CS579 Computational Linguistics

Homework #4

Problem 1: **Solve Exercise 4.2.1**

Exercise 4.2.1 Give tableau proofs of the following formulas:

1. $\neg\neg p \rightarrow p$
2. $((p \rightarrow q) \rightarrow p) \rightarrow p$
3. $(\neg p \rightarrow \neg q) \rightarrow (q \rightarrow p)$
4. $p \rightarrow (p \wedge (q \vee p))$
5. $(p \vee (q \wedge r)) \rightarrow ((p \vee q) \wedge (p \vee r))$.

※ See PDF page 115 of 1999 version of black book

Problem 2; **Solve Exercise 4.4.5**

Exercise 4.4.5 Give resolution proofs of the following formulas (recall that you were asked to convert the negations of these formulas into CNF in Exercise 4.4.1):

1. $\neg\neg p \rightarrow p$
2. $((p \rightarrow q) \rightarrow p) \rightarrow p$
3. $(\neg p \rightarrow \neg q) \rightarrow (q \rightarrow p)$
4. $p \rightarrow (p \wedge (q \vee p))$
5. $(p \vee (q \wedge r)) \rightarrow ((p \vee q) \wedge (p \vee r))$.

Compare these proofs with the tableau proofs requested in Exercise 4.2.1.

Problem 3: **Solve Exercise 5.6.3**

Exercise 5.6.2 Test the `nonRedundantFactors/2` predicate. For example, test it on a list containing the single clause:

```
[[a(m),a(Y),b(n,X),b(Y,Z),not(c(W)),not(c(f(Z)))]].
```

Explain the result you get. Then try the next exercise.

Exercise 5.6.3 If you have tried the previous exercise, you will have noticed that `nonRedundantFactors/2` over-generates new clauses. This is no surprise given its definition! Here is a suggestion to improve it by including a call to a predicate that discards clauses that are *subsumed* by others. (A clause C_1 subsumes a clause C_2 if and only if there is a substitution σ such that $C_1\sigma = C_2$. We say that C_2 is subsumed by C_1.)

```
nonRedundantFactors([],[]).

nonRedundantFactors([C1|L1],L5):-
   findall(C2,nonRedFact(C1,C2),L3),
   nonRedundantFactors(L1,L2),
   appendLists(L3,L2,L4),
   subsume(L4,L5).
```

Implement a subsumption check by giving a definition for `subsume/2`. Ensure you use unification with the occurs check.

※ See foResolution.pl in BB1 folder