The objective of this course is to make you *more strategic*, by which I mean enhancing your capacity for making intelligent and creative choices when interacting with your fellow human beings. The approach to doing so is game theory, which has been the focus of two rounds of Nobel Prizes in Economics. Game theory is a framework and a set of tools for solving the puzzles and tackling the challenges put forth by a collection of conscious, purposeful agents, whether they comprise a household, a team, a fraternity or sorority, a village, a company, an army, a market, a government, or a society. While the focus is primarily on the use of game theory in business, game theory has such broad relevance that we will also apply it in the arenas of politics, international relations, war, sports, history, crime, theology, and everyday life.

BEPP 284 satisfies the “Technology, Innovation and Analytics” requirement for the Wharton undergraduate major. Game theory is a valuable tool for determining the appropriate business strategies to complement new technologies, which will be exemplified by using game theory to analyze products with network effects (e.g., computer operating systems) and two-sided markets (e.g., online platforms).

BEPP 284 satisfies the BEPP Fundamental requirement for the BEPP major.

**Pre-requisites:** None

**Book**

Optional Readings

Basu, Kaushik, “Why, for a Class of Bribes, the Act of Giving a Bribe should be Treated as Legal,” March 2011.


Dr. Seuss, *The Sneetches*, 1953.


“Football Penalties: A Practical Guide to the Most Nail-biting Part of the World Cup,” *The Economist*, June 21, 2018


Course Requirements

Problem Sets (6): 10% (average of your best five problem sets; lowest problem set grade is dropped)

Two tests: 30% each

Paper: 30%

Virtual Corporate Reality: Extra credit (see below)
Lectures (with Applications)

Introduction to game theory - GSDM (Chp 1)

Modelling a strategic situation as a game - GSDM (Chp 2)
- Kidnapping

Optimal play by eliminating dominated strategies - GSDM (Chp 3; skip Appendix on Rationalizability)
- Advertising: cooperative vs. predatory
- Existence of God
- Product introduction: cookies and cigarettes
- Doping in sports

Strategic play and Nash equilibrium - GSDM (Chps 4, 5, 6.1-6.2)
- Catching cartels (Reading: Hammond)
- Sneetches (Reading: Dr. Seuss)
- Average bid procurement auctions in Italy
- Network effects and the computer industry (Reading: Shapiro & Varian)
- Braess’ Paradox
- Two-sided markets (Reading: Eisenmann et al)
- Vaccination
- Rent-seeking and lobbying

Randomizing play - GSDM (Chp 7)
- Avranches Gap in World War II
- Penalty kick in soccer (Reading: “Football Penalties”)
- Volunteers' Dilemma and the Bystander Effect

“At Bell Atlantic, we've found that the lessons of game theory give us a wider view of our business situation and provide us a more nimble approach to corporate planning.”
- Raymond W. Smith, Chairman

“If the human mind was simple enough to understand, we'd be too simple to understand it.”
- Emerson Pugh
Strategic play in sequential-move environments with perfect information - GSDM (Chp 8)
- Investment and hold-up (Reading: Brandenburger)
- Racial discrimination and sports
- Bribery in India (Reading: Basu)
- Bargaining

Strategic play in sequential-move environments with imperfect information - GSDM (Chp 9)
- Strategic delegation
- Agenda control
- Sexual harassment (Reading: Khazan, 2015) - Trigger Warning

Strategic play when there is repeated interaction
- Trench warfare in World War I (Chp 13)
- Bidding rings (GSDM, Chp 14)
- Medieval Law Merchant (Chp 15)
- Cooperation by bats (GSDM, Chps 14, 16.1)
- Cooperation by software programs (Reading: Capobianco & Gonzaga)

“Imagine how hard physics would be if electrons could think.”
- Murray Gell-Mann
  (Nobel Laureate, Physics)

“If there is any one secret of success it lies in the ability to get the other person's point of view and see things from their angle as well as your own.”
- Henry Ford

Electronics
The use of laptops, tablets, phablets, smartphones, smartwatches, tin cans with string, carrier pigeons, telepathy, or any other method that connects you to the world outside of this classroom is verboten during class, unless an exception is given (such as you have written permission to hold a séance to contact your great-great-grand mother.)
Problem Sets
Problem set due dates are in the schedule at the end of the syllabus. Note that numbered exercises refer to the 2nd edition (not the 1st edition) of *Games, Strategies & Decision Making*. Problem sets are to be turned in at the beginning of class. Given that answers will be posted immediately after class, late problem sets cannot be accepted.

Paper
You are to use game theory to model and make predictive statements about the behavior of people for either a real-world, historical, or fictional situation. A real-world situation is one that routinely occurs in human or non-human society. A fictional situation can be drawn from a story, poem, play, television show, movie, or computer software program but it is not to be a product of your imagination. Your imagination can be used to model a situation but not in creating the situation. Also, the situation cannot be one that we have gone over in class. The paper is to be original work and will be graded on: i) how creative, sophisticated, and accurate is your model; and ii) how compelling, insightful, and correct is your analysis. The project should be typed (though figures can be hand-drawn) and be at least five and no more than ten double-spaced pages (including figures). The paper is due December 3rd. Late papers will be penalized 1/3rd of a letter grade for each two days that they are late (e.g., if the grade without a penalty is B+ then the grade with a one-third penalty is B).

“One of the reasons game theory has finally been discovered by managers is the rapidity with which companies can now respond to changes in product, technologies and prices. Game theory helps you pay attention to your interactions with competitors, customers and suppliers, and to focus on the end-game so that your near-term actions promote your long-term interest by influencing what these players do.”

