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BLG 435E Artificial Intelligence - 2021/2022 Fall
Assignment 3 - Part 1

December 27th, 2021

1 (50 pts) First-Order Logic Representation and Inference via Resolution

FOL Representation

Represent the following sentences in first-order logic (FOL). You may define predicates as you like.

E x A y [(PyhsicsTeacher (y)/\ y!=x)->Talks (x,y)]

- All dogs are animal. A x [dog(X)-> animal(X)]
- Not all robots can carry objects. E xAy[(robot(x) & obj(y))-> carry(x,y)
- Everyone who graduated from high school also graduated from primary school. A x[gradHigh(x)->gradprim(x)]
- Some students did not take AI course. E x *[takeAI(x)]
- There is only one table. Ew. [Table(w) /\ Ax. (x *= w -> *Table(x))]
- There is a teacher who only talks to other teachers that are teaching physics.

FOL and Resolution

Arda, Cihan and Gamze are students in the same university. ✓

English, French, Russian and Turkish belong to language category (Same as "English, French, Russian and Turkish are languages"). ✓

Each student in the university speaks Turkish. ✓

Each student in the university speaks at least one of the foreign languages: English, French, Russian. ✓

Fish and hamburger belong to food category.

Classic, jazz and rock belong to music category.

1)studentAt(Arda,x) , studentAt(Cihan,x) , studentAt(Gamze,x)

5)Food(Fish),...

6)Music(Classic),....

2) Language (French),...

3)studentAt(X,Y)->speaks(Trukish)

4)studentAt(X,Y)-> (speaks(X,English) \/ speaks(X,French) \/ speaks(X,Russian))

Not \/

7)[studentAt(x,y) /\ speak(x,French)]-> [likeMusic(x,jazz) /\ *likeMusic(x,rock)]

8)[studentAt(x,y) /\ speak(x,Russian)]-> likeMusic(x,Rock)

9)[studentAt(x,y) /\ likeFood(x,Hamburger)]-> speaks(x,Eng)

10)[studentAt(x,y) /\ *eat(x,Hamburger)]-> *speaks(x,Eng)

Students who speak French like jazz music and dislike rock music. All students who speak Russian like rock music.

All students who like hamburger speak English. Students who do not eat hamburger do not speak English.

Arda likes jazz music and fish but dislikes classic music, rock music and hamburger.

Cihan dislikes whatever music Arda likes, and he likes whatever music Arda dislikes. He likes fish and dislikes hamburger.

Gamze likes fish, hamburger and classic music but dislikes jazz music and rock music.

Cihan:
like: classic,rock, fish
dislike:jazz,hamburger

Arda:
like:jazz,fish
dis:classic,rock,hamburger

- Construct a knowledge-base using the given facts.
- Use resolution to answer the following queries:
  - Arda speaks French.
  - Cihan speaks Russian.
  - Gamze speaks Russian.

NOT:
*studentAt(x,y) \/ *studentAt(x,y) =*studentAt(x,y)

*studentAt(X,Y) \/ (speaks(X,English) \/ speaks(X,French) \/ speaks(X,Russian))

*speaks(Arda,French)

*studentAt(X,Y) \/ (speaks(X,English) \/ speaks(X,Russian))

studentAt(Arda,x)

(speaks(X,English) \/ speaks(X,Russian))

[*studentAt(x,y) \/ *speak(x,Russian)]\/likeMusic(x,Rock)

speaks(X,English) \/ *studentAt(x,y) \/ likeMusic(x,Rock)

*likes(x,Rock)

speaks(x,English) \/ *studentAt(x,y)

studentAt(Arda,x)

speaks(x,English)

[*studentAt(x,y) \/ eat(x,Hamburger)] \/ *speaks(x,Eng)

[*studentAt(x,y) \/ likefood(x,Hamburger)]

*likefood(Hamburger)

2 (50 pts) Game Playing

Originally, Connect Four is a 2-player game in which the players take turns dropping one coloured disc from the top into one column. The discs fall straight down and occupy the lowest available location in the column.

In this question, the new version of the game which is called Connect Three will be used as a game board. The objective is connecting the three of the checkers in a row (diagonally, vertically or horizontally) while preventing the opponent from doing the same. The first person to reach the goal is the winner. The game board is 3x3 in size. You are in the middle of the following game and you will select your next action (A, B or C).

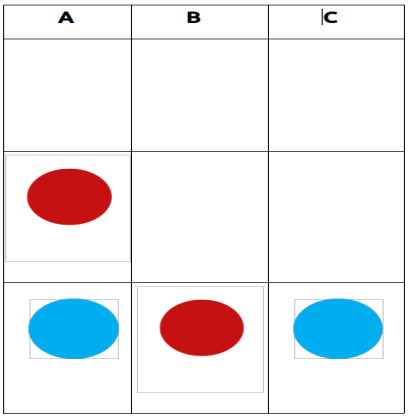

Figure 1: Connect Three Game

1. You are the blue player. Find your next move using minimax algorithm, assuming that your opponent plays optimally. Draw the minimax tree and show the minimax-value for all nodes.

2. You are the red player. Find your next move using minimax algorithm, assuming that your opponent plays randomly. Draw the minimax tree and show the minimax-value for all nodes.

3 Submission

Submit your homework files through Ninova. Please upload your pdf file using filename "BLG435E-HW-3-Part1-STUDENTID.pdf". You are going to submit:

A PDF file report containing answers of the questions and required explanations/analyses about your solutions.

You should answer Q1 in handwriting.

- Pay attention to the deadline of the homework, including hour.
- In case of any questions, feel free to send an e-mail to TA Gamze Akyol **akyolga@itu.edu.tr**.