CS360 Homework 2

Resolution with Propositional Logic

1) Consider the following popular puzzle. When asked for the ages of her three children, Mrs. Baker says that Alice is her youngest child if Bill is not her youngest child, and that Alice is not her youngest child if Carl is not her youngest child. Write down a knowledge base that describes this riddle and the necessary background knowledge that only one of the three children can be her youngest child. Show with resolution that Bill is her youngest child.

2) Consider the following popular puzzle. A boy and a girl are talking. "I am a boy" said the child with black hair. "I am a girl" said the child with white hair. At least one of them is lying. Write down a knowledge base that describes this riddle. Show with resolution that both of them are lying.

First Order Logic

3) Translate the following English sentences to first-order logic using the following predicates: Owns(x, y), Dog(x), Cat(x), Cute(x), and Scary(x). For example, Owns(x, y) means that object x owns object y:

(a) Joe has a cute dog.

(b) All of Joe's dogs are cute.

(c) Unless Joe owns a dog, he is scary.

(d) Either Joe has at least one cat and at least one dog or he is scary (but not both at the same time).

(e) Not all dogs are both scary and cute.

4) Translate the following sentences in first-order logic to English. Apple(x) means that object x is an apple, Red(x) means that object s is red, Loves(x, y) means that person x loves person y:

(a) $\forall x$ (Apple$(x) \Rightarrow$Red(x))

(b) $\forall x \; \exists y$ Loves(x, y)

(c) $\exists y \; \forall x$ Loves(x, y)

5) Specify what a grandmother is, using the predicates IsGrandMotherOf, IsMotherOf and IsFatherOf. IsGrandMotherOf(x, y) means that person x is the grandmother of person y, IsMotherOf(x, y) means that person x is the mother of person y, and IsFatherOf(x, y) means that person x is the father of person y. Define additional predicates if needed.