CIS 32 Homework 3

1. (The next two questions refer to the animals rule base given at the end of this assignment.)

   Given the following facts

   animal gives milk
   animal chews cud
   animal has black stripes

   use forward chaining to find out what animal is implied.
   Note that I don’t just want the answer, what I want is for you to give me all the facts that forward chaining infers.
   (10 points)

2. Given the following facts

   animal can fly
   animal lays eggs
   animal is good flyer

   use backward chaining to see if you can prove that the animal is

   (a) An ostrich
   (b) An albatross

   Note that I don’t just want the answer, what I want is for you to show the proof process that backward chaining goes through.
   (20 points)

3. What sets of facts would suffice to establish that an animal was an ostrich?
   (10 points)

4. Determine, for each of the following propositional logic formulae, whether it is:

   • a tautology;
• consistent;
• inconsistent.

(a) \( p \lor \neg p \)
(b) \( (p \Rightarrow q) \Rightarrow ((p \Rightarrow r) \Rightarrow (p \Rightarrow r)) \)
(c) \( p \lor q \lor \neg r \)
(d) \( (p \land q) \Rightarrow r \)
(e) \( p \Rightarrow (q \Rightarrow p) \)

(20 points)

5. Identify the propositions in each of the following examples, and rewrite them as propositional logic formulae. Draw up truth tables for each of the examples.

(a) If the reactor is on, then the warning system should be on.
(b) If the temperature is high, and the reactor is on, then the red light should be on, and the green light should be off.
(c) If the temperature is low, and the reactor is on, then the green light should be on and the red light should be off.

(15 points)

6. Use the truth table method to decide whether the following statements are true:

(a) \( (p \Rightarrow q) \models ((p \Rightarrow r) \Rightarrow (p \Rightarrow r)) \)
(b) \( (p \land q) \models \neg (p \lor q) \)
(c) \( (p \leftrightarrow q) \models (p \Rightarrow q) \)

(25 points)
The Animals Rule Base

R1: IF animal has hair
    THEN animal is a mammal

R2: IF animal gives milk
    THEN animal is mammal

R3: IF animal has feathers
    THEN animal is a bird

R4: IF animal can fly
    AND animal lays eggs
    THEN animal is bird

R5: IF animal eats meat
    THEN animal is carnivore

R6: IF animal has pointed teeth
    AND animal has claws
    THEN animal is carnivore

R7: IF animal is mammal
    AND animal has hoofs
    THEN animal is ungulate

R8: IF animal is mammal
    AND animal chews cud
    THEN animal is ungulate

R9: IF animal is mammal
    AND animal is carnivore
    AND animal has tawney colour
    AND animal has dark spots
    THEN animal is cheetah

R10: IF animal is mammal
    AND animal is carnivore
    AND animal has tawney colour
    AND animal has black stripes
THEN animal is tiger

R11: IF animal is ungulate
    AND animal has long legs
    AND animal has dark spots
THEN animal is giraffe

R12: IF animal is ungulate
    AND animal has black stripes
THEN animal is zebra

R14: IF animal is bird
    AND animal does not fly
    AND animal has long legs
    AND animal has long neck
THEN animal is ostrich

R14: IF animal is bird
    AND animal does not fly
    AND animal can swim
    AND animal is black and white
THEN animal is penguin

R15: IF animal is bird
    AND animal is good flyer
THEN animal is albatross