Instructor: Oleg Baranov (*Department of Economics*)

Instructor		Class	
Office:	ECON 14A	Class Location:	*online class*
Voice:	303.492.7869	Meeting Times:	*online class*
Email:	oleg.baranov@colorado.edu	Office Hours	W,TH 11:00 – 12:00 pm MT
Website:	www.obaranov.com	on Zoom:	(or by appointment)

1 Class Website

All course materials will be posted on the Canvas website that can be accessed at
https://canvas.colorado.edu/.

2 Instructions

This class will be taught ONLINE and delivered asynchronously which means there are not scheduled days and times. All class materials (including video lectures), activities and assignments are hosted on the class Canvas page. Students can complete the coursework throughout the week when it is convenient for them. Students must meet all milestones (assignments and class activities) that are assigned for a particular week. Instructions for each week will be posted on the class page (Announcements Tab).

3 Communication

The working communication channel is extremely important in online classes. Every student in the class needs to make sure that his or her email address is listed correctly on Canvas, and that he or she receives all class emails. It is important to monitor your email, especially around "Due" days and times. **In this class, I will assume that all students have received, read, and responded (if needed) to my emails after 24 hours from their "sent" times.**

Note: Fast responses to my emails are extremely important for students on the waitlist.

4   Course Description

Economists are increasingly involved not just in studying but in designing practical market mechanisms. These include auctions to sell diamonds, timber, electricity, procurement contracts and radio spectrum; matching algorithms to assign students to schools, or candidates to jobs; as well as marketplaces and mechanisms to sell internet advertising, trade nancial securities, or reward innovation. The eld of market design studies how to construct rules for allocating resources or to structure successful marketplaces. It draws on the tools of game theory and mechanism design to identify why certain market rules or institutions succeed and why others fail.

The course consists of three parts. In the rst part, we review the fundamental concepts from the game theory and develop strategic thinking. In the second part, we look at the \matching markets" that operate without prices, highly unusual for economics. Examples include assigning students to schools, assigning donor kidneys to transplant patients and college admissions. The third part of the class is on auctions and good auction design. Examples range from simple auctions used by eBay and Christie's to auctions used in nancial markets, auctions used by Google, Facebook and Microsoft to sell advertising, and auctions used by government to sell large-scale complex assets such as radio spectrum.

5   Textbook/Readings

A textbook for this class is \Market Design" by Guillaume Haeringer. Additional readings will be indicated in lecture slides and available on the class website. The readings are mostly economics journal articles, or popular press articles, that provide some context for the class. All listed papers (at least large parts of them) should be readable.

6   Informal Readings

A book *Thinking Strategically*" by Avinash Dixit and Barry Nalebu is a very famous book suitable for the Game Theory part of the class. A book *Who Gets What | and Why: The New Economics of Matchmaking and Market Design*" by Alvin E. Roth is an easy read suitable for the Matching part of the class.

7   Prerequisites

The course is available to students who have completed ECON 3070 Intermediate Microeconomic Theory. The class does not require prior knowledge of mathematical concepts beyond the ones covered in ECON 1088. However, the course includes a great deal of math, economic theory and extensive strategic arguments. Students should expect theoretical arguments in every class.

8 Assessment

There will be two midterm exams, the nal exam and ten problem sets.

Class Activities	*30 games/exercises*	15% of the grade (dropping two lowest scores)
Problem Sets	*10 problem sets*	20% of the grade (dropping one lowest score)
Practice Tests	*3 tests*	5% of the grade
Midterms	*2 midterms*	20% each
Final Exam		20%

There will be no make-up exams. A student who misses a midterm due to an excused absence will have the additional weight shifted to the nal. Feel free to form study groups to review and discuss lecture/reading materials, and homework assignments **but you must submit individual work for grading.**

Final Exam Policy: Every student in the course has to take the Final Exam and score at least 20 points (out of 100 points). **Any student who scores less than 20 points fails the class.**

9   Tentative Course Outline

Week	Covered Material	Slidepack
	MODULE 1: GAME THEORY	
1	Dominance and Iterative Dominance	1a
2 - 3	Nash Equilibrium	1b
4	Mixed Strategies & Dynamic and Bayesian Games	1c
5	**MIDTERM I**	
	MODULE 2: MATCHING	
6	Two-Sided Matching	2a
7	Two-Sided Applications	2b
8	One-Sided Matching, Kidney Exchange	2c
9	School Choice	2d
10	**MIDTERM II**	
11	**Spring Break**	
	MODULE 3: AUCTIONS	
12-13	Auction Theory	3a
13	Auction Design	3b
14	Multi-Item Auctions	3d
15	Sponsored Search Auctions	3e
16	Financial Exchanges	3f
17	**FINAL EXAM**	

10   Tutors

The Economics Department provides a free drop-in tutorial lab which provides assistance on all core courses in the major, and occasionally on other undergraduate courses in the Department. See appropriate links here https://www.colorado.edu/economics/undergraduate-program.

