CS1571
Fall 2019
10/14 In-Class Worksheet

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Where were you sitting in class today: Back Right

A. Pre-Reflection

On a scale of 1-5, with 5 being most confident, how well do you think you could execute these learning objectives:

11.2 Translate English sentences into first order logic _____
12.1 Demonstrate how to make inferences in FOL using resolution _____
12.2 Explain what a definite clause is and why it is useful. _____

B. Translate English sentences into FOL

1. Translate the following sentences into FOL:

Every major scale has a relative minor scale

∀x(major(x)) → ∃y(minor(y))^Relative(x, y)

There is something that someone is an expert in.

X= person Y=areas of expertise ∃x,yPerson(x) ^ Area(y) ^ Expert(x, y)

Someone at Pitt has learned four languages.

∃x atPitt(x) ^ Knows(four languages)

There is no one who possesses wisdom.

$\sim\exists x\ \text{Person}(x) \wedge \text{Wisdom}(x)$

C. Demonstrate how to make inferences in FOL using resolution:

2. Convert the following expression to conjunctive normal form:
   Everyone who loves all animals is loved by somebody.
   $\forall x\,(\forall y\,\text{Animal}(y) \Rightarrow \text{Loves}(x,y)) \Rightarrow (\exists y\,\text{Loves}(y,x))$

Step 1: Remove the biconditionals and implications.

$(\forall x\,\sim(\forall y\,\sim\text{Animal}(y) \vee \text{Loves}(x,y))) \vee (\exists y\,\text{Loves}(y,x)))$

Step 2: Move the negations inward.

$\forall x\,(\exists y\text{Animal}(y) \wedge \sim\text{Loves}(x,y)) \vee (\exists y\,\text{Loves}(y,x))$

Step 3: Standardize variables

$\forall x\,(\exists y\ \text{Animal}(y) \wedge \sim\text{Loves}(x,y)) \vee (\exists z\text{Loves}(z,x)$

Step 4: Skolemize

$\forall x\,(\text{Animal}(F(x)) \wedge \sim\text{Loves}(x,F(x))) \vee (\text{Loves}(G(x),x)$

Step 5: Drop universal quantifiers

$(\text{Animal}(F(x)) \wedge \sim\text{Loves}(x,F(x))) \vee (\text{Loves}(G(x),x))$

Step 6: Distribute v over ^

(Animal(F(x)) V (Loves(G(x), x)) ^ ~Loves(x, F(x))) V (Loves(G(x), x))

D. Prove Curiosity Killed the Cat Using Resolution

KB:

Animal(F(x)) v Loves(G(x), x)

~Loves(x, F(x)) v Loves(G(x), x)

~Loves(y,x) v ~Animal(z) v ~Kills(x,z)

~Animal(x) v Loves(Jack, x)

Kills(Jack, Tuna) v Kills(Curiosity, Tuna)

Cat(Tuna)

~Cat(x) v Animal(x)

~Kills(Curiosity, Tuna) (*this is your negative alpha*)

E. Explore Code

Download logic.py from https://github.com/aimacode/aima-python

Find substitution, unification, and resolution functions. Explain how they work.

Post-Reflection

On a scale of 1-5, with 5 being most confident, how well do you think you could execute these learning objectives:

11.2 Translate English sentences into first order logic _____
12.3 Demonstrate how to make inferences in FOL using resolution _____
12.4 Explain what a definite clause is and why it is useful. _____