

Consider the following family tree:

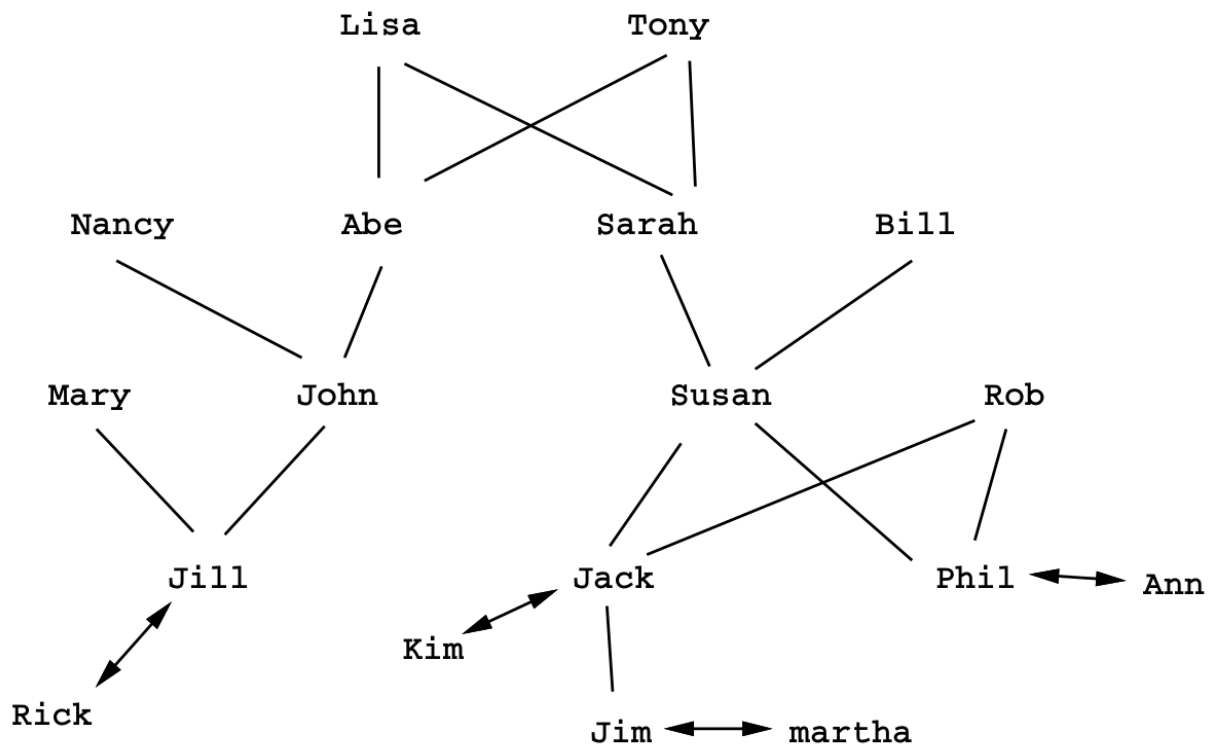


Figure 1: Family Tree

1. Transcribe the above diagram into father and mother relationships as Prolog facts. Also add facts describing gender (i.e., add facts that encapsulate gender information, e.g., male(abe).)
2. Define rules for the following relationships:
 - (a) fcousin(X,Y): X and Y are first cousins
 - (b) scousin(X,Y): X and Y are second cousins
 - (c) grnephew(X,Y): X is a great nephew of Y.
 - (d) niece(X,Y): X is a niece of Y.
 - (e) manc(X,Y): X is a male ancestor of Y.
3. Define a rule for checking if X and Y are "cousins of the same generation," i.e., X and Y are descendents of a common person and both are same no. of links down from the common ancestor.
4. Suppose the double arrows depict the relationship "married." Two individuals are also married if they have a common offspring. Rewrite the rules grnephew and niece taking into account relationships by marriage also.
5. Draw the search tree that Prolog will create for the query manc(bill, jim) using your definition above.

6. Implement the programs discussed in class for plus, times, and greaterthan using the successor representation of natural numbers.
7. Use the definition of plus and times to implement the factorial function. Will the factorial function work in the opposite direction?
8. Write a program for computing the quotient and remainder of two numbers (use the successor representation of numbers).
9. Write a logic program to define the relation $\text{fib}(N,F)$ to determine the Nth Fibonacci number (use the successor representation of numbers).

Note: All problems have to be programmed in Prolog.