האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

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 knesset distributed fairly? How do I make all siblings satisfied with a division of inheritance? And finally, how do I handle my morgage?

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: