

The Hebrew University of Jerusalem

Syllabus

Mathematics in Society - 80309

Last update 22-09-2024

HU Credits: 2

Degree/Cycle: 1st degree (Bachelor)

Responsible Department: Mathematics

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: Mt. Scopus

Course/Module Coordinator: Shulamit Solomon

Coordinator Email: shulamit.solomon@gmail.com

Coordinator Office Hours: By appointment

Teaching Staff:

Dr. Solomon Shulamit

Course/Module description:

How do we determine the winner of an election? How many votes should a shareholder get in a corporate voting? Are the seats in the kneset distributed fairly? How do I make all siblings satisfied with a division of inheritance? And finally, how do I handle my mortgage?

Course/Module aims:

The goal of this hands-on course is to discover a largely unfamiliar and user-friendly side of mathematics that is both practical, accessible, beautiful and fun.

Learning outcomes - On successful completion of this module, students should be able to:

- *use four different voting methods to determine winners of elections, and to rank the candidates*
- *understand that different voting methods applied to the same election can produce different results*
- *formulate certain mathematically precise notions of fairness and determine whether particular election results violate them*
- *understand that every voting method eventually violates one of these notions of fairness*
- *use Banzhaf and Shapley-Shubik methods to compute how power is distributed in a weighted voting system, including systems such as the UN Security Council*
- *understand that proportional voting schemes do not necessarily lead to proportional distribution of power*
- *apply apportionment methods in both political and other contexts*
- *analyze Alabama Paradox scenarios arising in apportionment*
- *understand and apply the Divider-Chooser, Lone Divider, and Lone Chooser methods for dividing valuable continuous goods, and the Method of Sealed Bids and Method of Markers for distributing valuable discrete goods, fairly*
- *understand that if these methods are applied correctly, all players are guaranteed fair shares*
- *understand and apply the notion of compound interest and the notion of annuity to solve problems related to loans and savings plans*
- *apply these notions to other contexts, such as population growth and decline*

Attendance requirements(%):

Teaching arrangement and method of instruction: Lecture

Course/Module Content:

- Voting Theory
 - Measuring Power
 - Apportionment
 - Growth and Finance
 - Fair Division
 - Fair Distribution
- *subject to change

Required Reading:

Weingart M., Seneres A., *Topics in Math for Liberal Arts*

Additional Reading Material:

Grading Scheme:

Written / Oral / Practical Exam 55 %
Presentation / Poster Presentation / Lecture/ Seminar / Pro-seminar / Research proposal 5 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 40 %

Additional information: