4CCS1ELA - Elementary Logic with Applications Programming with Logic II:

Predicate Definite Clause Programming

Tutorial List 7

Question 1:

Which of the following expressions are in prenex normal form?

1) $\forall x\, P(x) \vee \forall x\, Q(x)$
2) $\forall x \forall y\, \neg(P(x) \rightarrow Q(y))$
3) $\forall x \exists y\, R(x, y)$
4) $R(x, y)$
5) $\neg \forall x\, R(x, y)$
6) loves(mary, john)

Question 2:

Transform the following formulas to prenex normal form (PNF), following the four-step procedure described in the slides, and showing which transformation rules you have used.

For each PNF formula obtained, transform the matrix into conjunctive normal form. Then state whether the clauses can be represented as definite rules (not all of them can!).

1) $\forall x\, P(x) \rightarrow \exists x\, Q(x)$
2) $\exists x\, P(x) \rightarrow \forall x\, Q(x)$
3) $(\forall y\, H(y) \rightarrow \exists z\, W(z, y)) \rightarrow \exists z\, G(z)$
4) $\forall x\, (P(x) \rightarrow (F(x) \wedge G(x)))$

Question 3:

Consider the statement:

'If any train is late, all trains are late.'

a) Convert the statement into a first order formula, using the predicates T to mean '*is train*' and L to mean '*is late*'.

b) Transform the formula into PNF.

c) Represent the PNF as definite rules.