POLI 204C: Introduction to Game Theory
Fall 2018

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Course Description

This course is an introduction to the basic concepts and logic of noncooperative game theory. Some familiarity with basic set theory and proof theory will be essential. The course requirements will not require mathematical proficiency beyond basic algebra and some differential calculus.

Course Texts

I will circulate course notes. The following texts will also be helpful. The first and third are available from the UCSD bookstore; chs. 1–5 of the second are available on TED. (The third provides crucial background for the course. You should get a copy.)

1. Tadelis, *Game Theory* (Princeton UP, 2013)
2. Watson, *Strategy* (Norton, 3rd ed. 2013)
3. Velleman, *How To Prove It* (Cambridge UP, 2006)

Whether you grasp the salient intuitions behind a concept often depends on how the concept is presented to you. So it is worth checking out other texts for the sake of comparison. You might find some of the following helpful.

1. Fudenberg and Tirole, *Game Theory* (MIT Press, 1991)
2. Gibbons, *Game Theory for Applied Economists* (Princeton UP, 1992)
3. Gintis, *Game Theory Evolving* (Princeton UP, 2nd ed. 2009)
4. McCarty and Meirowitz, *Political Game Theory* (Cambridge UP, 2007)
5. Osborne, *An Introduction to Game Theory* (Oxford UP, 2003)
6. Rasmusen, *Games and Information* (Blackwell, 4th ed. 2007)

General Expectations

1. A PhD program is an apprenticeship. You should think of yourself as an apprentice scholar. Every other expectation follows from this.
2. An apprenticeship is "training-by-doing", not simply passive information consumption. You become a scholar by acting like a scholar. While I do not expect you to reach the performance standards of experienced scholars at this point, I do expect you to diligently strive to adopt the habits of experienced scholars. This means, among other things, that you take the initiative for your development as a scholar, that you give good-faith effort, that you seek out intellectual challenges, that you be willing to subject your thoughts to critical scrutiny, that you offer constructive criticism of others' views, and so on.
3. An apprenticeship involves the performance of repetitive exercises (particularly in the early stages) — for instance, reading and discussing assigned material, writing papers, and solving problem sets (including writing proofs). You will likely struggle to see the point of some (perhaps many) of these exercises in the moment you are performing them, and may even resent being asked to perform them. But keep in mind that these are part of a larger program of habit formation. (Think of Daniel's apprenticeship in *The Karate Kid*: "Wax on, wax off" was not obviously related to karate. If you don't understand this reference, watch this YouTube clip.)
4. Trial and error is a key mechanism for developing into a professional scholar — apprentices try to act like a scholar and, in light of feedback, learn what works and what doesn't. So an apprenticeship requires various mechanisms that give you feedback about your development trajectory — meaningful signals that tell you how you are progressing toward your goal of becoming a scholar.
5. Grades are one (but only one) feedback mechanism — they indicate the areas where you are making good progress as well as areas where you are lagging behind and thus need to make deeper investments. To ensure that grades are meaningful, low grades will be given for subpar performance on assigned exercises. (But you should not treat grades in this course as my judgment about your value as a person or your potential as a scholar. They are solely my judgment about where you are relative to where you need to be with respect to this particular set of skills. It is possible for me to think that you have high potential but that you are currently lagging behind where you need to be to realize that potential.)
6. As intellectual integrity is a cardinal scholarly virtue, it is important that an apprenticeship program implement policies that support the development of intellectual integrity. Hence, there are consequences for those who flout this virtue (more on these consequences below). These consequences are, like grades, a feedback mechanism intended to send meaningful signals about your development and reinforce the formation of scholarly habits.

Class Policies

1. Electronic devices (laptops, tablets) are prohibited, unless you secure an exemption from me. Any cell phone that is pulled out during class must be placed face-down on the desk for the remainder of class (excepting emergencies, of course).
   Rationale: Studies show: that electronic devices distract you and those around you and thus inhibit learning; that freehand note taking improves comprehension and retention.

2. All problem sets must be typeset — preferably LaTeX, Word accepted — and a hardcopy submitted electronically to Turnitin (via TED) at the agreed upon time. Game trees and other diagrams are an exception: these **must** be handwritten and appended to the end of the submission. To submit electronically, scan or take a photo of handwritten material. (I've linked to a comprehensive guide to LaTeX symbols on the course materials page. I've also posted some code examples for tables.) Handwritten problems sets will be returned ungraded.
   Rationale: I don't want to spend any time trying to decipher your handwriting while grading; I am using Turnitin to support the ongoing development of scholarly integrity.

