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Project 4: Prolog

Abstract

I created a knowledge base of facts and rules about genealogy. I chose to make a family tree of the Simpsons with my own silly spin: Fred Flintstone and Wilma Flintstone are the parents of Homer Simpson and Conan O'Brien is Homer's brother.

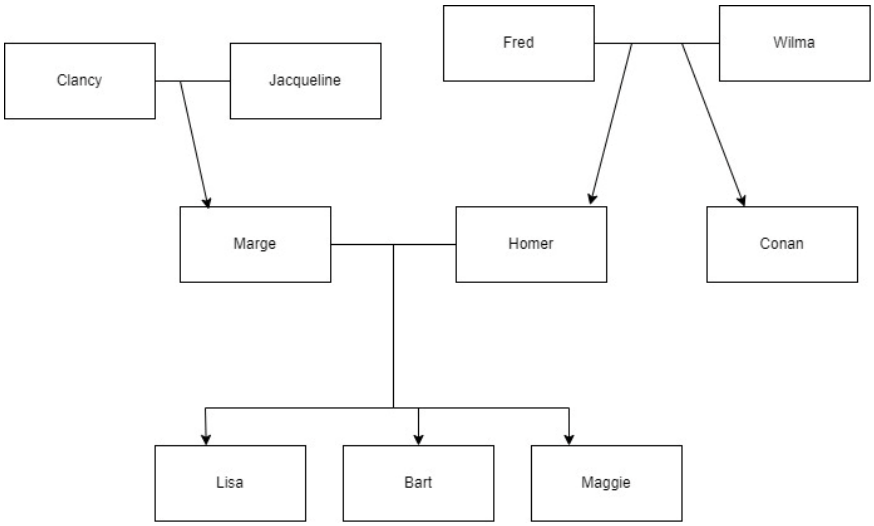

Figure 1: Family Tree

General Syntax of My Knowledge Base

The general syntax of my knowledge base works as follows:

```
child(X,Y) :- parent(Y,X).
```

Figure 2: Example of a rule in the knowledge base

For the rule in Figure 2, Y is the parent of X implies that X is the child of Y. If X = Leia and Y = Queen Amidala, then we would read child(X,Y) as: "Leia is the child of Queen Amidala".

The rest of the rules defined in the knowledge base were written to follow this general form. Figure 3 shows the related(X,Y) rule which defines related as X being a sibling, uncle, aunt, descendent, or ancestor of Y.

```
related(X,Y) :- sibling(X,Y); uncle(X,Y); aunt(X,Y); descendent(X,Y); ancestor(X,Y).
```

Figure 3: Another example of a rule in the knowledge base

Results

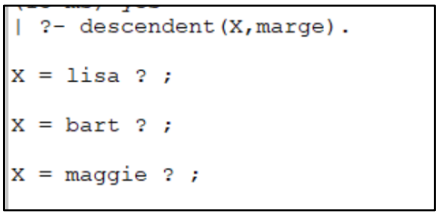

Figure 4: Query that asks who are the descendants of Marge?

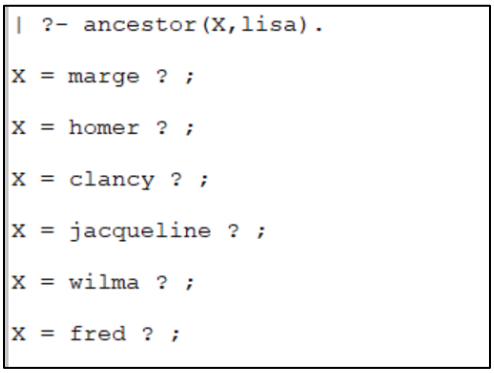

Figure 5: Query that asks who are the ancestors of Lisa?

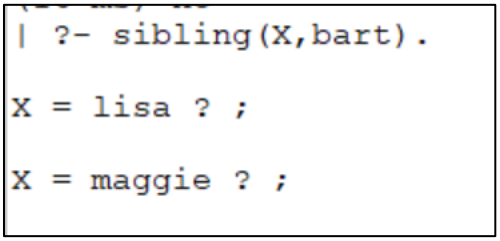

Figure 6: Query that asks who are the siblings of Bart?

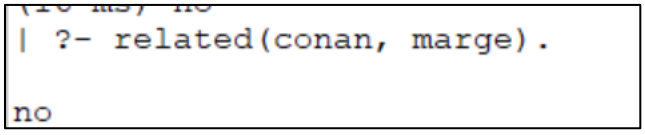

Figure 7: Query that asks if Conan is related to Marge?

Discussion

It was easy to formulate queries to identify descendants, ancestors, parents, and siblings. It could still use some additional rules to help make the knowledge base more thorough and better at identifying if two people are related. More genealogy terms could be added in the future (i.e., cousins, half-siblings, etc.) to improve the capabilities of knowledge base.

Strengths:

The strength of my knowledge base is that the rules already defined have worked successfully when I've thoroughly tested them.

I think it is fairly easy to add new rules, because I started to notice patterns after writing the mother and father rules and it was simple to follow the pattern when I added rules for grandma, grandpa, aunt, and uncle.

Weaknesses:

My knowledge base can't answer the following questions: is Bart the brother of Lisa? Does marge have any cousins? Is Fred Lisa's paternal or maternal grandpa?

There were some rules I wanted to add but were tricky to figure out. I didn't figure out how to add in rules to define birth order for the siblings. I also wanted to add a rule to define half-siblings in my knowledge base but unfortunately didn't get to it.

Appendix – The Full Knowledge Base

```
/* mother */
mother(X,Y) :-
female(X),
parent(X,Y).

/* father */
father(X,Y) :-
male(X),
parent(X,Y).

/* child */
child(X,Y) :- parent(Y,X).

/* full siblings */
sibling(X,Y) :-
mother(Z,X),
mother(Z,Y),
father(W,X),
father(W,Y),
X\=Y.

/* brother */
brother(X,Y) :-
male(X),
sibling(Y,X).
```

```
/* sister */
sister(X,Y) :-
female(X),
sibling(Y,X).

/* uncle */
uncle(X,Y) :-
male(X),
parent(Z,Y),
sibling(X,Z).

/* aunt */
aunt(X,Y) :-
female(X),
parent(Z,Y),
sibling(X,Z).

/* grandma */
grandma(X,Y) :-
female(X),
parent(Z,Y),
child(Z,X).

/* grandpa */
grandpa(X,Y) :-
male(X),
parent(Z,Y),
child(Z,X).
```

```
/* related */
related(X,Y) :-
sibling(X,Y);
uncle(X,Y);
aunt(X,Y);
descendent(X,Y);
ancestor(X,Y).

/* descendent */
descendent(X,Y) :-
child(X,Y).

descendent(X,Y) :-
child(X,Z),
descendent(Z,Y).

/* ancestor */
ancestor(X,Y) :-
parent(X,Y).

ancestor(X,Y) :-
parent(X,Z),
ancestor(Z,Y).
```

```
/* Basic Facts */
male(clancy).
male(fred).
male(conan).
male(homer).
male(bart).

female(jacqueline).
female(wilma).
female(marge).
female(lisa).
female(maggie).

parent(clancy, marge).
parent(jacqueline, marge).

parent(wilma, homer).
parent(wilma, conan).

parent(fred, homer).
parent(fred, conan).

parent(marge, lisa).
parent(marge, bart).
parent(marge, maggie).

parent(homer, lisa).
parent(homer, bart).
parent(homer, maggie).
```