Econ 4020: Auction Theory and Practice

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Course Outline

Opening Remark

This document is an incomplete draft of the syllabus, and I might have to make changes, especially to the topics we cover. I will update it as we go on, so keep an eye on this document. Meanwhile, read this entire course outline carefully! Any items, rules, requirements in this course outline may be subject to changes. When this happens, I will announce it during the lecture. Announcements in the class and through the UVA COLLAB website supersede any information contained in this course outline.

Course Description

Auction Theory and Practice has two parts: theory part and practice part. In the theory part, I discuss the basics of auction theory as an application of game theory. In that, I will teach you about equilibrium bidding in Second Price Auctions, (Symmetric and Asymmetric) First-Price Auctions, Optimal Auction Design, Collusion in Auctions, Vickrey-Clarke-Groves (VCG) Auctions, Generalized VCG. In the practice part, I will teach you how to analyze actual auction data, use it to estimate cost distributions of bidders, determine optimal reserve price, and quantify costs associated with bid preference programs. The second component of the practice part involves presenting good papers in empirical auctions in a group.

Auction is and an ancient method used to buy and sell both goods and services. Consider an individual who wants to sell her used car. How should she sell? Should she bargain with potential buyers, or should she post a take-it-or-leave-it price? Or should

she use auction? In this course's span, we will show that using an auction is (in all likelihood) the best the seller can do. However, should the seller set a minimum price below which she commits not to sell? If so, what should this minimum price be? There are different auction formats, e.g., the first-price auction where the winner pays her bid and the second-price auction where the winner pays the second-highest bid. So what kind of auction format should the seller choose? In many relevant cases, it does not matter - both lead to the same (expected) revenue for the seller. Now turn the table and consider a potential buyer who goes to online auction sites such as eBay cars to buy a second-hand car. She can see a few active bidders who are also interested in the exact vehicle. What should she bid? How does her bid change with the number of competitors?

Even when the seller does not know buyers' willingness to pay for the product/service, the seller can guarantee good revenue by exploiting the competition among the buyers. Auction is also used in procurement–a buyer, usually a government agent, solicits bids from sellers willing to sell the product or provide the service. For example, consider Virginia's DOT that wants to construct and maintain highways and solicits bids from many construction companies. What should be the auction rules that guarantee that VA selects the most efficient construction company? Now suppose the state also wants to ensure a minimum quality of the roads. Presumably, high-quality roads cost more, ceteris paribus. How should the auction rules change to reflect this dual objective? Competition among bidders, which is the key in a well-designed auction rule, can be rendered ineffective if the bidders come together and collude. Collusion often leads to a higher cost of procurement and inefficient outcome. How will this possibility of collusion affect the auction rules? Are some auction formats easier to collude with than others?

So you need to have prior knowledge of Game Theory, Calculus, statistics, and econometrics and some familiarity with computer programing/estimation such as Matlab or R or Python, or Julia. Unless you are *very* proficient in R or Python, use MATLAB. You should download the software from the UVA library (https://data.library.virginia.edu/research-software/matlab/). If you have taken an econometrics and or statistics

course on regression analysis, that is great! Since Auction Theory is about designing auction rules and determining how bidders will behave, we will verify some of our claims.

Textbook/Lectures/Papers

No textbook is appropriate for us, so learning is based on:

1. Lecture notes.

2. Research papers on empirical auctions (UVACollab).

Lectures

There will be two lectures each week. You are expected to attend all of them. Lectures will be held on Tuesday and Thursday at Wilson Hall 238 from 11:00 am- 12:15 pm.

Office Hours and Contact Information

Names	Gaurab Aryal
Office Hours	Wednesday 11:00-12:00 and with appointment
E-mail	aryalg@virginia.edu
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Grading Policy

There are no midterms or a final for this class. Your grade will depend on the empirical paper you write using the auction data that I provide, class attendance, and class presentations. Here is some basic information:

- Empirical paper: Currently, there are 27 students. You will form a group of 3, and each group will have to write an empirical paper on auction. I will give you auction data collected from highway construction projects run by the California Department of Transportation. I will also provide you with a set of questions that interests me.

