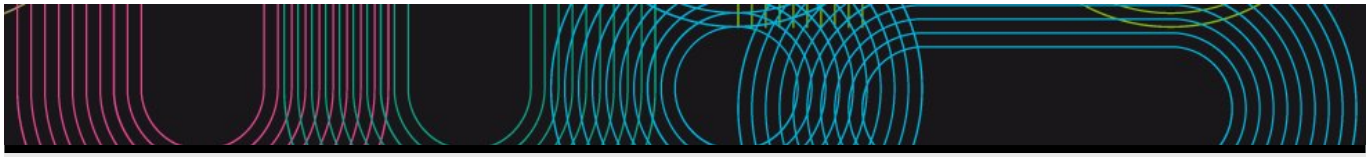

IDENTIFYING DATA				
Cooperative games				
Subject	Cooperative games			
Code	V03M184V01305			
Study programme	Máster Universitario en Técnicas Estadísticas			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Sánchez Rodríguez, María Estela			
Lecturers	Sánchez Rodríguez, María Estela Vidal Puga, Juan José			
E-mail	esanchez@uvigo.es			
Web	http://eio.usc.es/pub/mte/			
General description	The aim is to instruct students in the theory of cooperative games and their main applications. The program deals with the study of various coalitional models, distinguishing between transferable and not necessarily transferable utility, examples and applications, solutions and the main axiomatic characterizations. The course will provide students with a sufficiently broad perspective to initiate research in this field. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results
Code
A1
A2
A3
A4
A5
B1
B2
B3
B4
B5
C1
C2
C3
C6
D1
D3
D4
D5

Expected results from this subject	
Expected results from this subject	Training and Learning Results

To know and understand the theory of cooperative games, distinguishing the situations in which there exists a transferable utility from those in which there is not.	A1 A2 A3 A4 B1 C1 C3 C6 D1 D3
To know the main concepts related to cooperative game theory.	A2 A5 B2 C1 C3 C6 D3 D4
To know and properly calculate and interpret the most usual cooperative solution concepts.	A3 A4 B1 B3 B4 B5 C2 C3 C6 D1
To understand the interest of cooperative game theory models to resolve problems of division of profit, as well as cost sharing.	A4 B1 B3 C2 C6 D1 D4
To know the steps for the construction of a mathematical model taking into account the utility of the players.	A3 A5 B2 B3 B4 C1 C2 D1 D4
To be able to model real problems in terms of potential gains of cooperation.	A2 B2 B3 C1 C2 D1 D4
To have a positive attitude towards the most formal aspects of game theory.	A4 B3 D4
To enjoy the use and study of game theory as a tool for research.	A2 A3 A4 A5 B3 B4 D4
To point out the principles of the scientific thought, favouring the attitudes associated to the development of mathematical methods such as: the questioning of intuitive ideas, the critical analysis of statements, capacity of analysis and synthesis, or the choose of rational decisions.	A4 C3 D1 D4
To boost an attitude of ethical commitment, stressing on not copying the studies of others nor taking advantage of their work.	D4 D5