3. Late submissions (problem sets or exams) will not be graded but I will accept them and extend credit for submission (see Assessment below). A submission is considered late once the solutions have been posted online, unless you have confirmed with me, in advance, arrangements to the contrary. Information about the times at which I will post solutions is below.
   Rationale: A policy against late submissions encourages appropriate habit formation and taking personal responsibility for your development (see item 2 in General Expectations).

4. Group work. Collaboration on exams is strictly prohibited. You are permitted — indeed, encouraged — to work together when devising strategies for solving problems and when working out the logic of your answers. However, you are prohibited from submitting jointly written answers — *all submissions must be independently written.*
   Rationale: Methods education emphasizes skill development. Methods courses are typically designed to develop skills by introducing a body of concepts and problem-solving techniques and demonstrating their application, then having students try to replicate these applications in problem sets and exams (see item 3 in General Expectations). The spirit of the "independently written" rule is that you independently perform the reasoning and problem-solving techniques that are relevant to the course as a means to demonstrate the extent to which you have acquired the relevant methodological skills (see item 2 in General Expectations). Importantly, problem sets are not meant to be a report on ideas that you came up with on your own; this policy is not meant to emphasize independent production of ideas. This is why collaboration at the problem-solving stage is consistent with the policy: even if you devise a problem-solving strategy with others, the policy requires that *you use your own words to report your answer and explain the reasoning.* This conforms to the rationale for the policy: if you are able to accurately reproduce the explanation in your own words, that is some evidence that you have an independent grasp of the reasoning behind the jointly devised problem-solving strategy. If, however, you are not able to explain it in your own words — if you rely too heavily on the words used by others to explain the solution — that is evidence that you are unable to reproduce

the solution on your own. In short, the policy requires you to *provide an independent explanation of the reasoning that leads to the answer*. This rules out simply copying another's explanation verbatim; it also rules out close paraphrases. As a rule of thumb, you should avoid reporting close paraphrases of others' explanations in your submission. (Incidentally, this policy allows you to share LaTeX code that can be used to format structural elements such as tables, so long as the content of the tables is not shared.) Requiring you to provide evidence of the extent of your learning also ensures that your grade is a meaningful indicator of your progress and not of your collaborators' progress (see item 5 in General Expectations).

5. In view of the previous point, each problem set submission must include a short (no more than one page) personal reflection on the problem solving process. Content-wise, this meta-analysis should report on the following items: (a) enumerate the other students with whom you worked on the solutions and each group members' relative contribution to the solutions; (b) acknowledge any additional sources (textbooks, websites, etc.) that you relied on in arriving at your solutions; (c) indicate which concepts and problem solving strategies in the problem set you feel you understand adequately, and which concepts and strategies you feel you are struggling with.
   Rationale: Reflecting on your own learning process gives you (and me) useful information about your progress through your apprenticeship and supports intellectual integrity (see items 4 and 6 in General Expectations).

6. Suspected academic misconduct (e.g., the "independently written" rule, collaboration on exams) will be reported to the UCSD Academic Integrity Office. If you are found guilty by the AIO, they will determine the administrative sanction (e.g., integrity training, suspension, termination). The academic penalty will be left to me. The penalty for the first offense will be an upper limit of C− on your overall course grade; the penalty for a second offense will be an automatic F for the course.
   Rationale: To support the ongoing development of scholarly integrity (see item 6 in General Expectations).

Assessment

Overview. There will be five problem sets, four brief in-class quizzes on the problem sets, and two take home exams. For the purposes of calculating your final grade, you will decide by consensus on how these will be weighted. The following weights will the no-consensus default in the event that there is consensus by the beginning of the third class:

Weight	Assignment
10%	Quizzes (aggregate score)
30%	Problem sets (aggregate score)
30%	Exam 1 (end of week 5, date and time TBD)
30%	Exam 3 (end of quarter, date and time TBD)

Problem sets. There will be five problem sets. These are meant to be reasonably low-stakes "training exercises" to prepare you for the exams. Problem sets are optional in the sense that there's a relatively low overall cost for declining to submit solutions for a problem set. That said, you'd be wise not to skip these.

Solutions must be submitted electronically through the TED course site. Solutions will be graded only if submitted prior to my solutions being posted online. I will post solutions as follows:

- Problem set 1: Friday 12 October at 15:00
- Problem set 2: Friday 26 October at 15:00
- Problem set 3: Friday 9 November at 15:00
- Problem set 4: Monday 26 November at 12:00
- Problem set 5: Friday 7 December at 15:00

Problem sets will be graded on a ✓/✗ basis. The minimum standards for a ✓ are as follows.

