CS_125 Logic Programming
Coursework Assignment 1

Due date: Friday, 20 February 2004

Solutions are to be submitted in pairs.

Question 1.  (a) Write a Prolog program that defines a predicate parent/2 for the following family relationships: Mary is parent of Amanda; Amanda is parent of Chetan, Anne and Edward; Claire is parent of William and Harry; Anne is parent of Peter and Zara; Ron is parent of Chetan and Edward; Chetan is parent of William and Harry; Mark is parent of Peter and Harry.

(b) Define the following predicates:

females/1  defines the list of all female members of the family.
males/1  defines the list of all male members of the family.
family/1  defines the list of all members of the family.
female/1  where female(X) should hold iff X is a female member of the family.

Similarly, male/1.

mother/2  where mother(X,Y) should hold iff X is the mother of Y.

Similarly, grandmother/2, sibling/2, brother/2, aunt/2, ancestor/2.

Hints: Make sure that nobody is sibling (brother, aunt) of her/himself. Define the predicate ancestor recursively, similarly to the predicate connection of the program FLIGHTS.

(c) Ask Prolog queries that correspond to the following questions:

Who is William’s mother?
Who is William’s grandmother?
Who is brother of Zara?
Who is aunt of Harry?
Who has Mary as ancestor?

[30 marks]

p.t.o.
Question 2.  (a) Define the meaning of the digits 0, . . . , 9 by facts

\[
\text{means}(0, \text{zero}).
\]
\[
\text{means}(1, \text{one}).
\]

and so on.

(b) Define a predicate \text{trans}/2 that translates a list of digits into the corresponding list of meanings. For example, the query

?— \text{trans}([2,0,0,4], \text{Meanings}).

should yield the answer \text{Meanings} = [\text{two}, \text{zero}, \text{zero}, \text{four}].

Hint: Use recursion on lists.

(c) Test the predicate \text{trans} by translating your student number, written as a list of digits, into the corresponding list of meanings.  

[30 marks]

Question 3.  A puzzle: Three lists, each containing three letters,

\[
\text{L1} = [A, B, C]
\]
\[
\text{L2} = [D, E, F]
\]
\[
\text{L3} = [G, H, I]
\]

are to be found such that in the corresponding square of letters all rows, all columns, and also the diagonal, [A,E,I], correspond to words in the following dictionary:

aid, ale, ant, ape, ara arm, art, bat, bea, bee boa, but, dad, day, dry ear, eat, eel, egg, end eta, gem, get, got, hen ian, may, met, oat, old our, owe, pad, pie, pig pin, poe, pre, pro, ran rig, row, sam, say, sea see, set, ted, the, try

(a) Write a Prolog program that solves the puzzle. How many solutions do exist?

(b) Write a Prolog program that finds exactly those solutions of the puzzle where the letters B and D are different. What are these solutions?

[40 marks]