CSE 591
Knowledge Representation and Reasoning

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Introduction

Introduction

- Course Webpage:
  - http://peace.eas.asu.edu/joolee/teaching/kr-f09/
  - you need to enter username/password.
- Syllabus

Objectives

- Understand how to represent knowledge in a formal way
- Understand automated reasoning
- Understand the tradeoff between representation and reasoning
- Can use KRR tools and apply to the domain of choice

Topics

- Classical logic based approaches
- Non-classical logic based approaches
- Reasoning about states
- Reasoning about actions
- Ontology representation

Prerequisites

- No prerequisites other than graduate students.
- Undergraduates can enroll with my approval.
- Background in mathematical logic is a plus, but not a must. Mathematical maturity is a bigger plus

Grading

- (Tentative)
- curved
- Exams are usually difficult (students say)
- Distribution
  - class participation 20%
  - two midterms 15% + 15%
  - homework 25%
  - project 25%

Participation

- By presenting solutions to the problems (excluding those marked with ^{e}; they are for your own exercises)
- Each one counts for 10%. Two presentations are required
- Solutions you found by yourself. Can consult the materials handed out in class, but no other books, Internet, help from others.

Project

- Up to two people in a team
- You may choose your own topic
- I have some topics in mind
- Distribution
  - proposal: 10%
  - progress report: 30%
  - final report: 60%

Possible Projects

- Formal comparison of KR formalisms
- Implementing one formalism using the tools for another
- HW/SW modeling and verification
- Security protocol verification
- Reasoning about policy
- ....

Homework

- Weekly homework
  - By emails only. No help from others.
  - Append your name to the title; no other change
  - Use plain text in the body of the message. NO ATTACHMENTS (see “notation.pdf” on the class Webpage)
  - There will be penalty if the instruction is not followed
  - I may ask to clarify. Be prompt to reply

Topics

- Review of classical logic
  - Propositional logic, first-order logic, second-order logic
  - Grounding and Herbrand models
  - SAT solver / Herbrand model solver
- Answer set programming
  - Stable model semantics
  - ASP solver
- Circumscription
  - Circumscription solver
- Nonmonotonic Causal Theories and Action language C+
  - Causal Calculator
- Event Calculus
  - Discrete Event Calculus Reasoner
- Situation Calculus
  - Golog
- Description logics
  - KM

Papers to Read

(Books not required to buy.)

- Some chapters from "Handbook of knowledge representation"
- "Circumscription"
- "Mathematical Foundation of Answer Set Programming"
- "Nonmonotonic Causal Theories"
- "Stable Models and Circumscription"

The first paper to read

- Ch1 of Handbook of Knowledge Representation
  http://www.cs.utexas.edu/~vl/papers/Ch1.pdf

The first problem set

- Posted at the class webpage.
- Problems marked with ^{e} are for exercises. We will discuss other problems