11   Detailed Course Outline

Game Theory Part

1. Static Games (dominant and dominated strategies, iterative elimination of dominated strategies, Nash Equilibrium)

2. Dynamic Games (subgame perfect equilibrium and backward induction)

3. Incomplete Information (simple games with incomplete information, concept of Bayesian Nash equilibrium)

Matching Part

4. Introduction to Matching Markets (\marriage market" and one-to-one matching, stable matches, the Deferred Acceptance algorithm, existence result, optimal matches for both sides of the market, incentives of participants, roommate problem)

   Readings:

   \College Admissions and the Stability of Marriage" by David Gale and Lloyd Shapley (1962)

5. Stable Matching and Orderly Markets (stable matchings and orderly markets, the problem of market unravelling, case study: medical residents and the NRMP, medical fellowships, law clerks, college admission)

   Readings:

   \What Have We Learned from Market Design" by Alvin Roth (2008)

   \The Re-Design of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design" by Alvin Roth and Elliott Peranson (1999)

6. House Allocation and Kidney Exchange (House Allocation Problem, e cient outcomes and the core, serial dictatorship, the top trading cycles algorithm and its variations, kidney exchanges)

   Readings:

   \A Kidney Exchange Clearinghouse in New England" by Alvin Roth, Tayfun Sonmez and Utku Unver (2005)

   \Kidney Exchange: A Life-Saving Application of Matching Theory" (2005)

7. School Choice (School Choice Problem, the Boston algorithm and its incentives, deferred acceptance and top trading cycles as alternatives, problem of ties, case studies: NYC and Boston)

   Readings:

   \The New York City High School Match" by Atila Abdulkadiroglu, Parag Pathak and Alvin Roth (2005)

   \The Boston Public School Match" by Atila Abdulkadiroglu, Parag Pathak, Alvin Roth and Tayfun Sonmez (2005)

   \School Choice" by Joseph Malkevitch

Auctions Part

8. Introduction to Auction Theory (private value model, rst and second price sealed bid auctions, all pay auctions, ascending auctions, the revenue equivalence theorem, eBay auctions - equivalence and nonequivalence to the second-price auction)

   Readings:

   \The Bidding Game" National Academy of Sciences Beyond Discovery Report (2003)

9. Designing Good Auctions (how to design an auction, facilitating entry, reserve prices, bidder subsidies, collusive bidding, optimal auction design)

   Readings:

   \What Really Matters in Auction Design" by Paul Klemperer (2002)

10. Common Value Auctions (common value model, the winner's curse, examples and applications, aggregation of information, application to oil lease auctions)

    Readings:

    \An Empirical Study of an Auction with Asymmetric Information" by Ken Hendricks and Robert Porter (1988)

    \Anomalies: The Winner's Curse" by Richard Thaler (1988)

11. Multi-Unit Auctions (multi-unit auctions, uniform price, pay-as-bid price (discriminatory), demand reduction, Vickrey pricing and e cient auction design, case study: treasury auctions)

12. Sponsored Search Auctions (the sponsored search market, Google's advertising auction, bidding incentives and equilibria, other ways to run the auction, Facebook's Vickrey auction, optimal design in search auctions (Yahoo case study))

    Readings:

    \The Economics of Internet Search" by Hal Varian (2007)

    \Online Advertising: Heterogeneity and Con ation in Market Design" by Jonathan Levin and Paul Milgrom (2010)

13. Financial Markets and High-Frequency Trading (electronic markets for trading equity and other nancial securities, the use of auctions for IPOs, real-time trading and market clearing, competition between exchanges)

    Readings:

    \Concept Release on Market Structure" by SEC (2010)

    \The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response" by Eric Budish, Peter Cramtom and John Shim

Syllabus Statements

Classroom Behavior

someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the [Public Health Office](contacttracing@colorado.edu) (contacttracing@colorado.edu).

In this class, if you are sick or quarantined, notify me to work out an individual plan for covering materials and submitting assignments.

ACCOMMODATION FOR DISABILITIES

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions]() on the Disability Services website.

PREFERRED STUDENT NAMES AND PRONOUNS

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

HONOR CODE

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code academic integrity policy. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the [Honor Code website]().