Family Tree Specification

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Immediate family consists of

Mathew

George (father)

Susan (mother)

Varghese (brother)

Sara (sister)

Mother has 4 siblings-

Anil, Sunil, Ajin and Anju.

Anil is married to Laila. Their children are Vinay and Varsha.

Sunil is married to Binny. Their children are Naveen and Nikhil.

Ajin is married to Saju. Their children are Melissa, Jeremy and Serena.

Anju is married to Moby. Their children are Neha and Nohael.

Father has 2 siblings-

Reena and Koshy.

Koshy is married to Shirly. Their children are Robin and Ronith.

Reena is married to Shaji. Their children are Shibin, Shinu, Sheena and Shiju.

Father's parents are Fr M K Mathai (represented as frmathai) and Saramma.

Mother's parents are M G Mathews (represented as Mathewsr) and Mary.

Relations used in FOL

1. Sibling relation

$$\forall x, y \; \exists P1, P2 \; \ni \; sibling(x, y) \rightarrow parents(P1, P2, x) \cap parents(P1, P2, y)$$

2. Brother relation

$$\forall x, y \;\; brother(x, y) \rightarrow male(x) \cap sibling(x, y)$$

3. Sister relation

$$\forall x, y \;\; sister(x, y) \rightarrow female(x) \cap sibling(x, y)$$

4. Mother relation

$$\forall x, y \;\; \exists P \;\; mother(x, y) \rightarrow female(x) \cap parent(P, x, y)$$

5. Father relation

$$\forall x, y \;\; \exists P \;\; father(x, y) \rightarrow male(x) \cap parent(x, P, y)$$

6. Child relation

$$\forall x, y \;\; \exists C \;\; child(x, y) \rightarrow father(y, x) \cup mother(y, x)$$

7. Cousin relation

$$\forall x, y \;\; \exists P1, P2 \; (P1 \neq P2) \ni \; cousin(x, y) \rightarrow \big(mother(P1, x) \cap mother(P2, y) \cap sibling(P1, P2)\big)$$
$$\cup \; (mother(P1, x) \cap father(P2, y) \cap sibling(P1, P2)\;)$$
$$\cup \; (father(P1, x) \cap father(P2, y) \cap sibling(P1, P2))$$

**this relation can be simplified in FOL but written in this format to preserve direct analogy with the actual PROLOG database.*

8. Aunt relation

$$\forall x, y \;\; \exists C \;\; aunt(x, y) \rightarrow female(x) \cap cousin(C, y) \cap mother(x, C)$$

9. Uncle relation

$$\forall x, y \;\; \exists C \;\; uncle(x, y) \rightarrow male(x) \cap cousin(C, y) \cap father(x, C)$$

10. Paternal Grandparent relation

$$\forall x, y \ \exists P \ \ paternalgrandparent(x, y) \rightarrow (father(x, P) \cap father(P, y)) \cup (mother(x, P) \cap father(P, y))$$

11. Maternal Grandparent relation

$$\forall x, y \ \exists P \ \ maternalgrandparent(x, y) \rightarrow (father(x, P) \cap mother(P, y)) \cup (mother(x, P) \cap mother(P, y))$$

12. Maternal Grandfather relation

$$\forall x, y \ \ maternalgrandfather(x, y) \rightarrow male(x) \cap maternalgrandparent(x, y)$$

13. Maternal Grandmother relation

$$\forall x, y \ \ maternalgrandmother(x, y) \rightarrow female(x) \cap maternalgrandparent(x, y)$$

14. Paternal Grandfather relation

$$\forall x, y \ \ paternalgrandfather(x, y) \rightarrow male(x) \cap paternalgrandparent(x, y)$$

15. Paternal Grandmother relation

$$\forall x, y \ \ paternalgrandmother(x, y) \rightarrow female(x) \cap paternalgrandparent(x, y)$$

16. Grandchild relation

$$\forall x, y \ \exists C \ \ grandchild(x, y) \rightarrow paternalgrandparent(y, x) \cup maternalgrandparent(y, x)$$

17. Ancestor relation

$$\forall x, y \ \ ancestor(x, y) \rightarrow \neg(sibling(x, y)) \cap \neg(cousin(x, y)) \cap \neg(child(x, y)) \cap \neg(grandchild(x, y))$$

18. Descendant relation

$$\forall x, y \ \ descendant(x, y) \rightarrow ancestor(y, x)$$