Comp 3710 Artificial Intelligence Concepts.

Assignment 4 (Points 10)

Due on 28/03/2021 Before 11:59pm

The aim of this assignment is to learn the concept that we discussed in logical agents, first order logic and inference.

Part I: (Points 7)

1. State whether the following are true or false and provide required explanation. **(1 point)**
   a. $A \Leftrightarrow B \models \neg A \vee B$
   b. $(A \wedge B) \Rightarrow C \models (A \Rightarrow C) \vee (B \Rightarrow C)$

2. Convert the following set of sentences to CNF. **(1 point)**
   a. $A \Leftrightarrow (B \vee E)$
   b. $C \wedge F \Rightarrow \neg B$
   c. $\neg((\neg A \Rightarrow \neg B) \wedge \neg C)$
   d. $(A \Rightarrow B) \Rightarrow (\neg C \wedge B)$

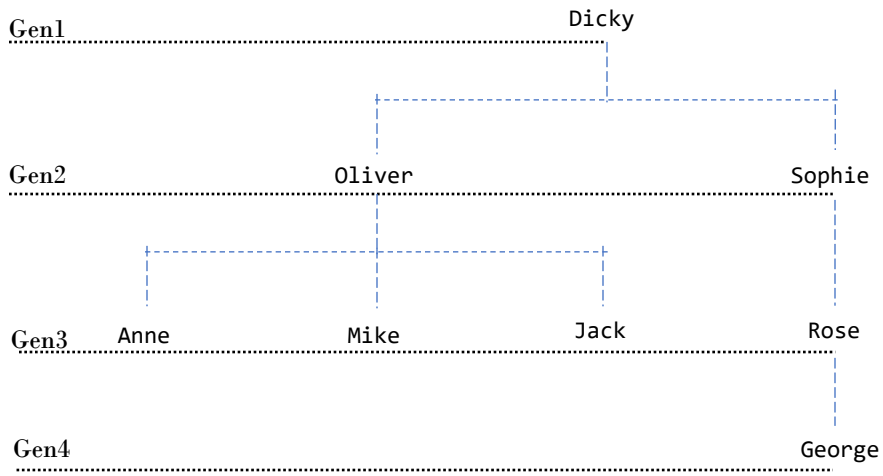
3. Translate the following English sentences into first order logics. Use suitable vocabulary. **(2 points)**
   a. Some students take AI.
   b. There exists a smart student.
   c. Brothers are siblings (Consider the fact that sibling is a symmetric relation)
   d. One's mother is one's female parent
   e. Every person has only one mother
   f. A cousin is a child of a parent's sibling
   g. Every farmer owns a donkey
   h. Some birds are crows, but no birds are squirrels.

4. Translate the following formulas into natural English (**no xs or ys**!), according to their intuitive intended meaning: **(2 points)**
   a. $\forall x\ (Male\ (x) \vee Female(x))$
   b. $\forall x, y, l\ \ SpeaksLanguage\ (x, l) \wedge SpeaksLanguage\ (y, l) \Rightarrow Undestands\ (x, y) \wedge Undestands\ (y, s = x)$
   c. $\exists x\ Parent(Joan, x) \wedge Female(x) \wedge [\forall\ y\ Parent(Joan, y) \Rightarrow y = x]$
   d. $\exists c\ Parent(Joan, c) \wedge Parent(Kevin, c)$
   e. $\exists p\ (Planet(p) \wedge \forall h\ (Human(h) \wedge LivesOn(h, p)))$
   f. $\forall x\ (\ Student(x) \Rightarrow \exists\ y\ (\ Course(y) \wedge Takes(x, y)\ ))$
   g. $\neg\exists\ x, y, n\ Person(x) \wedge Person(y) \wedge \neg(x = y) \wedge [HasSSN(x, n) \wedge HasSSN(y, n)]$
   h. $\forall\ x, n\ Person(x) \wedge HasSSN(x, n) \Rightarrow Digits(n, 9)$

5. For each pair of atomic sentences, give the most general unifier if it exists, if not exist, explain why. **(1 point)**
   a. $P(A, B, B), P(x, y, z)$.
   b. $Q\big(y, G(A, B)\big), Q(G(x, x), y)$.
   c. $Older(Father\ (y), y), Older\ (Father\ (x), John)$.
   d. $Knows(Father\ (y), y), Knows(x, x)$.

Part II: (Points 3)

1. Consider the following family tree corresponding to the following Prolog program: I highly recommend using **SWI-Prolog** to write the prolog program if you are new learner. (3 points)



Males: Dicky, Oliver, Mike, Jack, George

Females: Anne, Rose, Sophia

Define new predicates for the following family relations: Father, Mother, Sister, Brother, Grandmother, Grandfather, Ancestor, Cousin, Uncle, Son and Daughter.

Your program should be able to answer the following question.

   a. Was George the parent of Oliver?
   b. Who was Oliver's parent?
   c. Who were the children of Oliver?
   d. Who were the brothers of Anne?
   e. Who were the cousins of Rose?

Create any of your own questions (five) and test the answers.

For the above ten queries, you should test the answers and attached the screenshot/ prolog program with each question.

****

Submission should include a PDF document which should satisfy the following:

- All answer must be typewritten
- All required steps must be given clearly.

AND prolog program file.