CS 560: Homework 7

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Question 1

KB
$\neg mortal \vee \neg mythical$ (1)
$mortal \vee mythical$ (2)
$mammal \vee mythical$ (3)
$horned \vee mortal$ (4)
$horned \vee \neg mammal$ (5)
$magical \vee \neg horned$ (6)

Proof
$yes \vee \neg horned$ (7)
    Use (4)
$yes \vee mortal$ (8)
    Use (1)
$yes \vee \neg mythical$ (9)
    Use (3)
$yes \vee mammal$ (10)
    Use (5)
$yes \vee horned$ (11)
    Use(7)
yes

Question 2

(∀X∀Y p(X,Z)→q(X, Y)∨r(Y, Z))

(¬∃Y (∀X¬p(X, Z))→¬q(X, Y)∧r(Y, Z))

Question 3

George is a male butcher.
$male(george) \wedge butcher(george)$

Everybody likes George.
$\forall X \; likes(X, george)$

Everybody is a butcher.
$\forall X\ butcher(X)$

Nobody is a butcher.
$\forall X\ \neg butcher(X)$

There is a male butcher.
$\exists X\ male(X) \wedge butcher(X)$

No man is a butcher.
$\forall X\ \neg(male(X) \wedge butcher(X))$
$\forall X\ \neg male(X) \vee \neg butcher(X)$

Question 4

Part a:
$\neg(\exists X\ (boy(X)))$
$\exists X\ \neg boy(X)$
$\neg boy(f(X))$

Part b:
$\exists X\ (\neg(\exists Y\ (likes(X, Y))))$
$\exists X\ \exists Y\ \neg likes(X, Y))$
$\neg likes(f(X), g(Y)))$

Part c:
$\forall X\ (\neg(\forall Y\ (likes(X, Y) \longleftarrow mother(X, Y))))$
$\forall X\ (\neg(\forall Y\ (likes(X, Y) \vee \neg mother(X, Y))))$
$\forall X\ ((\forall Y\ \neg likes(X, Y) \wedge mother(X, Y))))$
$\neg likes(X, Y) \wedge mother(X, Y)$

Question 5

- $hunting$
- $robbing$

Question 6

- $robbing$
- $hunting \wedge banking$

Question 7

$$
\begin{aligned}
H = \{ \\
&\neg f(X) \longleftarrow c(X) \\
&f(X) \longleftarrow q(X) \\
\}
\end{aligned}
$$

$$
\begin{aligned}
F = \{ \\
& c(X) \longleftarrow q(X) \\
& q(r) \\
\}
\end{aligned}
$$

Question 8

- Robert is a francophone:
  $f(X) \longleftarrow q(X)$

- Robert is not a francophone:
  $\neg f(X) \longleftarrow c(X)$

Question 9

$$
\begin{aligned}
H = \{ \\
& f(X) \longleftarrow q(X) \\
\}
\end{aligned}
$$

$$
\begin{aligned}
F = \{ \\
& c(X) \longleftarrow q(X) \\
& q(r) \\
\}
\end{aligned}
$$

Question 10

```
step2(not(not(X)),NewX) :-
        !,
        step2(X,NewX).

step2(not(or(X,Y)),and(NewX,NewY)) :-
        !,
        step2(not(X),NewX),
        step2(not(Y),NewY).

step2(not(and(X,Y)),or(NewX,NewY)) :-
        !,
        step2(not(X),NewX),
        step2(not(Y),NewY).

step2(not(X),not(NewX)) :-
        !,
        step2(X,NewX).

step2(or(X,Y),or(NewX,NewY)) :-
        !,
        step2(X,NewX),
        step2(Y,NewY).

step2(and(X,Y),and(NewX,NewY)) :-
        !,
        step2(X,NewX),
        step2(Y,NewY).

step2(X,X).



test2 :-
        findall(X,step2(or(d,not(e)),X),L1),
        write(L1),nl,
        findall(X,step2(or(d,not(not(e))),X),L2),
        write(L2),nl,
        findall(X,step2(or(d,not(or(e,not(f)))),X),L3),
        write(L3),nl,
        findall(X,step2(or(or(a,not(b)),not(or(e,not(f)))),X),L4),
        write(L4),nl,
        findall(X,step2(and(a,or(b,or(c,not(or(d,not(e)))))),X),L
5),
        write(L5),nl.

/**
RESULTS:
```

```
?- test2.
[or(d,not(e))]
[or(d,e)]
[or(d,and(not(e),f))]
[or(or(a,not(b)),and(not(e),f))]
[and(a,or(b,or(c,and(not(d),e))))]
true.
**/
```