MA 4400

Cooperation and Competition

Instructor: Prof. Guillermo Owen

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Office hours: By appointment

Prerequisites: MA3042, OA3201, and an introductory course in probability.

Required Text: Game Theory, by Guillermo Owen. Fourth Edition. Emerald Publishing Group. ISBN 13: 978-178190507

Course Description

The course will develop game theoretic concepts in evaluations of the importance of players in bargaining situations and of elements in networks. Topics covered include cooperative and noncooperative games, bargaining, the Shapley Value, and coalitions. The course will study applications to military problems and applications to economics, political science, and biology. There will be extensive reading from the literature.

Learning Activities and Assignments

This course is organized into modules, with each module focused on a specific topic related to game theory. The required learning activities for each module may be found under the Modules tab in the tool menu of the Sakai site. Activities for a module may include any or all the following:

- **Required readings** to be completed before the first session of the module
- **Class meetings** including lectures, demonstrations, and discussion
- **Practice problems** to be completed between class sessions
- **Quizzes** taken via the Tests and Quizzes tool on the Sakai site
- **Homework** to be turned in via the Assignments tool Sakai site

Success in achieving the learning goals of the course will be assessed by a comprehensive final exam.

Grading

Final grades in the course will be determined on the following basis:

Quizzes	**35%**
Homework problems	**30%**
Final exam	**35%**

Academic Integrity

All students are expected to follow the NPS Honor Code.

Distance Learning

To accommodate the needs of students through a distance learning model, this course uses the NPS Sakai CLE for course materials and assignments Zoom for class meetings.

- NPS Sakai: https://cle.nps.edu/
  - Login using your standard NPS credentials
  - Click on the course name: "MA4400: Cooperation and Competition"
  - If you experience problems with Sakai, contact the Technology Assistance Center (TAC) by email to tac@nps.edu or phone (831) 656-1046.
- Zoom
  - Access the Zoom tool from the Tools menu in the Sakai virtual classroom
  - Recordings are usually available shortly after class; they are found under the "Cloud Recordings" tab on the Zoom page
  - o Zoom instructions are available at https://wiki.nps.edu/display/SakaiCLE/Zoom

Course Topics and Schedule

Hours	Topic	Section
1-2	Games, Strategies	1.1-1.3
3	Equilibrium strategies	1.4
4	Two-person zero-sum games	2.2
5	Mixed strategies	2.3
6	Minimax Theorem	2.4
7-8	Computation of Optimal Strategies	2.5
9	Relation to Linear Programming	3.1-3.2
10	Infinite Games	4.1-4.5
11-12	Multistage Games	5.1-5.4
13-14	Utility Theory	7.1-7.2
15	Two-person general-sum games	8.1
16-17	Two-person cooperative games: bargaining	9.1
18	Threats	9.2
19	n-person games	10.1-10.2
20-21	Domination	10.3
22-23	The Core	10.4-10.5

24-25		Stable Sets	11.1-11.4
26-28		The Shapley Value	12.1-12.2
29		Banzhaf Value	12.4
30	9	Coalitional Value	12.5
31-32		The Bargaining Set	13.1
33		The Kernel	13.2
34		The Nucleolus	13.3
35-36		Non-atomic games	14.1-14.2
37		Games without side payments	15.1-15.5
38		Spatial Games	16.1
39-40		The Modified Power Index	16.2