- F. William Barnett,
  McKinsey & Company
Virtual Corporate Reality

VCR is an industry simulation package co-developed with Prof. Christopher Ruebeck at Lafayette College. Students form teams and compete in a market setting. Your performance in VCR is an opportunity for extra credit of up to 3 additional points which would be added to your course grade. The number of points is based on the final value of your firm according to the following formula: extra credit points = \(\min\{3, 0.015 \times FV\}\) where FV is the “final value measured in millions of dollars.” For example, if \(FV = 100\) (so your firm is valued $100 million) then your final numerical course grade (on a scale of 0 to 100) is increased by \(0.015 \times 100 = 1.5\) points. If \(FV = 200\) then it is raised by 3 points. If \(FV\) exceeds 200 then you get the maximum of 3 points.

After numerical grades are determined (and before adding extra credit), I will set the mapping from numerical grades to letter grades (at which time a curve is typically applied). Only after that mapping is set are extra credit points added. Hence, lowering another team’s FV will not benefit your course grade because extra credit is added after grades are curved. Maximizing your firm’s value is what will maximize the number of extra credit points you receive. Details on VCR are provided in a separate document, and the VCR program can be found at https://vcr.lafayette.edu/cgi-bin/login.cgi

Ethics

You are expected to review and abide by the University of Pennsylvania's Code of Academic Integrity. Violations of the code carry serious sanctions. All cases of code violations will be turned over to the Office of Student Conduct and I reserve the right to impose additional sanctions, including a failing grade for the assignment or test or even the course.

“Only the paranoid survive.”
- Andy Grove, Co-founder of Intel

“I think that God in creating Man somewhat overestimated his ability.”
- Oscar Wilde
<table>
<thead>
<tr>
<th>Lecture</th>
<th>Date</th>
<th>Topic</th>
<th>Due Dates</th>
<th>Problem Set</th>
<th>GSDM Readings</th>
<th>Optional Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/27/2019</td>
<td>Introduction</td>
<td></td>
<td></td>
<td>GSDM - Chp 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8/29/2019</td>
<td>Extensive Form Games</td>
<td></td>
<td></td>
<td>GSDM - Chp 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/3/2019</td>
<td>Strategic Form Games</td>
<td></td>
<td></td>
<td>GSDM - Chp 3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9/5/2019</td>
<td>Iterative Deletion of Dominated Strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9/10/2019</td>
<td>Iterative Deletion of Dominated Strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9/12/2019</td>
<td>Iterative Deletion of Dominated Strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>9/17/2019</td>
<td>Nash Equilibrium</td>
<td>PS #1 is due</td>
<td>Chp. 2: Exercise 5; Chp. 3: Ex. 6</td>
<td>GSDM - Chps 4, 5</td>
<td>Hammond</td>
</tr>
<tr>
<td>8</td>
<td>9/19/2019</td>
<td>Nash Equilibrium</td>
<td></td>
<td></td>
<td></td>
<td>Dr. Seuss</td>
</tr>
<tr>
<td>9</td>
<td>9/24/2019</td>
<td>Nash Equilibrium with Randomized Actions</td>
<td>PS #2 is due</td>
<td>Chp. 4: Ex. 4; Chp. 5: Ex. 7</td>
<td>GSDM - Chp 7</td>
<td>Football Penalties</td>
</tr>
<tr>
<td>10</td>
<td>9/26/2019</td>
<td>Nash Equilibrium with Randomized Actions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>10/1/2019</td>
<td>Nash Equilibrium: Tipping &amp; Congestion</td>
<td>PS #3 is due</td>
<td>Chp. 7: Ex. 2, 12</td>
<td></td>
<td>Shapiro &amp; Varian</td>
</tr>
<tr>
<td>14</td>
<td>10/10/2019</td>
<td>FALL BREAK - No class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>10/15/2019</td>
<td>Test #1 (evening)</td>
<td></td>
<td></td>
<td>GSDM - Chp 6.1, 6.2</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>10/17/2019</td>
<td>Nash Equilibrium: More Applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>10/22/2019</td>
<td>Sequential Play and Perfect Information</td>
<td></td>
<td></td>
<td>GSDM - Chp 8</td>
<td>Brandenburger</td>
</tr>
<tr>
<td>18</td>
<td>10/29/2019</td>
<td>Sequential Play and Perfect Information</td>
<td>PS #4 is due</td>
<td>Chp. 8: Ex. 7, 14</td>
<td></td>
<td>Basu</td>
</tr>
<tr>
<td>19</td>
<td>10/31/2019</td>
<td>Sequential Play and Imperfect Information</td>
<td></td>
<td></td>
<td>GSDM - Chp 9</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>11/5/2019</td>
<td>Sequential Play and Imperfect Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>11/7/2019</td>
<td>Sequential Play and Imperfect Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>11/12/2019</td>
<td>Cooperation and Reputation</td>
<td>PS #5 is due</td>
<td>Chp. 9: Ex. 7, 11</td>
<td>GSDM - Chp 13</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>11/14/2019</td>
<td>Cooperation and Reputation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>11/19/2019</td>
<td>Cooperation and Reputation</td>
<td></td>
<td></td>
<td>GSDM - Chp 14, 16.1</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>11/21/2019</td>
<td>Debrief: Virtual Corporate Reality</td>
<td>PS #6 is due</td>
<td>Chp. 13: Ex. 2; Chp. 14: Ex. 2</td>
<td>GSDM - Chp 15</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>11/26/2019</td>
<td>Cooperation and Reputation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>11/28/2019</td>
<td>THANKSGIVING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>12/3/2019</td>
<td>Cooperation and Reputation</td>
<td>Paper is due</td>
<td></td>
<td>Capobianco &amp; Gonzaga</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>12/5/2019</td>
<td>Test #2 (evening)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Problem sets refer to numbered exercises from the 2nd edition (not the 1st edition) of Games, Strategies & Decision Making.