

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 2
Maximum Points: 35
Due: 1:30 PM, Thursday, September 24, 2009

Name(s)⟨user name(s)⟩: _____

September 17, 2009

You must turn in the answers to this homework set in a submitted file by 1:30 PM on the date shown above.

The submitted file must be named `hw2.ext`, for an appropriate value of `ext`. **Include your name(s) and user name(s) at the top of the file.** Submit that file by executing the Unix command

```
submit_cse463 hw2.ext
```

or

```
submit_cse563 hw2.ext
```

whichever is appropriate for you. The file can be a text file, or produced by some word processing software, but it must be formatted so it is easy to read.

You are also to submit two additional files, one for each exercise, as instructed below. The files must be named `cpwPropRules.e` and `tomsEvening.cl`.

1. (8) For this exercise, let S be the sentence,

Tom is the driver of the car implies that Betty is not the passenger in the car.

- (a) (3) Using the syntax of and semantics of CarPool World given in the file, `/projects/shapiro/CSE563/decreasoner/examples/ShapiroCSE563/cpwPropRules.e` formulate S .
- (b) (2) Make a copy of `/projects/shapiro/CSE563/decreasoner/examples/ShapiroCSE563/cpwPropRules.e`, and append your formalization of S to it. Place it here in your answer file, and submit it.
- (c) (1) Using `timberlake.cse.buffalo.edu`, run `ubdecreasonerP` on your extended file. (Recall that the instructions for this are on the “System Documentation” page of the course web site.) Place the output here in your answer file:
- (d) (1) According to `ubdecreasonerP`, how many models satisfy your set of wfps?
- (e) (1) In each model that satisfies your set of wfps, who is the driver of the car?

2. (27) For this exercise, you will finish the Tom's Evening Domain, and use `wang:entails` to check that the query is logically entailed by the knowledge base. Recall that the problem is

Domain Knowledge: If there is a good movie on TV and Tom doesn't have an early appointment the next morning, then he stays home and watches a late movie. If Tom needs to work and doesn't have an early appointment the next morning, then he works late. If Tom works and needs his reference materials, then he works at his office. If Tom works late at his office, then he returns to his office. If Tom watches a late movie or works late, then he stays up late.

Situation-Specific Assumptions: Tom needs to work, doesn't have an early appointment, and needs his reference materials.

Query to be Proved: Tom returns to his office and stays up late.

- (a) (4) Finish choosing atomic propositions to represent the domain. Following the class discussion, we have identified the propositions in the domain. You just have to finish choosing symbolic atomic propositions. For completeness, the ones we have already chosen are listed here:

- `[GoodMovie]` = There's a good movie on TV
- `[NeedsReferences]` = Tom needs his reference materials
- `[StaysHome]` = Tom stays home
- `[StaysUpLate]` = Tom stays up late
- `[ReturnsToOffice]` = Tom returns to his office
- `[WatchesLateMovie]` = Tom watches a late movie
- `[WorksAtOffice]` = Tom works at his office
- `[WorksLate]` = Tom works late

The ones you need to choose are

- i. (1) `[_____]` = Tom has an early appointment the next morning
- ii. (1) `[_____]` = Tom has an early appointment
- iii. (1) `[_____]` = Tom needs to work
- iv. (1) `[_____]` = Tom works

- (b) (12) Finish formalizing the sentences of the domain using the computer-readable syntax, CLIF. Here the sentences are listed in order, and those we did in class are already filled in:

- i. (3) If there is a good movie on TV and Tom doesn't have an early appointment the next morning, then he stays home and watches a late movie.
- ii. (3) If Tom needs to work and doesn't have an early appointment the next morning, then he works late.
- iii. (3) If Tom works and needs his reference materials, then he works at his office.
- iv. (0) If Tom works late at his office, then he returns to his office.

```
(if (and WorksLate WorksAtOffice) ReturnsToOffice)
```
- v. (0) If Tom watches a late movie or works late, then he stays up late.

```
(if (or WatchesLateMovie WorksLate) StaysUpLate)
```
- vi. (3) Tom needs to work, doesn't have an early appointment, and needs his reference materials.
- vii. (0) Tom returns to his office and stays up late.

```
(and ReturnsToOffice StaysUpLate)
```

- (c) (6) Add any additional background knowledge you need. This knowledge should be reasonable and should not trivialize answering the query. (*Suggestion: relate Tom's having an early appointment the next morning to Tom's having an early appointment, and Tom's needing to work to Tom's working.*)

- (d) (2) Make a copy of the file `/projects/shapiro/CSE563/Examples/Wang/tomsEvening.cl`, and add your material to it. Insert that file into your answer file here, and submit it.

- (e) (3) Load and run your file by doing the following
- i. Run Lisp by following the directions in the “System Documentation” page of the course web site.
 - ii. Load the `wang` program by following the directions in the “System Documentation” page of the course web site.
 - iii. Change into the `wang` package by entering the Lisp command
`:pa wang`
 - iv. Load your Tom’s Domain file.
 - v. Have Lisp evaluate the expression
`(entails KB Query)`
 - vi. Exit Lisp by entering the Lisp command
`:ex`

Insert the entire Lisp run into your answer file here: