**University of California Merced, Spring 2018 Semester**
**Economics 170. Game Theory**
**Course Syllabus**

*Please note that each class member is responsible for knowing all of the contents of this syllabus and for fulfilling all of the requirements described in this syllabus.*

**Prerequisites:** ECON 100, Microeconomic Theory and a mathematics background commensurate with completing MATH 011, Calculus I (which is already a prerequisite for ECON 100). Please note that this course will make free use of mathematical notation and arguments, so students will need a certain degree of "philosophical maturity" and "mathematical maturity" in order to successfully study this material. In particular, students must be used to working through algebraic equations and inequalities and occasionally using arguments that incorporate differential calculus. Students will be required to study examples and the proofs of certain theorems and occasionally prove theorems for homework and exams.

**Instructor:** Peter Vanderschraaf, SSM 263A.

**Meetings:** M W 6:00-7:15 p.m., Kolligan Library 396

**Office Hours:** F 2:00-4:00 p.m. and by appointment

**Required Text:** Stephen Schecter and Herbert Gintis, *Game Theory in Action* (Princeton University Press 2016)

**Supplementary Text:** Lecture Notes on Game Theory, to be posted on our class bulletin board.

**Software and Internet Resources:** I recommend that class members have access to MatLab, since there may be occasions when I present to the group computer simulations of games and other class members may enjoy trying to run these simulators themselves. I also recommend that class members consider downloading the computer package Gambit, from

http://gambit.sourceforge.net/

Gambit allows users to create interactively game in extensive and strategic form.

There are various game theory resources such as lecture podcasts available on the Internet, but so far I have not learned of any that I would specifically recommend for class members. It may not be worth the time spent searching to try to find any Internet resources other than the Gambit software I have recommended here.

**Bulletin Board:** All class members are welcome and encouraged to post relevant questions, examples and comments in our bulletin board. The URL for our class CatCourses bulletin board is

https://catcourses.ucmerced.edu/courses/9661

**Announcements and Outside Class Discussion:** All business announcements will be both posted in writing on our electronic bulletin board, maintained by CatCourses and presented orally at our meetings. Posted announcements will be forwarded to all class members by e-mail via our CatCourses site. Class members are strongly encouraged to post substantive questions and comments regarding our readings and in-class discussion on our electronic bulletin board.

**Course Description:** *Game theory* is the branch of decision theory where decision problems interact. This course will cover those parts of game theory of special interest to social scientists

and philosophers. We will discuss specific elements of the formal theory, including: (*i*) the distinction between cooperative and noncooperative games, (*ii*) games in the strategic and the extensive form, solution concepts, (*iii*) epistemic conditions sufficient for predicting the outcomes of games, (*iv*) equilibrium refinements, (*v*) salience and dynamical models of equilibrium selection, (*vi*) folk theorems of indefinitely repeated games, and (*vii*) topics in experimental game theory. We will discuss results in experimental economics that test some of the assumptions of classical game theory.

Throughout the course we will examine applications of the formal concepts of game theory to problems in moral and political philosophy and the social sciences.

**Course Goals and Outcomes:**

In this section, 'game theory' is to be understood as it was described in the Course Description section.

*i*. *Course Goals*: (1) Students shall be exposed to some of the basic concepts of game theory, including the basic concepts of classical game theory (in which games are analyzed from an *a priori* perspective) and evolutionary game theory (in which games are analyzed from an evolutionary or inductive learning perspective)., (2) Students shall see some of the most important recent analytical and experimental findings in game theory., and (3) The course requirements shall, so far as is possible, encourage students to cultivate analytical skills that will serve them throughout their student and post-graduation careers.

*ii*. *Course Learning Outcomes (CLOs)*: At the end of this course, a student should be able to:

1) Give clear oral and written and verbal explanations of game-theoretic concepts.
2) Derive the answers to specific questions raised regarding specific noncooperative games.
3) Develop and write analytical proofs of elementary game-theoretic propositions.
4) Understand the distinction between an *a priori* mathematical analysis of a game and an evolutionarily analysis of a game.
5) Use results from experimental economics to explain how real individuals are likely to interact in specific games.
6) Explain the relevance game-theoretic concepts and of specific games to issues in philosophy, the social sciences, biology and computer science.
7) Understand both the utility and the limitations of game theory for understanding social phenomena.

To support student services coherently across the coursework in the Economics program, these CLOs help students to meet the Economics Program Learning Outcomes (PLOs) 1, 2 and 5:

1. Describe the underlying economic incentives and tradeoffs associated with the decisions made by individuals, firms, international organizations and governments.
2. Apply economic concepts in analyzing policy debates and evaluating policy outcomes.
5. Communicate clearly and cogently in written and oral form in academic and professional environments.

