Programming Paradigms Exercise 2 - Prolog 1

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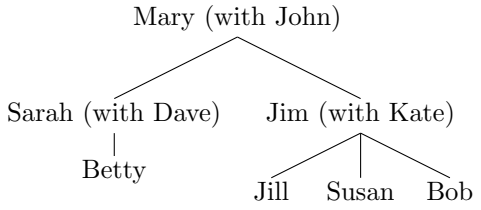
1. Consider the following family tree:



   (a) Encode the family tree as a Prolog knowledge base, making use of a binary predicate `parent` and two unary predicates `male` and `female`.

   (b) Write a predicate `sister(X,Y)` that is true if `X` is a sister of `Y`. Hint: what is the definition of (half-)sister?

   (c) How can I query the knowledge base to:

      i. Test whether `Susan` is sister of `Bob`?

      ii. Obtain the sisters of `Susan`?

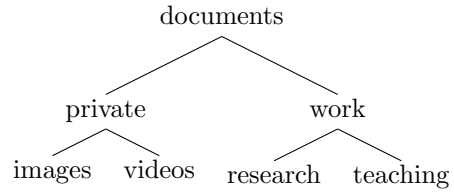
      iii. Obtain the persons having `Susan` as sister?

   (d) Run the query `sister(A,B).` What does this query return? Then fetch more answers. Can you explain why the pairs of persons appearing in the answer are returned in this particular order?

   (e) write a predicate `grandfather(X,Y)` that is true if `X` is a grandfather of `Y`.

   (f) write a predicate `aunt(X,Y)` that is true if `X` is an aunt of `Y`.

2. (a) Write a knowledge base representing the following directory tree:



   (b) Add a clause that can be used to retrieve all descendant nodes of a node.

3. Write a Prolog program to compute the Fibonacci series $(1, 1, 2, 3, 5, 8 \ldots)$. For example, to compute the 10th Fibonacci number the query must be as follows:

```
?- fibonacci(10,X).
```

4. (a) Create a basic Prolog knowledge base (consisting of facts) describing relationships on Twitter:

   - Anne follows Fred
   - Fred follows Anne, Julie and Susan
   - John follows Fred
   - Julie follows Fred
   - Susan follows John and Julie

   Add some for facts describing that the persons above tweeted the following messages:

   - Anne tweeted tweet1 and tweet5
   - Fred tweeted tweet2, tweet7, and tweet8
   - John tweeted tweet3, and tweet4
   - Julie tweeted tweet6
   - Susan tweeted tweet9 and tweet10

   (b) Write the rules required in order to answer the following questions:

   i. Assuming that only direct followers will see a tweet, which tweets can Fred see?
   ii. Find all the persons who are friends, i.e., they follow each other.
   iii. Output for each person which tweets they can see.
   iv. Assuming that Julie can see all the tweets of her friends and all the tweets of her friends' friends, which tweets can Julie see (exclude her own tweets)?