Contents	
Topic	
The TU model	The characteristic form, basic definitions, examples, special classes of games. Set and single valued solutions. Axiomatization.
Set valued solutions	The core. Characterisations. The D-core. Stable sets. The core-cover. The Weber set. Characterisation of convex games.
Single valued solutions	The Shapley value and other related solutions. Axiomatic characterisations of the Shapley value. Asymmetric situations: the weighted values. A priori unions: the coalitional value. Restricted communication: the Myerson value. The prenucleolus and the nucleolus. The tau-value. The core-center. Programming and computer resources.
Applications	Simple games. Market games. Cost games. Airport games. Bankruptcy games. Games arising from operational research problems.
The NTU model	Definition of NTU games. Properties of the characteristic function. TU games as a particular case of NTU games. Hyperplane games. Market games. Preferences vs utility. Matching games. Gale-Shapley algorithm.
Bargaining problems	Solutions in bargaining problems. Nash solution. Kalai-Smorodinsky solution. Egalitarian solution. Discrete Raiffa solution. Continous Raiffa solution. Properties.
Axiomatic characterisations in bargaining problems	Characterization of the Nash solution. Characterization of the Kalai-Smorodinsky solution. Characterization of the egalitarian solution.
Solutions in general NTU games	The core in NTU games. The Shapley lambda-transferable value. The Maschler-Owen consistent value. The Harsanyi value. Axiomatic characterizations.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	20	0	20
Seminars	5	10	15
Autonomous problem solving	14	75	89
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	First contact and introduction to the subject.
Lecturing	Theoretical bases and guidelines for the exercises.
Seminars	The doubts will be attended and discussed.
Autonomous problem solving	Problems and exercises are proposed to solve with the help of the lecturer.

Personalized assistance	
Methodologies	**Description**
Lecturing	The lecturer will expose in class and/or by videoconference the basic theory. Several examples illustrate the application of the theoretical results.
Autonomous problem solving	The classes of problems and laboratory will be a complement to the theoretical classes. Bulletins of problems and specific software will be used in the classes. The students will participate in the resolution of the exercises.

Assessment						
	Description	Qualification	Training and Learning Results			
Autonomous problem solving	The student has to solve a series of problems and exercises in a time/conditions established. Different tools can be used, as chats or videoconference.	100	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C6	D1 D3 D4 D5

Other comments on the Evaluation

Continuous Assessment (CA):

First opportunity:

Tests Part I (TU Games): Activity I: 22.5%, Activity II: 22.5% and Active participation in classes: 5%.

Tests Part II (NTU Games): Activity I: 25%, Partial exam: 20% and Active participation in classes: 5%.

The minimum mark in each part will have to be 5 points, and the average between the marks of the two parts will be taken.

Second opportunity:

Final exam: 100%.

Global Assessment (GA): Students who wish to do so may request a single exam which will be worth 100% of the final mark, on the official dates. This request must be made no later than 10 days after the end of the course.

The students that wish it can request the realization of one only exam that will mark 100% of the final note, in the official dates. If the student choose this option, he/she must communicate it to the professor at most 10 days later after finishing the classes.

Sources of information

Basic Bibliography

Sánchez Rodríguez E., Vidal Puga J., **Juegos coalicionales**, Universidade de Vigo, 2014

González Díaz J., García Jurado I., Fiestras Janeiro G., **An Introductory course on mathematical game theory**, AMS, 2010

Mirás Calvo M.A., Sánchez Rodríguez E., **Juegos cooperativos con utilidad transferible usando Matlab: TUGlab**, Universidade de Vigo, 2008

Complementary Bibliography

Aumann R., Hart S. (eds.), **Handbook of game theory with economic applications, vol. 3**, Elsevier Science, 2002

Curiel I., **Cooperative game theory and applications**, Academic Publishers, 1997

Chun Y., Thomson W., **Bargaining problems with claims**, 24, Elsevier, 1992

Driessen T., **Cooperative games, solutions and applications**, Kluwer Academic Publishers, 1988

Gardner, R., **Juegos para empresarios y economistas**, Antoni Bosch, 1995

Myerson R., **Conference structures and fair allocation rules**, 9, Springer Heidelberg, 1980

Owen G., **Game theory**, 4, Emerald Publishing Limited, 2013

Peters H., **Axiomatic bargaining game theory**, Springer, 1992

Roth A.E., **The Shapley value: Essays in honour of Lloyds S. Shapley**, Cambridge University Press, 1988

Recommendations

Other comments

The students that plan to choose this course can also choose the courses of Introduction to the Theory of Games and Networks and Planning, as well as other Operations Research courses. Anyway, the subject Cooperative Games is self-contained and can also be chosen without previous requirements.