

4511W, Spring-2020

ASSIGNMENT 5:

Assigned: 04/13/20 Due: 04/20/20 at 11:55 PM (submit via Canvas, you may take a picture of handwritten solutions, but you must put them in a pdf) Submit only pdf or txt files

Written/drawn:

Problem 1. (20 points)

Consider the following sentences:

$$A \wedge (B \vee C) \wedge (C \Rightarrow B)$$

(1) What models satisfy the sentence above?

B

(2) What models satisfy the sentence above (just “B”)?

(3) Show whether or not “Sentence from (1) entails Sentence from (2)” using your previous answers.

Problem 2. (25 points)

Consider the following sentences:

$$A \vee C$$

$$\neg A \vee B$$

$$C \vee \neg D \vee \neg E$$

$$D \vee C$$

$$\neg B \vee \neg D \vee E$$

(1) Use resolution to determine whether these sentences entail C

(2) Use resolution to determine whether these sentences entail E

When answering both of these, show your work step-by-step.

Problem 3. (20 points)

Convert the paragraph below into first-order logic.

Youtube has free videos about cats and dogs. Youtube has good educational videos as well. Some cat videos (on youtube) are good, but not any dog videos. All bad youtube videos have ads, but some good videos have ads as well. I put a dog video onto youtube.

Problem 4. (25 points)

Consider the sentences below. You may assume the objects are: {Lion, Elk, Eagle}

$$\forall x \text{ Carnivore}(x) \vee \text{Herbivore}(x)$$

$$\exists x \text{ Herbivore}(x)$$

$$\forall x, y \text{ Carnivore}(x) \wedge \text{Herbivore}(y) \Rightarrow \text{CanEat}(x, y) \wedge \text{Happy}(x)$$

(1) Convert these sentences to equivalent propositional logic sentences.

(2) Then convert your answers from part (1) which only contain the “Lion” object (and no others) to CNF (Conjunctive Normal Form). (Doing the full CNF is quite long and the way you handle “Lions” should generalize to the others).

Programming (python/lisp):

Problem 5. (10 points)

Use logicAlt.py provided (just copy to base folder where logic.py is but import for logicAlt instead otherwise you might need to install the “networkx” package, which you can do by using the command: `python3 -m pip install networkx`) to setup a propositional logic knowledge base (i.e. “KB”) of problem 2 using the `tell()` commands. (As always, you can check out the `/tests/` folder for example usage.) Then use this code to answer the following questions:

- (1) Is the following true: $\text{KB} \models (E \iff A) \vee B \vee E$
- (2) Is the following true: $\text{KB} \models (A \Rightarrow E) \wedge (D \Rightarrow B)$
- (2) Is the following true: $\text{KB} \models (A \Rightarrow E) \vee (D \Rightarrow B)$