CS 411 - Artificial Intelligence I

Fall 2022

Assignment 9

Department of Computer Science

University of Illinois at Chicago

Total Points: 25

1. Explain how first-order logic overcomes shortcomings of propositional logic [4]

First order logic can use quantifiers. Propositional logic does not use quantifiers.

First order logic expresses generalization, specialization, and pattern which propositional logic do not perform.

In first order logic are allowed to use forAll & exist over variables, making the logic more expressive. In propositional logic we are allowed to use and, or & etc.

2. Express universal quantification in terms of existential quantification [4]

"for every x" / "for all x" = universal quantifier, denoted by ∀x.

"there exists an x such that" = existential quantifier, denoted by ∃x.

Example is asserting that everyone dislikes winter is the same as asserting there does not exist someone who likes winter.

W = winter

∀x¬ Likes(x, W) <-> ∃x Likes(x, W)

<u>By DeMorgan</u>

$\forall x \neg W = \neg \exists x W$

$\neg \forall x W = \exists x \neg W$

$\forall x W = \neg \exists x \neg W$

$\neg \forall x \neg W = \exists x W$

3. Translate the following into first-order logic (17)

   a. Some students took CS411 in Spring2020 [2]

b. Some students wear a hoodie with UIC logo on it [2]

c. Something that glitters is not always gold, whereas gold always glitters. [3]

d. No one can win with everyone all the time. [4]

e. All CS courses are difficult, except two. [6]