Prolog Family Relationship Verification Based on “I'm My Own Grandpa”

Introduction:

This project models complex family relationships described in the humorous song I'm My Own Grandpa by Dwight Latham and Moe Jaffe. The song presents a scenario where, through various marriages and familial connections, the narrator paradoxically becomes his own grandfather. Using Prolog, this project demonstrates how logical reasoning can verify such intricate relationships by defining and testing family connections through facts and rules.

Background:

The song's narrative is a perfect example of complex kinship relationships that can be represented using Prolog's logical framework. The goal is to minimize the number of hardcoded facts while maximizing the use of rules to infer relationships, thus showcasing Prolog’s efficiency in handling relational logic. This project involves defining fundamental family relationships like parent, child, spouse, and sibling, as well as extended relationships such as grandparent, uncle, and in-law, based on the song's storyline.

Implementation:

Facts-

The program defines

Two wife facts: wife(pretty\_widow, me) and wife(redhair, dad)

Four child facts: child(redhair, pretty\_widow), child(me, dad), child(onrun, redhair), and child(baby, me).

Two married facts: married(me, pretty\_widow), and married(dad, redhair).

Two female facts: female(pretty\_widow), and female(redhair).

Four male facts: me, dad, onrun, and baby

Rules-

The rules of the program are written to define under what conditions a person is a child, parent, grandparent, or related through other familial connections. Rules are constructed using logical statements, where the predicate is followed by conditions that must be satisfied for the rule to be true.

The rules are categorized into different sections:

Parents and Children, Siblings, Extended Family (Grandparents, Uncles, Aunts), In-law, Step Relationships and spouse relationship.

Each rule enables Prolog to deduce complex familial relationships logically, validating connections like grandparents, siblings, and even paradoxical roles such as being one’s own grandparent.

The main query to run during the test is:

?- runIt.

This query evaluates various family relationships based on the facts and rules defined in the program. The expected output is as follows:

Is redhair the daughter of me?: true

Is redhair the mother of me?: true

Is dad the son-in-law of me?: true

Is baby the brother of dad?: false

Is baby the uncle of me?: true

Is baby the sibling of redhair?: true

Is onrun the grandchild of me?: true

Is me the grandchild of pretty\_widow?: true

Is me my own grandpa?: true

This output confirms that the relationships are evaluated correctly according to the complex family structure described in I'm My Own Grandpa. The key conclusion from this test is that the program logically verifies even the paradoxical relationship where "me" is his own grandfather.

Testing:

The runIt query evaluates multiple key family relationships described in the song, verifying if the Prolog rules match the narrative. For instance, the query daughter(redhair, me) evaluates to true, as "redhair" is "me’s" daughter. On the other hand, son\_in\_law(dad, me) returns true, confirming that "dad" is "me’s" son-in-law due to his marriage to "redhair."

Other tests include verifying that "onrun" is "me’s" grandchild (grandchild(onrun, me): true) and that "me" is his own grandfather (grandfather(me, me): true). Each query reflects the song's complex family dynamics, with Prolog accurately modeling and verifying each relationship.

Conclusion

This project successfully demonstrates Prolog's capability to model and verify complex family relationships through logical rules and minimal facts. By simulating the relationships in I'm My Own Grandpa, the program proves the feasibility of representing even the most convoluted kinship scenarios, showcasing Prolog's strength in logical reasoning and deduction.