School of Computer Science and Engineering

COMP4418: Knowledge Representation and Reasoning

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Lecturers:

- Haris Aziz (K17-L3; Haris.Aziz@unsw.edu.au)
- Maurice Pagnucco (Lecturer-in-Charge; J17-501B; morri@cse.unsw.edu.au)
- Abdallah Saffidine (K17-501B; abdallahs@cse.unsw.edu.au)

Aim: Introduce

- Techniques used in KR to represent knowledge
- Associated methods of automated reasoning

Units of Credit: 6

Prerequisites: COMP3411 plus 6 Units of Credit in COMP3###

Course in AI plus some familiarity with

- LISP/PROLOG
- First-order logic

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Marking: 3 assignments of equal value (15%) and final exam work 55%.

No project but some programming

Text: References provided in class

Format:

- Lectures:
  - Wednesdays 1-3pm, Online
  - Thursdays 4-6pm, Online
  - Lectures posted online before class. Part of class time used for interactive sessions.
- Consultations: as required

Course Structure:

- 3 weeks: Introduction to KRR.
- 3 weeks: Non-monotonic reasoning, reasoning about action.
- 3 weeks: Social choice, resource allocation and cooperative game theory.
- Note Week 6 is Flexibility Week and there will be no lectures held that week.

Topics for KRR Part 1: Introduction:

- Introduction
- First-order logic
- Expressing knowledge
- Full Clausal logic
- Horn Clause logic
- Procedural representation
- Nonmonotonic reasoning and defaults

Topics for KRR Part 1: Potential Additional Topics:

- Production systems
- Description logics
- Frames
- Inheritance networks
- Probabilities
- Defaults
- Defaults
- Abductive explanation
- Action
- Planning
- Expresiveness/tractability
- Belief Change
- Cognitive Robotics

Topics for KRR Part 2: Non-monotonic reasoning, reasoning about actions

- Introduction to Answer Set Programming
- Solving problems with Answer Set Programming
- Reasoning about Actions

Topics for KRR Part 3: Algorithmic Decision Theory

– Social Choice Theory: voting rule; impossibility results; axiomatic approach; tournament solutions; domain restrictions; randomization

– Multi-agent Resource Allocation: allocation problems; efficiency concepts; fairness concepts; representation of preferences; mechanisms; allocation under endowments; allocation under priorities; allocation of divisible items

– Cooperative Game Theory: solution concepts; stability; core, Shapley value, computational of payoffs, computational issues