

# COMP 4418 Knowledge Representation and Reasoning

(T3, 2024)

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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

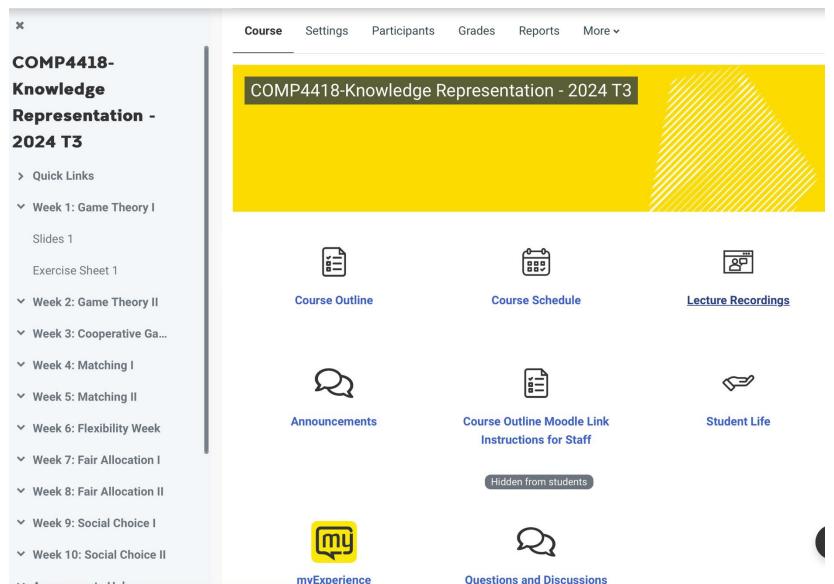


How to reason about decision making?

How to make joint decisions?

How do make fair decisions?

# https://moodle.telt.unsw.edu.au/course/view.php?id=86744





#### **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.