To support student services coherently across the coursework in the MBE program, these CLOs help students to meet the MBE Program Learning Outcomes (PLOs) 1, 2 and 3:

1. Describe the underlying economic incentives and tradeoffs associated with the decisions made by individuals, firms, organizations, institutions and governments.
2. Apply theories and concepts from disciplines in Management and Business Economics (e.g. accounting, economics, statistics, finance, and marketing) to business management situations.
3. Communicate clearly and cogently in written and oral form within professional and academic environments.

**Meeting Format:** We will run this course in lecture and discussion format, with discussion of assigned topics at each class meeting. We will discuss the main concepts and work through many concrete examples together in class.

**Outside Meeting Work:** Following class meetings, students should extend and complete any of the notes they take in class so that they will be able to review and refer to them easily throughout the course, especially in preparation for exams.

Recommended homework problems will be posted on our class web site. These homework problems will not be required or evaluated for purposes of grading, but working through these problems will be invaluable in preparing for the required exams.

Students will generally be responsible for studying some of the details of some of the main results we discuss on their own outside of class. For example, I may present a result and a "SKETCH OF PROOF" of some result that class members should be able to comprehend immediately, and then ask that class members study a more detailed "PROOF" of this result on their own outside of class. Students will also generally be responsible for completing the details of certain examples presented in class or creating additional examples of their own.

**Methods of Evaluation:** (*i*) Four midterms, and (*ii*) a final exam. There also will be penalties assessed for poor class participation, and I reserve the right to give class members opportunities for extra credit.

More about (*i*) and (*ii*): The midterm and final exams will be in-class and closed text. For each exam, each student may bring one sheet of paper marked with notes on one side of the page only. Each midterm will cover the most recently discussed material in class whereas the final will be comprehensive. Of the five exams each student must take, the exam for which she/he scored the lowest will not count towards the final grade, that is, the lowest of a student's five exam scores will be dropped. If student misses an exam for any unexcused reason, this missed exam will be the dropped exam.

The best way to prepare for these exams is by careful study of the recommended homework exercises and the notes you write based on the material covered in class. You may not miss any exam unless you have a serious medical condition documented by a physician on the date of the midterm. Missing a midterm for any other reason will result in your receiving no credit for this midterm.

**Special Class Rules** (some of which can affect your final grade):

(1) *Attendance Rules*: Class members are ordinarily required to attend all regular class meetings. For at least the first part of the semester, I will take roll at the start of each class both to record

attendance and to help me learn your names more quickly. A student may miss up to two class meetings without penalty. I reserve the right to count late arrival or leaving class early as missing a class meeting. An absence will be excused only for the following reasons: (*a*) if a class member must be absent for official university business (such as attending a required athletic event), in which case the student must provide official university documentation to receive an excuse, or (*b*) if a class member must be absent for medical reasons, in which case the student must provide a report from a doctor to receive an excuse. Each absence beyond the two meeting limit will result in a 2 point deduction from your final score. If you need to miss a meeting because of a personal matter such as a family crisis or a job interview, plan on this as using up one of your "free" absences.

(2) *Restrictions on e-mail*: Class members are to use e-mail only to set up meetings and appointments. Any substantive questions regarding course work must be presented in person. Any other substantive questions regarding the course must be presented either in person or on the course bulletin board. For example, if you would like to take an exam one working day early because you are traveling to another state on the day the exam is assigned, you may send an e-mail requesting a meeting to discuss your situation, but you may not submit a request for an earlier exam by e-mail. I reserve the right to disregard without response any e-mails I receive other than e-mails requesting an appointment to meet in person.

(3) *"Concert" Rule*: A default rule for our class is that members are not to use their phones, computers or other electronic devices without express permission. For unauthorized use of electronic devices, doing work for other classes, or any other distracting conduct, I reserve the right to deduct 2 points from your final score for each offense. Any penalties for violating this rule will be assigned to the offender or offenders without warning after the class meeting they occur.

(4) *Study Sessions*: While I do not permit collaboration on exams, I encourage you to study together in preparation for the midterms and final exam. If group members want to organize any formal study sessions and would like me (Vanderschraaf) to attend, I will do my best to do so. But it is up to group members to organize such sessions, which includes reserving the room.

(4) *"No-Advertisements" Rule*: No discussion of extra-curricular university activities is to take place during class time. However, if you would like to encourage class members to attend or participate in some extracurricular activity, you may do so after class ends, before class starts or by sending class members a message outside of class. (For example, if you would like to encourage class members to attend a particular event on campus, you may post a message to that effect in the appropriate part of our electronic bulletin board.) This is primarily a rule directed against university offices and other faculty, not members of our class. At other universities I have worked for, many university offices and department heads encourage faculty to announce extra-curricular university activities in class or to allow visitors to come to classes and use class time to discuss their activities and services. I generally don't permit this, because I regard it as an improper use of your tuition dollars.

