CMPT 411/721 - Knowledge Representation and Reasoning

Assignment 4

Due date: December 2, 2019

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November 19, 2019

Important Note: Students must work individually on this, and other CMPT 411/721, assignments. You may not discuss the specific questions in this assignment, nor their solutions with any other student. You may not provide or use any solution, in whole or in part, to or by another student.

You are encouraged to discuss the general concepts involved in the questions in the context of completely different problems. If you are in doubt as to what constitutes acceptable discussion, please ask!

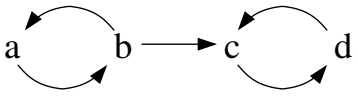
1. [6 marks]

   Consider the following description logic ontology (TBox):

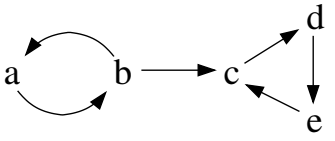
   i. $Organism \doteq Animal \sqcup Plant$
   ii. $Person \sqsubseteq Animal$
   iii. $Grass \sqsubseteq Plant$
   iv. $Cow \sqsubseteq Animal \sqcap \forall eats.Grass$
   v. $Carnivore \doteq Organism \sqcap \forall eats.Animal$
   vi. $Rancher \doteq Person \sqcap \forall eats.Cow \sqcap \exists owns.Ranch$

   (a) Express the axioms i, iv, and vi in informal English.
   (b) Translate the axioms i, iv, and vi into first-order logic formulas.
   (c) In the above ontology, what is the relation between Rancher and Carnivore? For example, is every Rancher a Carnivore? How about the other way round? Justify your answer by showing whether the subsumptions hold or not via the tableau algorithm.

2. [2 marks] For the two argumentation networks below, give all admissable sets, preferred extensions and stable extensions.



(a)



(b)

3. [2 marks] Consider the following assertions

   $\{l,\ l \rightarrow c,\ x,\ x \rightarrow \neg l,\ f,\ f \rightarrow \neg a, \neg a \rightarrow \neg x\}$

   with intended interpretations:

l: Levels of CO_2 are increasing.

c: Global temperatures are increasing.

$l \to c$: Increase in levels of CO_2 leads to global temperatures increasing.

x: Study x is reliable.

$x \to \neg l$: If study x is reliable then (it shows that) levels of CO_2 are not increasing.

f: Funding for study x is provided by AcmeOil.

$\neg a$: Study x is not done at arm's length (i.e. with no outside interference).

$f \to \neg a$: If funding for study x is from AcmeOil, it's not done at arm's length.

$\neg a \to \neg x$: If study x is not done at arm's length, its results are not reliable.

Express this in the Besnard-Hunter framework. That is give

(a) The various relevant arguments, and

(b) provide an argument graph showing whether c is warranted or not, fully giving all information (such as undercutters, etc). (If no argument graph can be given, explain why not.)