Universität des Saarlandes
Fachrichtung 6.2 – Informatik
J. Siekmann, S. Autexier
C. Benzmüller, C. Brown, C. Hahn

6th Theoretical Assignment in Artificial Intelligence (SS 2005)

Issued: June, 6 2005 Due: June, 13 2005

Exercise 6.1: **40 P**

In Russel/Norvig (pages 298-300) a resolution proof for the query *Did Curiosity kill the cat?* is given. In the following, the clauses are given in a slightly different manner.

1. (a) $Dog(D)$
   (b) $Own(Jack, D)$
2. $\neg Dog(y) \vee \neg Own(x, y) \vee AnimalLover(x)$
3. $\neg AnimalLover(x) \vee \neg Animal(y) \vee \neg Kills(x, y)$
4. $Kills(Jack, Tuna) \vee Kills(Curiosity, Tuna)$
5. $Cat(Tuna)$
6. $\neg Cat(x) \vee Animal(x)$
7. $\neg Cat(x) \vee \neg Kills(Curiosity, x)$

For both resolution strategies below, give a resolution proof.

- Unit preference strategy (20 P)
- Set of support strategy (Choose the clause 7 as Set of Support) (20 P)

Exercise 6.2: **30 P**

In this exercise, we are concerned with the encoding of rules in a production system. The domain we chose are horses and variants. For these we can define the following, although very simplified, circumstances:

> *If a car is faster than a Porsche then it is a sportscar. It is also a sportscar if it is faster than another sportscar. If X is faster than Y and Y is faster than Z, then X is faster than Z. Furthermore, a car that is faster than a Porsche and a Ferrari is a Formula-1-car.*

(a) List predicates that are required to encode the above facts (e.g., $Faster(X, Y)$) (10 P)

(b) Encode the above facts as production rules. (20 P)

Exercise 6.3: **15 P**

In this exercise we prepare the construction of a RETE-network. To this end we must identify subformulas that occur frequently in the preconditions of the production rules. Then we introduce new predicates to abbreviate these subformulas. For instance, if $H(X) \wedge P(X, Y)$ is a subformula that occurs in different production rules, then we define a predicate $B(X, Y)$ by setting $B(X, Y) := H(X) \wedge P(X, Y)$.

(a) There is a multiply occurring subformula of the production rules from the previous exercise. Identify this subformula. (5 P)

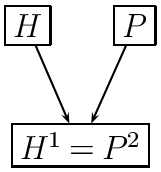
(b) Introduce a new predicate for the identified subformula and reformulate the production rules using this new predicate. (10 P)

In the next exercise we will see that using this predicate simplifies the construction of a RETE network.

Exercise 6.4: **15 P**

Construct a RETE-network using the simplified production rules you obtained in the previous exercise. Note that in a RETE-network only predicates occur, but no literals. To represent a subformula $H(X) \wedge P(Y, X)$, where the variable X occurs in two different literals, we use a notation which expresses that the respective arguments of H and P must be equal. For instance we represent the above formula by $H^1 = P^2$. Assume, the literals $H(X)$ and $P(Y, Z)$ are already represented as nodes in the network:

Then the node for the formula $H(X) \wedge P(Y, X)$ is represented by



Construct a RETE-network using that notation for the production rules you obtained in the previous exercise.