Course guide
220218 - 220218 - Game Theory

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Molinero Albareda, Xavier

Others: Magaña Nieto, Antonio

TEACHING METHODOLOGY

The teaching methodology will consist of the following three parts:

(1) Classroom sessions devoted to presenting the contents. The teacher will introduce the theoretical basis of the matter, that is, concepts, methods, and results, and will illustrate them by means of suitable examples for ensuring a good comprehension of them.

(2) Classroom sessions devoted to practical work. Applications of the theory to solve a variety of practical examples will be proposed by the teacher. Reasoning, analytical thinking, and criticism will be promoted. Exercises to be solved individually or in small groups will also be proposed, as well as activities for self-study (see part (3)).

(3) Self-study including complimentary exercises and activities. Students, independently, need to work on the materials provided by the teacher and the outcomes of the classroom sessions, in order to fix and assimilate the concepts.

LEARNING OBJECTIVES OF THE SUBJECT

- To discover the subject and methodology of Game Theory, a branch of Operations Research devoted to the analysis of conflicts of interest.
- To make special emphasis on Cooperative Games, games where coalitions (groups of players) are allowed.
- To realize the convenience of applying Game Theory to solve problems of cooperative games, simple games, and weighted majority games, illustrated by means of examples of this field.

In particular, Shapley value (Banzhaf value) and Shapley-Shubik index (Banzhaf-Coleman index) will be introduced, among other main concepts on Game Theory.

STUDY LOAD

Type	Hours	Percentage
Hours large group	27,0	36.00
Self study	48,0	64.00

Total learning time: 75 h

CONTENTS

Part 1: Introduction to Game Theory, and Cooperative Games

Description:
A brief history of Game Theory, and Cooperative Games.

Related activities:
Exercises. Examination 1.

Full-or-part-time: 8h
Theory classes: 4h
Self study : 4h

Part 2: The Shapley value (Banzhaf value)

Description:
Definitions, concepts, calculus, and examples related to the Shapley value (Banzhaf value) on Cooperative Games.

Related activities:
Exercises. Examination 1.

Full-or-part-time: 24h
Theory classes: 4h
Practical classes: 4h
Self study : 16h

Part 3: Simple Games and Weighted Majority Games

Description:
Definitions, concepts, calculus, and examples related to Simple Games and Weighted Majority Games.

Related activities:
Exercises. Examination 2.

Full-or-part-time: 16h
Theory classes: 4h
Practical classes: 2h
Self study : 10h

Part 4: The Shapley-Shubik index (Banzhaf-Coleman index)

Description:
Definitions, concepts, calculus, and examples related to the Shapley-Shubik index (Banzhaf-Coleman index) on Simple and Weighted Majority Games.

Related activities:
Exercises. Examination 2.

Full-or-part-time: 27h
Theory classes: 5h
Practical classes: 4h
Self study : 18h

GRADING SYSTEM

The final mark will be obtained by weighting activities as follows:
- Exercises, weight: 20%
- Examinations, weight: 40% each

Examinations will be at individual level. Exercises might be occasionally allowed to be solved by small groups

ADDENDUM.
Given the exceptional situation of the pandemic, the grading system may be modified.

BIBLIOGRAPHY

Basic:
- Carreras, Francesc; Magaña, Antonio; Amer, Rafael. Teoría de juegos [on line]. 2001. [Barcelona]: Edicions UPC, 2001 [Consultation: 22/06/2020]. Available on: http://hdl.handle.net/2099.3/36427. ISBN 8483014777.
- Taylor, Alan D; Zwicker, William S. Simple games : desirability relations, trading, pseudoweightings. Princeton, N. J: Princeton University Press, 1999. ISBN 0691001200.

Complementary:
- Maschler, Michael; Solan, Eilon; Zamir, Shmuel. Game theory. Cambridge: Cambridge University Press, 2013. ISBN 9781107005488.