Your goal is to use the data and the model we learn to answer those questions by the end of the class. I will grade you on how well you answer those questions and approach the problem and explain the data. I will provide more details about the expectations as we progress in the class.[1]

- Presentations of Research Papers: Each group presents two papers on empirical auctions that I will upload in the Collab. A group is assigned two papers on a first-come-first-serve basis. During these presentations, attendance is mandatory for everyone.

- Presentations of a Case Study: Each group will also present a case study about the application of auctions that have not been covered in the class. Before you choose a topic to explore, you have to get my approval first.

Final breakdown of the grades:

1. Attendance –5%.
2. Data Section – 10%.
3. Model Section – 5%.
4. Empirical Strategy Section – 10%.
5. Results Section– 10%.
6. Presentations of published papers– 5% + 5%.
7. Presentations of a case study– 10%.
8. Final Paper – 40%.

I will use the default grading scale for undergraduate courses http://its.virginia.edu/sis/grading/gradethresholds.html#undergraduate to determine the final grades.

[1] You should not use Microsoft Word to submit your paper. Please use LaTeX to write your paper. It is an editor designed to write scientific documents. If you have not worked with LaTeX please use https://www.overleaf.com/. You should be able to set up an account using UVA computing id.

Course Outline and Timetable

A	B	C	D	E
Week	Class	Dates	Topic	Due dates and What?
1	T	24-Aug	Introduction	
	Th	26-Aug	Second Price Auction	
2	T	31-Aug	Identification of Second Price Auction + Simulated Data	Group Formation Deadline
	Th	2-Sep	First Price-Auction	
3	T	7-Sep	First Price-Auction	
	Th	9-Sep	First Price-Auction	
4	T	14-Sep	Empirical Analysis of Symmetric Auctions -1 (Identification and Estimation)	
	Th	16-Sep	Empirical Analysis of Symmetric Auctions -2 (Identification and Estimation)	
5	T	21-Sep	Practice with Simulated Data	
	Th	23-Sep	First Price-Auction when Bidders are Asymmetric- Theory/Practice part 1	Data Section
6	T	28-Sep	First Price-Auction when Bidders are Asymmetric- Theory/Practice part 2	
	Th	30-Sep	Empirical Analysis of Asymmetric Auctions -1 (Identification and Estimation)	
7	T	5-Oct	Empirical Analysis of Asymmetric Auctions -2 (Identification and Estimation)	
	Th	7-Oct	Optimal Reserve Price	Model Section: Asymmetric First Price Auctions
8	T	12-Oct	Reading Day No Class	
	Th	14-Oct	Collusion Among Bidders	
9	T	19-Oct	Collusion Among Bidders	
	Th	21-Oct	Q&A: Final Paper	
10	T	26-Oct	Student Presentations of empirical auction papers - Groups 1,2,3	Empirical Strategy Section: Identification and Estimation Steps
	Th	28-Oct	Student Presentations of empirical auction papers - Groups 4,5,6	
11	T	2-Nov	Student Presentations of empirical auction papers - Groups 7,8,9	
	Th	4-Nov	Vickrey-Clarke-Groves Auctions - 1	
12	T	9-Nov	Vickrey-Clarke-Groves Auctions - 2	
	Th	11-Nov	Q&A: Final Paper	
13	T	16-Nov	Student Presentations of empirical auction papers - Groups 1,2,3	Results Sections
	Th	18-Nov	Student Presentations of empirical auction papers - Groups 4,5,6	
14	T	23-Nov	Student Presentations of empirical auction papers - Groups 7,8,9	
	Th	25-Nov	Thanksgiving No Class	
15	T	30-Nov	Students' Presentations of an application of auction -Groups 1, 2, 3	
	Th	2-Dec	Students' Presentations of an application of auction -Groups 4, 5, 6	
16	T	7-Dec	Students' Presentations of an application of auction -Groups 7, 8, 9	Final Paper Due on December 14th by 5 pm EST

Scholastic Dishonesty

The university has strict rules concerning academic honesty. The underlying principle is that all work submitted for assessment (assignments, reports, exams) should be your original work. Anyone committing scholastic dishonesty on an exam will receive an F for the class. For more on this, see http://www.virginia.edu/onmyhonor/honorNetscape.html.