UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Ad hoc course announcement

Title: **Preference-Based Collective Decision-Making: Principles, Algorithms, and Applications**

Lecturer: **Prof. Adolfo R. Escobedo**

North Carolina State University
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CV: *Adolfo R. Escobedo is an associate professor in the Edward P. Fitts Department of Industrial and Systems Engineering at North Carolina State University in the U.S. He received the Ph.D. in Industrial and Systems Engineering from Texas A&M University in 2016. He is engaging in teaching and research activities at the University of Naples Federico II, as part of Fulbright Scholar Award. Escobedo has obtained mutiple research distinctions including the 2021 INFORMS Computing Society Prize. His work is at the intersection of operations research and computing, with applications including collective decision-making, planning and operation of sustainable infrastructures, and optimization software foundations.*

Credits: **4**

Overview

In many practical settings, collective decisions are driven by preferences or subjective evaluations provided by multiple agents, which must be considered to either choose a winner from a set of alternatives or to allocate a limited set of resources. This course introduces principles, mathematical models, and algorithms from the field of computational social choice as foundational tools for designing, analyzing, and implementing such decision mechanisms. The course examines how individual preferences can be aggregated into collectively desirable outcomes, how fairness can be formally defined and operationalized, and what trade-offs emerge. Emphasis is placed on practical implications for engineered and socio-technical systems. The course duration is 15 hours. It includes five 3-hour lectures and a final assessment of 2 hours.

Schedule

Lecture	Date	Room	Time	Topics
1	02/19/26	TBD	10:00-13:00	Preference Aggregation Basics (Hands-on Exercises)
2	02/24/26	TBD	14:00-17:00	The Axiomatic Framework
3	02/26/26	TBD	10:00-13:00	Computational Implications (Python Exercises)
4	03/03/26	TBD	14:00-17:00	Multiagent Resource Allocation (Hands-on Exercises)
5	03/05/26	TBD	10:00-13:00	Cake Cutting and Assessment

I Lesson
Preference Aggregation Basics. Definition of key concepts and terminology. Descriptions of prominent voting rules and common schemes for their classification. Exposition of practical benefits and drawbacks across various applications (e.g., group decision-making, project selection) with hands-on exercises.

II Lesson
The Axiomatic Framework. Minimal and middling-strength requirements for attaining desirable collective outcomes; description of voting rules that satisfy/violate groupings of these requirements. Overview of Arrow's Impossibility Theorem and additional limitations of social welfare functions.

III Lesson
Computational Implications. Overview of computational barriers to manipulation offered by certain voting rules. Algorithmic implementation in Python with real-world datasets.

IV Lesson
Multiagent Resource Allocation. Common criteria for allocating a finite set of indivisible goods among a set of agents who hold preferences over these goods. Rationalization of utilitarianism, equality, and equity principles and discussion of fairness and efficiency trade-offs. Allocation protocols applied to various contexts (e.g., online auctions, participatory budgeting with community projects) using hands-on exercises.

V Lesson
Cake Cutting. Allocation of a single divisible good among a set of agents who hold preferences over the different sections of the good. Procedures for attaining envy-freeness and proportionality applied to various contexts (e.g., division of shared land, allocation of supercomputing time). Assessment test.

Notes

The course will be delivered simultaneously in person and online via Microsoft Teams to accommodate students who are unable to attend on campus. While remote participation is supported, students who can attend in person are strongly encouraged to do so, as in-person attendance offers a more interactive and engaging learning experience.

Teams | Preference-Based Collective Decision-Making: Principles, Algorithms, and Applications | Microsoft Teams

For more information, please contact:
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