

COMP_SCI 371

HW 4

Due 2/13/2020 1:59 p.m.

In this assignment, we will practice reasoning in a knowledge base. Specifically, we will use Horn clauses and the NextKB knowledge base via Companions.

Your goal is to learn more about the people of the Northwestern CS department. To do so, you will write a set of Horn clauses that, when queried, return the answers to the following questions. Put your Horn clauses in a text file with a krf extension (e.g. "<name>_hw4.krf") and the line `(in-microtheory KRR-Winter2020RulesMt)` at the top. For each query, include a comment with the question number and the answer(s). You can manually extract the relevant parts (i.e. variable bindings) of the returned query answer. When we load your file into Companions, and run the appropriate query (using `KRR-Winter2020RulesMt` as the context), we should get the same answer(s) you do.

0. Getting Set Up

- 1) Start a Companions
 - a) Enter a username
 - b) Click Start Session>Interaction-Manager
- 2) Load knowledge
 - a) Right click on the interaction-manager agent
 - b) Select "Load Flatfile" and navigate to "KRR-Winter2020Facts.krf"
- 3) Access the kb
 - a) Right click on the interaction-manager agent
 - b) Select "Browse KB"
- 4) See HornClausesCheatSheet.pdf (on Canvas) for some tips

1. Horn clauses

Please write queries that answer the following questions. The second line of each is how we will call the query (HINT: This, with open variables, should be the consequent in your Horn clause). You will need to use the NextKB knowledge base, but do not define any new concepts. The first one is done for you.

0. **Question:** When do the courses that are taught by Brenna Argall meet?

Query: `(courseTaughtTime BrennaArgall ?time)`

```
;;; 0) "Tuesday and Thursday from 2:00 to 8:00",  
;;; "Tuesday and Thursday from 11:00 to 12:20"
```

```
(<== (courseTaughtTime ?person ?time)  
      (courseInstructor ?course ?person)  
      (courseTimeString ?course ?time))
```

1. **Question:** What is the email address of the person who teaches CS348 in the winter semester?
Query: (emailOfCourseInstructor CS348-Winter2019 ?email)

2. **Question:** Who are the faculty who earned at least one degree at Northwestern University?
Example answer: BrentHecht (who earned his PhD at Northwestern University)
Query: (degreeEarnedAt ?faculty NorthwesternUniversity)

3. **Question:** At which universities did the instructors, who teach courses in the spring quarter of the 2019 academic year, earn their PhD degrees?
Example answer: MassachusettsInstituteofTechnology (Ken Forbus teaches CS396 in the spring and got his PhD at MIT)
Query:
(phdInstitutionsByQuarterTaught (SpringQuarterFn (AcademicYearFn NorthwesternUniversity (YearFn 2019))) ?institution)

4. **Question:** What are the full names of the instructors, each of whom teaches two or more courses during the winter quarter of the 2019 academic year?
Example answer: " "Vincent St-Amour"" (teaches CS213 and Social Computing & CS214)
Query:
(teachesMultiple ?name (WinterQuarterFn (AcademicYearFn NorthwesternUniversity (YearFn 2019))))

5. **Question:** What are the universities from which instructors who teach two or more courses during the spring quarter of the 2019 academic year go their PhD degrees?
Example answer: TuftsUniversity (MichaelHorn who teaches CS313 and CS330)
Query:
(educationOfTeachersOfMultiple ?university (SpringQuarterFn (AcademicYearFn NorthwesternUniversity (YearFn 2019))))
Hint: Make use of Horn clauses that you have already defined.

6. **Question:** What are the names of the courses, other than variations of CS396, that are taught by the same instructor during at least two quarters or by different instructors during each of three quarters during the 2019 academic year?
Example answers: "Introduction to Artificial Intelligence" (taught by KristianJHammond, MichaelRubenstein, and WillieWilson), "Introduction to Systems" (taught by VincentSt-Amour in the fall and spring)
Query: (taughtMultiple ?course (AcademicYearFn NorthwesternUniversity (YearFn 2019)))