On occasion I have allowed university librarians and guest lecturers to visit a class I am leading. I don't consider this a violation of our rule because these visitors present material to the group that is directly relevant to their work in the course.

(5) *"Show and Tell" Rule*: Anyone may bring to class and discuss in class unusual items or introduce examples from your personal experiences on condition that these items are directly

relevant to our class discussion. This is a rule directed primarily at me (Vanderschraaf), but it applies to all of us. I sometimes bring to class photos, books, recordings, news articles and other items with the hope that they serve to illuminate some of the issues we are discussing. I also find I frequently introduce examples from history, films, magazines and other sources that do not tend to appear in the philosophy literature if I judge such examples to be relevant to our class discussion. All members of our class may do the same.

**Grading Rules:** Please note that point totals assigned to any assignment are to be considered final. However, if a student elects to challenge the point total assigned to any exam, I will grade this assignment a second time and the score assigned after the second grading will be the score that counts towards the final point total, even if the score of the second grading is lower than that of the first grading.

**Grading:** (*i*) Each midterm exam will count for up to 25% of the course grade (50 points possible for each midterm). (*ii*) The final exam will count for up to 25% of the course grade (50 points possible). However, as noted above of the five exam scores awarded to each student, only the four highest scores will count towards the final grade.

The grading distribution (of 200 possible points for the course) will tentatively be as follows:

186-200 points A

184-185 A-

182-183 B+

166-181 B

164-165 B-

162-163 C+

142-160 C

140-141 C-

120-139 D

0-119 F

I will not raise the number of points required to earn a particular grade, but reserve the right to relax the grading scale at the end of the semester if I think the group's overall performance warrants this.

**Academic Integrity:** *i*. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. This policy is discussed in full at

http://studentlife.ucmerced.edu/2.asp?uc=1&lvl2=121&lvl3=121&lvl4=123&contentid=171

*ii*. Each student is responsible for completing all exam questions on her/his own. You may not collaborate or steal in any way on exams. Any collaborative behavior or theft during an exam will result in a minimum penalty of each collaborating student receiving no credit for this exam, and may result in receiving a failing grade (F) for the course and/or University disciplinary action.

You are encouraged to study together and to discuss information and concepts covered in our regular meetings with other class members. For example, class members may study together in preparation for an exam that has not yet been distributed to them.

**Accommodations for Students with Disabilities:** The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

**Schedule**

*Disclaimer*: With the exception of the midterm dates, we will likely be somewhat open to modifying our actual schedule of topics as the semester progresses. We want to be as flexible as we can be while still covering an adequate amount of material for a first course in game theory because the particular interests of class members and the speed at which we work through certain topics will likely warrant modifications to this schedule.

1. Jan 17: Organization meeting. First motivating examples of noncooperative games.
2. Jan 24: Introduction to games in extensive form. Examples of games of perfect and imperfect information. Backwards induction analysis of games of perfect information.
3. Jan 29: Introduction to games in strategic form. The relationship between the strategic and the extensive form.
4. Jan 31: Rationalizability and eliminating dominated strategies.
5. Feb 5: Introduction to the Nash equilibrium concept. Examples of Nash equilibria in pure and mixed strategies.
6. Feb 7: Epistemic assumptions of backwards induction, rationalizability and Nash equilibrium.
7. Feb 12: **Midterm**
8. Feb 14: General conditions for the existence of Nash equilibria.
9. Feb 21: Methods of computing pure and mixed strategy Nash equilibria.
10. Feb 26: Equilibrium selection by refinement. Subgame perfect equilibria.
11. Feb 28: Correlated equilibrium.
12. Mar 5: Applications of Nash and correlated equilibria in the social sciences and philosophy.
13. Mar 7: **Midterm**
14. Mar 12: Common knowledge and its connections with solution concepts.
15. Mar 14: Introduction to games of incomplete information. The Harsanyi transformation. Bayesian equilibria.
16. Mar 19: Applications of games of incomplete information in the social sciences and philosophy.

17. Mar 21: Introduction to bargaining games. The Nash bargaining problem. The Ultimatum game.
18. Apr 2: Experimental findings on bargaining games.
19. Apr 4: **Midterm**
20. Apr 9: Introduction to repeated games. The basic Folk Theorem of indefinitely repeated games.
21. Apr 11: Applications of the Folk Theorem in the social sciences and philosophy.
22. Apr 16: Evolutionary game theory. Evolutionarily stable and neutrally stable strategies.
23. Apr 18: Equilibrium selection by dynamic adjustment processes. Evolutionary stability and replicator dynamics.
24. Apr 23: Applications of evolutionary game theory in the social sciences and philosophy.
25. Apr 25: **Midterm**
26. May 2: Review of salient topics we have discussed.
27. May 10, **Final Exam, 3:00-6:00 p.m.**