

COMP 4418

Knowledge Representation and Reasoning

(T3, 2024)

Instructors



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Knowledge Representation and Reasoning



Knowledge representation and reasoning (KRR) is the study of how to represent information about the world in a form that can be used by a computer system to solve and reason about complex problems. It is an important field of artificial intelligence (AI) research.

Multi-Agent Systems

Multi-agent systems (MAS) is a core area of research of artificial intelligence. A multi-agent system consists of multiple decision-making agents which interact in a shared environment to achieve common or conflicting goals.

Multi-Agent Systems: Game Theoretic Foundations

How to reason about decision making?

How to make joint decisions?

How do make fair decisions?

Assessment Structure

Assignment 1, 15%, Due Week 4

Assignment 2, 15%, Due Week 7

Assignment 1, 15%, Due Week 10

Exam, 55%

Schedule

Week	Topics covered	Activities	Assessments
1	Noncooperative Game Theory	Lectures	
2	Noncooperative Game Theory	Lectures	Assignment 1 released: Tuesday
3	Cooperative Game Theory	Lectures	
4	Matching	Lectures	Assignment 1 due: Friday
5	Matching	Lectures	Assignment 2 released: Tuesday
6	Flex Week: No Classes		
7	Fair Allocation	Lectures	Assignment 2 due on Friday
8	Fair Allocation	Lectures	Assignment 3 released: Tuesday
9	Social Choice	Lectures	
10	Social Choice	Lectures	Assignment 3 due: Thursday

Game Theory

Game Theory is the study of how agents strategize and make decisions.

Provides the mathematical framework for decision making in AI, operations research etc.

Game Theory

Non-cooperative Game Theory: competitive environment with no binding contracts. Applications include Computer Chess.

Cooperative Game Theory: focusses on cooperation and coalition formation. Applications include sharing of logistics costs.

Matching under Preferences



Arises when agents seek to be allocated to one another on the basis of preferences.

Applications include matching of job applicants to jobs, courses to students, and kidneys to patients.

Fair Allocation



How to allocate resources or tasks in a fair or efficient manner.

Applications include task allocation, scheduling, resource allocation etc.

Social Choice

*How to make collective decisions
respecting the preferences of agents,*

Applications include budget
allocation, deciding on a joint
schedule, recommender systems, and
fair clustering.