Econ 4010 Syllabus Fall 2016

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Course Goal: To provide a challenging introduction to the most important ideas in game theory, with an emphasis on applications to microeconomics. Game theory (which is really the theory of multiperson decisions) is a branch of mathematics that is indispensable to modern economic theory and has useful applications to areas as diverse as biology, politics, and corporate strategy to name a few. We will emphasize applications to economics, and introduce some key ideas in *mechanism design*, which uses game theory to answer questions like: "What is the most advantageous way for someone to sell something when the seller doesn't know how much the potential buyers are willing to pay?"

Note: If you are not very comfortable with calculus or you do not enjoy solving problems then this course is *definitely* not for you. Students have told me that this class is significantly more difficult than the typical economics class. If you prefer not to take very challenging classes then taking some other class would be a much better choice.

Accommodations: Any student who feels that he or she may need to discuss individual accommodations, please make an appointment to see me as soon as possible. If you are entitled to receive extra time on tests, you should let me know as soon as possible at the beginning of the semester so that I can make the necessary arrangements.

Use of Class Material from Past Semesters, Answer Keys or Solutions Manuals: I expect that students will *not* use exams, problem sets or other materials from previous semesters of this course to study for the exams or to complete assignments. In this class, using materials from past semesters, or using answer keys, or solutions manuals is considered a violation of the UVA honor code.

Text: The following book is required:

Martin J. Osborne: An Introduction to Game Theory, Oxford, New York, 2003.

One of the main advantages of the text is that it has many exercises and the author has made the answers to many of them are available on the web (follow a link at https://www.economics.utoronto.ca/osborne/igt/index.html

Grading: There will be a midterm and a final exam. Depending on available grading assistance, between three and six problem sets will be required and they total 20% of your grade. The midterm counts 35% and the final 45%. Problem sets handed in less than a day late will be penalized 50%. More than a day late they will not be accepted. Acceptable reasons for missing an exam are incapacitating illness, participation in a university-sponsored intercollegiate competition, family emergency, or major religious holidays. If you do miss the midterm you should inform me of your excuse within one week of the exam. No make-up tests will be given, but if you have an acceptable excuse

your other scores will be scaled up proportionately. (An adjustment may be made if the class performance indicates that the test was significantly harder or easier than the other requirements.) If your excuse is unacceptable your grade will be similarly adjusted, but you will be subject to a 25 % penalty. Examples of unacceptable excuses are oversleeping, losing your notes, or having had rehearsals the night before the test.
The midterm will be given in class on October 6.

Final Exam: Because I plan to be out of town during the exam period you will not be able to reschedule your exam. If you are unable to take the final exam as scheduled at 9 am on Monday Dec 12, you should drop this class.

Punctuality: I expect you to be on time for classes. Late arrival disrupts everyone's concentration. Very occasionally, because of unusual circumstances, you may be late. **If you are late** you must send me, by the end of the working day, an **email message** explaining **why** you were late and outlining the steps you are taking to make sure that you will be not be late again. If you don't, your final grade can be penalized up to three percentage points for each infraction

Other Sources: Students wanting to try other approaches to the material may find the following references useful: The books are listed in increasing order of difficulty. The first two are at a more elementary level than our text, the last two are at a more advanced level than our text, and the middle book is at about the same level as our text.
Avinash K, Dixit and Barry Nalebuff: Thinking Strategically, Norton 1991.
(When the authors started to revise the book they ended up substantially rewriting it as The Art of Strategy: Norton 2008)
Avinash K, Dixit and Susan Skeath: Games of Strategy, Norton 2001
Prajit K. Dutta: Strategies and Games, Cambridge MA: MIT Press, 2001
Robert Gibbons: Game Theory for Applied Economists, Princeton 1992
Drew Fudenberg and Jean Tirole: Game Theory, MIT 1991

An elementary book that applies game theory to business decisions is:
Adam Brandenburger and Barry Nalebuff: Co-opetition, Doubleday, 1996

To do well in 4010 it is more important to concentrate on the topics we cover in class than to read everything in the textbook. Your class notes should be the best guide for studying for the exams. If you miss a class you are responsible for getting the class notes from someone who was present.

