Virtual Machines

Exercise Sheet 9

Deadline: June 19th, 2011

Exercise 1: *Introduction to Prolog*   *8 Points*

Write a Prolog program including the following predicates:

a) `odd/2` (`even/2`) where the first parameter is a list and the second one a list containing only the odd (even) elements of the first parameter, e.g. `odd([1,2,3,4,5], [1,3,5])`.

b) `last/2` where the first parameter is a list and the second one is the last element of this list, e.g. `last([1,2,3], 3)`.

c) `reverse/2` with two lists as parameters, where one is the reverse list of the other, e.g. `reverse([1,2,3], [3,2,1])`.

d) `chain/2` with two lists, where the first list includes the second one as connected chain, e.g. `chain([1,2,3,4,5,6], [2,3,4])`.

e) `remove/3` with three parameters where the third is a list just like the second one, yet with all occurrences of the first parameter removed, e.g. `remove(2, [1,2,3,2,5], [1,3,5])`.

Hint: You can write auxiliary predicates if needed.

Exercise 2: *Solving Riddles with Prolog*   *8 Points*

Once upon a time, famous Albert Einstein created the following riddle that in his opinion only 2% of the population were able to solve.

- There are five houses, each painted in a distinct color.

- In each house, there lives a person.

- Each person preferres a certain drink and cigarette flavour.

- They all have pets.

- None of the five persons lives in the same house, drinks the same drink, smokes the same cigarettes or has the same pet as one of his neighbours.

The following hints are given:

- The Brit lives in the red house.

- The Swede owns a dog.

- The Dane enjoys tea.

- The green house is located left of the adjacent white house.

- The owner of the green house drinks coffee.

- The person that smokes Pall Mall owns a bird.

- The man who lives in the middle house drinks milk.

- The owner of the yellow house smokes Dunhill.

- The Norwegian lives in the first house.

- The one who smokes Marlboro lives next to the person that owns a cat.

- The man who has a horse lives next to the person that smokes Dunhill.

- The man who smokes Winfield likes beer.

- The Norwegian lives next to the blue house.

- The German smokes Rothmanns.

- The man who smokes Marlboro has a neighbour who drinks water.

Finally, the ultimate question is, **who owns the fish**?

a) Write a Prolog program that solves the above riddle.
   Hint: In order to be able to perform relative comparisons between the houses' positions, you could introduce absolute positions (represented by integers). Also, the order of the constraints you are going to write has a great influence on execution speed. However, optimization is not mandatory.

b) Now, who owns the fish?

Exercise 3: *WiM Code Generation*   *4 Points*

Produce $code_A/code_G$ for the following terms/goals:

a) $f(X, g(b, Y), g(\bar{X}, \bar{Z}))$

b) $p(f(g(X, h(\bar{Y}, \_), b), Z))$

Use the address environment $\rho = \{X \mapsto 1, Y \mapsto 2, Z \mapsto 3\}$.