- *Conscientious effort.* You must demonstrate a reasonably serious effort to provide your own answers to *each* problem. Simply copying answers from other sources (e.g., the textbook, past solution keys, etc.) does not qualify (in addition to being a form of academic misconduct).
- *Minimal competence.* Your answers must demonstrate a satisfactory grasp of key concepts and follow problem-solving strategies that could be reasonably expected to get you to a solution (e.g., the kinds of strategies that can be found in standard textbooks or in lectures).

Aggregate scores for problem sets will be calculated according to the table. For every problem set for which you decline to submit solutions, your aggregate score will drop by a one-third step. E.g., if you have 3 ✓, 1 ✗, and 1 non-submission, your aggregate score will fall to B; 3 ✓ and 2 non-submissions results in a B−.

# of ✓	Letter
5	A
4	A−
3	B+
2	B
1	B−
0	C+

A note about how to write up solutions. *Use prose to make your reasoning transparent to the reader.* For example, suppose you are asked to prove a theorem like the following one. (Incidentally, by now you should be familiar enough with the material in Velleman to follow this proof. If you can't follow, you have some work to do.)

Theorem. *If $A \subseteq B$ and $A \subseteq C$, then $A \subseteq B \cap C$.*

Write your proof like this:

Proof. Let x be arbitrary and assume $x \in A$. By definition of $\subseteq$, our hypotheses are $\forall x(x \in A \rightarrow x \in B)$ and $\forall x(x \in A \rightarrow x \in C)$. So, by universal instantiation, we can conclude that $x \in B$ and $x \in C$. Since x is arbitrary, we can use universal generalization and $\wedge$-introduction to conclude that $\forall x[x \in A \rightarrow (x \in B \wedge x \in C)]$. Thus, by the definitions of $\subseteq$ and $\cap$, we conclude that $A \subseteq B \cap C$. □

Do not write your proof like this:

Proof. x arbitrary and $x \in A$.
$\Rightarrow \forall x(x \in A \rightarrow x \in B)$ and $\forall x(x \in A \rightarrow x \in C)$
$\Rightarrow x \in B$ and $x \in C$
$\Rightarrow \forall x[x \in A \rightarrow (x \in B \wedge x \in C)]$
$\therefore A \subseteq B \cap C$. □

Quizzes. There will be four in-class quizzes probing your understanding of your problem set answers. Quizzes will be graded on ✓/✗ basis. You must get the answer(s) "mostly" right to get a ✓. Your aggregate score will be determined according to the table. There will be one quiz at the start of the following classes: Monday 15 October; Monday 29 October; Monday 12 November; Monday 27 November.

# of ✓	Letter
4	A
3	A−
2	B+
1	B
0	B−

Exams. There will be two take home exams. These are not to be done in collaboration with others. You will be permitted to use your personal notes, my notes, and the textbook (no online sources). The exam questions will be posted online at a mutually agreed upon time (to be determined during the first week of class). Solutions will be submitted electronically through TED. You will have five hours to complete the exam from the time it is posted, at which point I will post the solutions. No exams will be accepted once the solutions are posted online.

Fair warning: the level of difficulty for the exams may be set so that it is unlikely that anyone will finish in the allotted time. But don't worry — do your best and I'll curve the grades for each exam.

Calculating your overall grade. Your final letter grade will be the weighted grade point average for the problem sets and exams in accordance with the agreed-upon weights. (Information about grade points can be found at http://blink.ucsd.edu/instructors/academic-info/grades/system.html.)

Provisional Schedule

Subject to revision.

Week 1 Why models? (Readings on TED)
Weeks 1/2 (Expected) Utility theory (Tadelis, part 1)
Problem set 1

Weeks 2/3 Model basics (Tadelis, chs. 3, 6 & 7; Watson, chs. 1–5)

— Games with complete information —
Weeks 3/4 Static (Tadelis, chs. 4–6; see also: Watson, chs. 6–11)
>Dominance, Nash equilibrium
Problem set 2

Weeks 5/6 Dynamic (Tadelis, chs. 8–11; see also: Watson, chs. 14–15)
>Subgame perfect equilibrium, repeated games
Problem set 3

— Games with incomplete information —
Weeks 7/8 Static (Tadelis, ch. 12)
>Bayesian Nash equilibrium
Problem set 4

Weeks 9/10 Dynamic (Tadelis, chs. 15–17; see also: Gibbons, ch. 4)
>Perfect Bayesian equilibrium, sequential equilibrium
Problem set 5

First exam will cover material up to the end of week 5
Second exam will cover material from week 5 through week 10