CMPT 411/721

Knowledge Representation and Reasoning

Fall 2019

Course Information

Instructor:
Jim Delgrande, T9015; email: jim
Office hours: tentatively Tuesday, Thursday 2:00-3:00

TA:
Turash Mosharraf; email: turash_mosharraf
Office hours: TBA

Lecture Hours: MWF 14:30 – 15:20
Lecture Room: M: AQ3159

Course Home Page: www2.cs.sfu.ca/CourseCentral/411/jim

Course Info

Goal:

Introduction to Knowledge Representation and Reasoning in AI

- We'll cover approaches used in KR to represent knowledge for different applications (dealing with e.g. diagnosis, uncertainty, object-centred representations)

- Also, methods to automate reasoning for these approaches.

Prerequisites:

- None officially
    - The course focusses on logical reasoning, so exposure to logic would be good.
- A course in AI would be good, for familiarity with issues and goals of KRR.
- *Interest*

Course Grading

Grading

- Marks:
    - 40% - 4 assignments
    - 20% - midterm test;
    - 40% - final exam.
- No project, but some programming
- The final is Wed., Dec. 11 at 12:00
    - You *must* be able to attend the final
    - The final will be 2 hours

Course Grading

Letter Grades

Letter grades will be assigned as follows:

A+: ≥90;	A: 84-89;	A-: 80-83;
B+: 77-79;	B: 74-76;	B-: 70-73;
C+: 67-69;	C: 64-66;	C-: 58-63;
D : 50-57;	F: < 50.	

Notes

- Grads and undergrads are treated as distinct cohorts
  - Grads may be asked to do some additional work on assignments.
  - ☞ If you are taking the concurrent B.Sc./M.Sc. program please let me know!

- In calculating a final mark, grades will *not* be scaled down.
  - They might be scaled up, but this is rare.

Course Policies

Coursework and Academic Honesty

- All course work must be done individually by each student.
- It's ok to discuss general principles and directions for an assignment, but the solutions you submit must be yours
  ☞ i.e., you must have created them entirely on your own.
- Failing to do so will be considered academic dishonesty and appropriate penalties will be applied.
- If you're in doubt, please ask.

Course Policies

- For questions concerning the assignments (either for the interpretation of an assignment or for a grade), please
    - see the TA first, and then
    - talk to me if you still have concerns.

- If you have any concerns regarding grading of an assignment or a test, please notify myself or the TA within one week of the material being handed back.

Even More Course Policies

Office Hours and Email

- Please use email only for brief questions or for points of clarification.
- For longer questions or problems please see the TA or myself during office hours.

Due Dates

Unless announced otherwise, all assignments are due at 23:59 on the given date; and late assignments will not be graded.

Text and references

- We'll be following the text by Ron Brachman and Hector Levesque, *Knowledge Representation and Reasoning* for maybe 50% of the course.
- Slides based on the text are available from the course home page.
- The book is available for downloading from the Elsevier site.
- Other slides and papers will be made available as needed.

Other references

References:

Here are some AI references that may come in handy.

- *Artificial Intelligence: A Modern Approach,* 3nd *ed.*, Stuart Russell and Peter Norvig, Prentice Hall, 2010.

- *Artificial Intelligence: Foundations of Computational Agents*, David Poole and Alan Mackworth, Cambridge University Press, 2010.
    - The first edition is also pretty good: *Computational Intelligence*, David Poole, Alan Mackworth and Randy Goebel, Oxford University Press, 1998.

- Lots of other references...

Other references

Logic references:

- There are numerous good books that introduce logic. Two such books are:
  - *Introduction to Mathematical Logic*, E. Mendelson
  - *A Mathematical Introduction to Logic*, H. Enderton
- Various AI texts have a good introduction to logic.
  - Branchman and Levesque in particular is good.

Informal Intro to KR

- *Common Sense, the Turing Test, and the Quest for Real AI*, Hector J. Levesque, MIT Press, 2017

Other KR books

The following books contain further information on material covered in class, in case you're interested in learning more.

- *Handbook of Knowledge Representation*, F. van Harmelen, V. Lifschitz, and B. Porter (eds.), Elsevier Science, 2008

- *Nonmonotonic Reasoning*, Grigoris Antoniou, MIT Press, 1997.

- *An Introduction to Description Logic* F. Baader, I. Horrocks, C. Lutz, and U. Sattler, Cambridge Press, 2017

- *Answer Set Solving in Practice*, M. Gebser, R. Kaminski, B Kaufmann, and T. Schaub, Morgan & Claypool Pub., 2012

- *The Elements of Argumentation*, P. Besnard and A. Hunter, The MIT Press, 2008

Topics

Outline (may be subject to change):

1. Introduction
2. Logic: propositional and first-order. Expressing knowledge
3. Reasoning in logic: resolution
4. Horn clause logic: efficient reasoning
5. Description logics
6. Defaults/answer set programming
7. Argumentation
8. Abductive explanation
9. Reasoning about action (maybe)
10. Expressiveness / tractability