Prerequisites: A basic knowledge of **calculus** and of fundamental concepts of **probability** is needed for this course. In particular you need to know how to use calculus to solve maximization problems like the following

Find the positive number x that makes the value of the function $f(x) = x^{1/x}$ as big as possible.

You should be familiar with the formula for conditional probability for one event *A* given another event *B*. You should know what a continuous random variable is and you should know what a probability distribution function and a probability density function are. As a check you should be able to answer the following

If X is uniformly distributed between 2 and 10,

(a) find the probability distribution function and the probability density function for X
(b) find the expected value of X^3

The bad news is that we will be beginning the semester with a test, to be given during the first meeting of discussion section. The test is required: If you are absent you will be dropped from the class. The good news is that your grade will not count towards your final grade in the course. The exam is designed for your benefit: Its purpose is to tell you whether you have the background in, and facility with, the mathematics and statistics that are necessary for success in Econ 4010.

To prepare for the test you may want to spend a few hours reviewing selected topics in mathematics and statistics. In mathematics, you should review differentiation of functions, including power, exponential, and log functions; differentiation of sums, products, and quotients of functions, and of composite functions (via the chain rule). You should also review the use of calculus to determine maxima and minima (including first- and second-order conditions).

In statistics you should review basic ideas of probability including continuous and discrete random variables, probability density functions, and (cumulative) distribution functions. You should check that you know how to calculate the expectation of a function of a random variable

If you do poorly on the test, I will not force you to drop the class, but I would strongly advise you against continuing. It would be better to change to a class that does not use as much math or probability, or wait and improve your math skills before again trying 4010.

Trying to add into 4010?

If you are trying to add into Econ 4010 from the wait list it is important for you to come to all classes and to do as well as you can on the background test. I will be deciding which students to add on the basis of these criteria because I believe that they best indicate which students will benefit the most from taking the class. Because of the number of students who want to add in there will likely be some more challenging questions on the test. You can't really prepare for these but just try to be alert and be in command of your knowledge of calculus, basic probability and intermediate micro.

Reading Guide

The table below gives a rough outline of the topics to be covered and when we plan to cover them: we may proceed faster or slower than this table indicates. The number in bold type refers to the chapter of the textbook that deals with the material. Sometimes we will deal with a topic in much greater depth than the textbook does: these topics are followed by an asterisk *

Tuesday	Thursday
Aug 23 Introduction	**Aug 25 2 Static (Strategic Form) Games**
Aug 30 2 Auctions, and Dominance	**Sep 1 2 Nash Equilibrium**
Sep 6 3 Cournot and Bertrand	**Sep 8 4 Mixed Strategies**
Sep 13 5 Dynamic Games and Backward Induction	**Sep 15 5 Subgame Perfect Equilibrium**
Sep 20 5 14 Finitely Repeated Games	**Sep 22 Infinitely Repeated games**
Sep 27 16 Bargaining *	**Sep 29 16 Bargaining ***
Oct 4 ***Reading Day***	**Oct 6** ***MIDTERM EXAM***
Oct 11 Go over midterm	**Oct 13 Static Games of Incomplete Informa**
Oct 18 Cournot with Private Costs	**Oct 20 9 Private Value Auctions**
Oct 25 Auction Equilibrium *	**Oct 27 9 Revenue Equivalence ***
Nov 1 Reserve Prices	**Nov 3 9 Optimal Auctions ***
Nov 8 The Revelation Principle and Mechanism Design*	**Nov 10 9 Common Value Auctions ***
Nov 15 10 Dynamic Games of Incomplete Information *	**Nov 17 10 Perfect Bayesian Equilibrium***
Nov 22 10 Signaling games *	**Nov 24** ***Thanksgiving***
Nov 29 10 Refinement in Signaling Games	**Dec 1 10 Signaling in labor markets***
Dec 6 10 Signaling in labor markets*	
	MONDAY DEC 12: 9 A.M. FINAL EXAM