

22997 - Networks, Crowds and Markets

Syllabus Information

Academic Course: 2021/22

Academic Center: 304 - Faculty of Law and Economics
332 - Faculty of Economic and Business Sciences

Study: 3327 - Bachelor's degree in International Business Economics

Subject: 22997 - Networks, Crowds and Markets

Credits: 5.0

Course: 3 and 4

Teaching languages:

Theory: Group 1: English

Group 6: English

Seminar: Group 101: English

Group 102: English

Group 601: Pending

Group 602: Pending

Teachers: Arnau Messegué Buisan

Teaching Period: First Quarter

Presentation

Networks and social groups are pervasive and influence many of our decisions and outcomes, both at the individual and aggregate level. A large body of academic literature has come up trying to understand the effect of networks and groupings in different economic contexts, often based on existing theories on networks, crowds, behavior and information diffusion from other fields. The objective of this course is to give students an introduction to this emerging area. The ideas, models, and methods from this course are useful in different contexts and can be relevant, for example, for students who want to pursue careers in information industries/data science.

REMARK: The course is rigorous and rather mathematical; we study mathematical models, algorithms, and their analysis. Students are expected to know the mathematics covered in Mathematics 1,2, 3 as well as Probability and Statistics, and some elements of Game Theory (covered, for example, in Introduction to Game Theory).

Associated skills

GENERAL SKILLS

Instrumental:

- Ability to analyze and synthesize
- Ability to organize and plan
- General basic mathematical knowledge
- Problem solving
- Written and spoken capabilities

Interpersonal:

- Criticism
- Learning capacities
- Research abilities

- Autonomous work
- Ability to generate new ideas (creativity)

Systemic: Other:

? Written and oral communication abilities using a specialized language (mathematics)

SPECIFIC SKILLS

- Model formalization of different settings through mathematical language
- Solutions of mathematical models
- Knowledge of basic tools in mathematical analysis and linear algebra and their applications to economics and business

Prerequisites

This is a course in the MQA (Advanced Quantitative Methods) track. This implies it puts emphasis in the use of mathematics to understand socioeconomic phenomena. Students are expected to have a decent background on mathematics and probability. For example, we are going to make use of matrix algebra (matrix operations, linear systems, eigenvectors,...) and results from probability theory such as Bayes' rule, and we are going to use some elements of game theory to, for example, compute Nash equilibria in games played on a network/graph.

Contents

We are going to cover the following topics (not necessarily in this order and with different levels of detail):

- 1 Network/Graph Theory
- 2 Models of Influence and Belief Propagation
- 3 Power Laws
- 4 Algorithms for Community Detection
- 5 Games played in networks
- 6 Segregation
- 7 Groups and Networks on Markets

Some of the topics may require mathematical concepts not necessarily seen in previous math courses. In such case, we are going to devote a bit of time to present these concepts as well.

Teaching Methods

Organization

- Mondays and Tuesdays (18:30-20:00 Bcn time): live classes; in these sessions we are going to cover theory concepts, and there may be some short activities (such as tests, quizzes,...) that can be evaluated during the sessions (it is, of course, important that students attend these classes); we may also devote some time in these classes to other activities that involve the whole class.

- Wednesdays (weeks 1,3,5,7,8,9; time schedule depending on the assigned group): classroom sessions, in campus, in small groups. The main role of these classes is to discuss solutions to proposed problems or other related activities/projects proposed during the term. We may also devote part of these classes to complement some of the concepts/results/examples from online sessions.

Students are supposed to do the following assignments:

- Attending the classes
- Individual study: solving and reviewing problems, reviewing the material taught in class and the textbooks or in other related references.
- Before attending the seminars: working on the problem sets.
- Attending the seminars and handing in the assigned problem sets.
- Working on the proposed readings, projects, and on the presentation and report
- Keeping a collaborative attitude with regards to the rest of group members for the different proposed activities, such as the presentation/report

Class Rules

No plagiarism, cheating or copying will be tolerated. If detected, the grades of all involved parties may be reduced down to Fail and reported to the Dean's office.

Evaluation

The grading is based on the following components.

1. Final Exam: 60%

The final exam will take place at the end of the quarter and will last for two hours. The exam will cover all the material discussed and taught in class and in the seminars, as well as the rest of work done during the term. It will cover both theoretical and practical aspects of the material. You should get at least a 4 in this exam to pass the course (this is a necessary condition but it is not sufficient: your final average grade should be at least 5.)

2. Presentation and Report: 25%.

Groups of 3/4 students are expected to make a short presentation (25 minutes max.) and write a report about a research paper. Presentations will take place in seminar sessions, during the last four weeks of the term. Each group can get a different grade in this section, according to performance during the presentation.

3. Other assignments: 15%.

There will be short quizzes and tests throughout the course testing class preparation and understanding. The grade from this section is

10%: Average grade from all tests.

5%: Active participation in answering the quizzes during session classes.

Final Grade: The final grade will be calculated as a weighted average with the weights as described above.

Make-up final Exam: If you get a final grade below 5.0, it is considered a fail. There will be a recovery exam for those that don't pass. Only students that have followed the continuous evaluation can take the recovery exam. The conditions to consider that a student has participated in the continuous evaluation are:

- handing in solutions to problem sets and the rest of work proposed during the term;
- regular attendance to seminars
- and getting at least a 4 in the presentation/report.

This exam is scheduled by Secretaria and takes place during the second term. Again, a necessary condition to pass the course is obtaining at least a 4 in this exam. The same weights apply in this case for the final average grade.

For international students: this recovery exam can only be taken here, there is no option of doing it at distance.

For UPF students: for students who are unable to attend the recuperation exam due to exchange study placement in the second term, an extra recuperation exam will be held the end of the 3rd term. Students must contact the professor by email **before the date of the recovery exam in the second term** to register for this extra recuperation exam.

Bibliography and information resources

Basic bibliography

The following two books are going to be useful for some sections:

Networks, Crowds, and Markets: Reasoning About a Highly Connected World by David Easley and Jon Kleinberg, Cambridge University Press

Network Science by Albert-László Barabási

Additional bibliography

Micromotives and Macrobehavior by T. Schelling

Social and Economic Networks by M. Jackson

Networks: An Introduction by M. Newman

Social Network Analysis: Methods and Applications by S. Wasserman and K. Faust

Social Media Mining by R.Zafarani, M.Ali Abbasi, and H.Liu, Cambridge University Press

Other teaching resources

Articles related to the topics covered in class taken from press, specialized journals, and/or blogs. These will be listed as we advance in the course.