4CCS1ELA - Elementary Logic with Applications
Programming with Logic III:
Predicate Logic Programming

Tutorial List 8

Question 1:

Let *?P(x, y)* be a query to the following program:

Q(x, y), T(x, y) , S(y) → P (x, y)

Q(a, b)

Q(a, c)

Q(a, d)

T(a, c)

T(a, d)

S(d)

Show the derivation trees and the order in which they are generated if:

a) The left query atom is always chosen

b) The first listed matching rule/fact is chosen

c) If failure, backtrack to last choice point and choose next listed rule or matching fact

Question 2:

a) Draw a successful derivation tree for the query:

? travel_from(london, cairo) to the program

1) *direct_flight(x, y) → travel from(x, y)*
2) *direct_flight(x, z), travel_from(z, y) → travel_from(x, y)*
3) *direct_flight(london, paris)*
4) *direct_flight(paris, athens)*
5) *direct_flight(athens, cairo)*

b) Suppose the above program also included the facts:

6) *direct_train(london, paris)*
7) *direct_train(cairo, alexandria)*

How would you modify the above program so that *travel_from(x, y)* is true if one gets from *x* to *y* by a sequence of direct journeys by plane or by train?

Question 3:

Specify the following as a predicate logic program:

1) *Anne is the mother of Ted.*
2) *Bob is the father of Ted.*
3) *Bob is the father of Fred.*
4) *Anyone who is a mother of someone, is the parent of someone.*
5) *Anyone who is a father of someone, is the parent of someone.*
6) *If z is the parent of x and the parent of y, then x and y are siblings.*

Draw a successful derivation tree for the query: ? *siblings(Ted, Fred)*

Question 4:

A 'matryoshka' or 'babushka' doll is a set of wooden dolls from Russia, where smaller dolls are contained in bigger ones. Below are a photograph and a schematic picture of such dolls.

In this schematic, the dolls from outer to inner doll are: katarina -> olga -> natasha -> irina.

a) Write three facts to represent which doll is directly contained in which other doll. Use the predicate *directly_contains*.
b) Identify the base and recursive cases of the program that tell us which doll is (directly or indirectly) contained in which other doll, such that the query ? *contains(katarina,natasha)* succeeds, while ? *contains(olga, katarina)* fails.