CIS 716 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 has feathers
   animal has long legs
   animal has vestigial wings
   ```

   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 gives milk
   animal chews cud
   animal has black stripes
   ```

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

   (a) A zebra
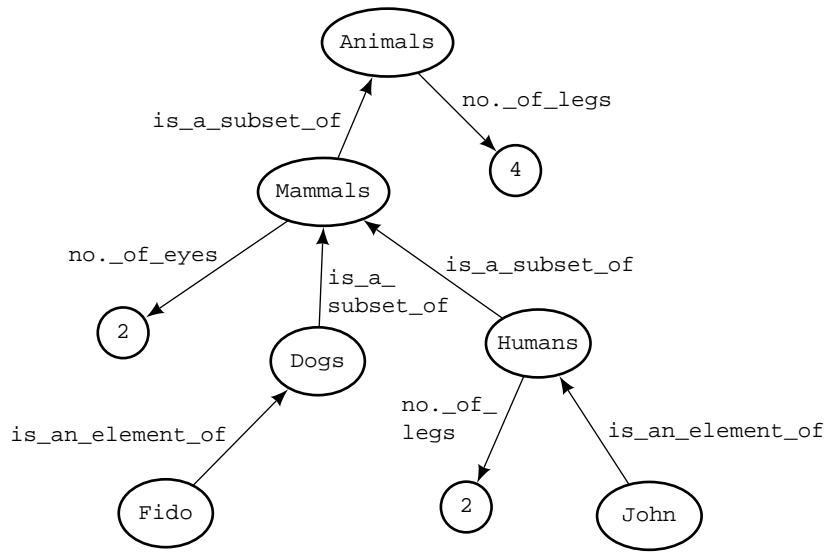
   (b) A giraffe

   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 a buffalo?

   (10 points)

4. Consider the following semantic network:

(a) Write down every fact that you can infer about Fido.

(b) How many legs and how many eyes does John have? Why?

When answering these questions be sure to give answers based upon the knowledge in the semantic network.

(20 points)

5. Using the following propositions:

p	Its is raining
q	I have an umbrella
r	I get wet

Formulate the following expressions in words:

(a) $(p \wedge q)$

(b) $(p \wedge \neg q) \wedge r$

(c) $p \wedge (q \vee r)$

(d) $\neg p \vee r$

(e) $\neg(p \lor r)$

(20 points)

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

   - a tautology;
   - consistent;
   - inconsistent.

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

(20 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 is a bird
      AND animal eats meat
      AND animal has claws
      THEN animal is raptor

R5:   IF animal eats meat
      THEN animal is a carnivore

R6:   IF animal is a bird
      THEN animal lays eggs

R7:   IF animal is a bird
      AND animal has vestigial wings
      THEN animal cannot fly

R8:   IF animal has pointed teeth
      AND animal has claws
      THEN animal is carnivore

R9:   IF animal is mammal
      AND animal has hoofs
      THEN animal is ungulate

R10:  IF animal is mammal
      AND animal chews cud
      THEN animal is ungulate

R11:  IF animal is mammal
      AND animal is carnivore
```

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        AND animal has tawney colour
        AND animal has dark spots
        THEN animal is cheetah

R12:  IF animal is mammal
        AND animal is carnivore
        AND animal has tawney colour
        AND animal has black stripes
        THEN animal is tiger

R13:  IF animal is ungulate
        AND animal has long legs
        AND animal has dark spots
        THEN animal is giraffe

R14:  IF animal is ungulate
        AND animal has black stripes
        THEN animal is zebra

R15:  IF animal is ungulate
        AND animal has a hump
        THEN animal is buffalo

R16:  IF animal is bird
        AND animal does not fly
        AND animal has long legs
        AND animal has long neck
        THEN animal is ostrich

R17:  IF animal is bird
        AND animal does not fly
        AND animal can swim
        AND animal is black and white
        THEN animal is penguin

R18:  IF animal is bird
        AND animal is good flyer
        THEN animal is albatross
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