auctions Advice (AA), to give their best estimate of the number of bidders and their values.

AA has identified the same marginal values for the three museums listed above, but has also identified a fourth museum, Old Rocks, with the following marginal values:

Marginal values	1st horn	2nd horn	3rd horn	4th horn	5th horn
Old Rocks	10	70	0	0	0

3d. Given the marginal values displayed in the table above, which considerations would Old Rocks have in relation to its bidding strategy in the Vickrey auction? (a qualitative explanation is sufficient)

Now that they have discovered that Old Rocks may also participate in the auction, the Ministry is wondering whether a Vickrey auction is still the right choice.

3e. Would you propose any changes to the format? Please also explain the intuition behind your answers. (a qualitative explanation is sufficient)

Another group of government officials are worried that the museums have an interest in increasing their competitors' payments for the horns.

3f. If museums were interested not only in maximising their own payoff, but also in minimising the payoffs of competing museums, how would this impact their bidding incentives in the Vickrey auction? (a qualitative explanation is sufficient)

## Problem 4

The British government is auctioning off two licenses for seabed rights in the North Sea to prospective offshore wind developers. The two licenses will be sold in two sequential second-price auctions.

The two licenses are for geographically separate regions, but the two regions are of exactly the same size and are located right next to each other, so any buyer would be indifferent between the two licenses.

There are three offshore wind developers that will submit bids for the licenses: DING, Waterfall and Equisyd. None of the bidders are budget-constrained and all three bidders are risk-neutral. Each of the developers is interested in acquiring only a single license, i.e. they have single-unit demand.

We assume that the three bidders can accurately calculate their own private value of acquiring a license, and that their values are independently and uniformly distributed between 1 and 2 million pounds.

4a. Find the equilibrium bidding strategy in each of the two sequential auctions. Please also explain the intuition of your result.

*4b. What is the British government's total expected revenue, summed across the two auctions?*

A month before the auctions, DING gets a new CEO who is known as a bit of a wild-card. Specifically, she is a risk-lover.

*4c. How does this development impact DING's bidding strategy in each of the two auctions? (a qualitative explanation is sufficient)*

Waterfall and Equisyd learn that DING's bidding strategy will be influenced by their new risk-loving CEO. Waterfall and Equisyd remain risk-neutral.

*4d. How does the news about DING's preferences impact the bidding strategies of Waterfall and Equisyd (if at all)? (a qualitative explanation is sufficient)*

## **Problem 5**

In 2013, Norway held a simultaneous multi-unit auction for three very important spectrum licenses.

There were three mobile network operators in Norway at the time (Telesyd, Telio and Tele3) that would all definitely take part at the auction, and there was also a small chance of a new entrant (i.e. a fourth bidder) taking part at the auction.

The regulator's primary policy objective associated with the allocation was to safeguard competition on the down-stream market for mobile services. The regulator was not directly concerned with revenue maximisation.

The Norwegian regulator decided to employ a discriminatory sealed-bid auction and set a reserve price of 0 for the licenses. The regulator also decided to impose a spectrum cap so that each bidder would be able to bid for a maximum of one license. Furthermore, the regulator decided not to disclose the number of qualified bidders prior to the auction.

*5a. Imagine that you were in Tele3's position. What would have been your considerations in relation to bidding strategy? (a qualitative explanation is sufficient)*

The bidders submitted their bids and the regulator announced the results: The three licenses were allocated to Telesyd, Telio and a surprise 4<sup>th</sup> bidder (a Russian oligarch), so Tele3 lost out.

Tele3 subsequently had to shut down its operations in Norway as it could not compete without winning one of the critical spectrum licenses. The number of competitors on the Norwegian market for mobile services thus decreased from three to two as a result of the outcome of the auction (at least until the Russian oligarch could manage to build up a network and enter the market). Competition was thus weakened, contrary to the regulator's policy objectives.

*5b. What could the Norwegian regulator have done differently to avoid this outcome? Please provide several suggestions, if possible. (a qualitative explanation is sufficient)*