Artificial Intelligence: Homework #3

Assigned on 4/13/2021 (Tuesday); Due at 12:00 am on 4/23/2021 (Friday)

1. Which of the following are valid (necessarily true) sentences?
   (a) $(\exists x\ x=x) \Rightarrow (\forall y\ \exists z\ y=z)$.
   (b) $\forall x\ P(x) \vee \neg P(x)$.
   (c) $\forall x\ Smart(x) \vee (x=x)$.
2. Arithmetic assertions can be written in first-order logic with the predicate symbol < , the function symbols + and ×, and the constant symbols 0 and 1. Additional predicates canalso be defined with biconditionals.
   (a) Represent the property "x is an even number."
   (b) Represent the property "x is prime."
   (c) Goldbach's conjecture is the conjecture (unproven as yet) that every even number is equal to the sum of two primes. Represent this conjecture as a logical sentence.
3. Write down logical representations for the following sentences, suitable for use withGeneralized Modus Ponens:
   (a) Horses, cows, and pigs are mammals.
   (b) An offspring of a horse is a horse.
   (c) Bluebeard is a horse.
   (d) Bluebeard is Charlie's parent.
   (e) Offspring and parent are inverse relations.
   (f) Every mammal has a parent.
4. Consider how to translate a set of action schemas into the successor-state axioms of situation calculus. (10.15)
   (a) I Consider the schema for *Fly(p,from,to)*. Write a logical definition for the predicate *Poss(Fly(p,from,to),s)*, which is true if the preconditions for *Fly(p,from,to)* are satisfied in situations.
   (b) Next, assuming that *Fly(p,from,to)* is the only action schema available to the agent, write down a successor-state axiom for *At(p, x, s)* that captures the same information as the action schema.
5. For each pair of atomic sentences, give the most general unifier if it exists:
   (a) *P(A, B, B),P(x, y, z).*
   (b) *Q(y, G(A, B)),Q(G(x, x),y).*
   (c) *Older(Father(y),y),Older(Father(x),John).*
   (d) *Knows(Father(y),y),Knows(x, x).*