

**CSE-AI TY A div**

**Student Name:** Prachee Prasad

**Roll No.:** 381060

## **Assignment 3**

### **Perform Parsing of Family Tree using Knowledge Base**

#### **Problem Statement:**

To implement a program that represents and parses a **Family Tree** using a **Knowledge Base**, enabling the inference of relationships like parent, child, sibling, and grandparent through logical rules and stored facts.

#### **Objective:**

To understand how **knowledge representation** and **rule-based reasoning** work in Artificial Intelligence by modeling human relationships using a **Knowledge Base** and applying logical inference to derive new relationships.

#### **Requirements:**

- Programming Language: **C++**
- Concepts: Knowledge Base, Rule-Based Reasoning, Tree Structure, Recursive Parsing
- Input: Predefined family relations (hardcoded)
- Output: Relationships such as parent, children, siblings, and grandparents displayed in structured form.

#### **Operating System:**

Windows / Linux / macOS

#### **Libraries and Packages Used:**

- **C++ iostream, string, and map** for relationship storage and retrieval
- No external libraries required

## Theory:

### Definition:

A **Knowledge Base** is a structured collection of facts and rules used by an inference engine to deduce new information.

In this context, it stores **family relationships** (like parent-child) and allows queries to derive indirect relationships such as siblings and grandparents.

### Structure:

- **Facts:** Represent known relationships (e.g., John is father of Mary).
- **Rules:** Define logical connections (e.g., if A is parent of B and B is parent of C, then A is grandparent of C).
- **Inference Engine:** Uses rules to derive new facts from existing ones.

## Methodology:

1. Store base relationships (facts) such as "A is parent of B."
2. Parse these relationships to build a hierarchical **family tree structure**.
3. Define rules to infer new relations:
  - If A is parent of B and B is parent of C  $\rightarrow$  A is grandparent of C.
  - If A and B share the same parent  $\rightarrow$  A and B are siblings.
4. Use recursion or search to traverse and print relationships.
5. Display the parsed family tree in a readable format.

## Advantages:

- Mimics reasoning in human-like systems.

- Allows complex relationship inference from minimal data.
- Easy to extend with new rules or members.

### Limitations:

- Requires predefined rules; cannot infer beyond what is defined.
- Scalability can become an issue for very large family trees.
- Doesn't handle uncertain or probabilistic relations.

### Working / Algorithm:

#### Algorithm Steps:

1. Initialize the knowledge base with known parent-child relationships.
2. Create a recursive function to display the family tree hierarchy.
3. Define functions for inferring relationships:
  - **getChildren(), getParents(), getSiblings(), getGrandparents()**
4. Use conditional logic to derive indirect relationships.
5. Display results in a readable structured form (tree-like format).

### Conclusion:

The **Family Tree Parsing using Knowledge Base** demonstrates how **AI systems use facts and rules** to reason about relationships logically. It serves as a foundation for more advanced expert systems, showcasing structured data representation and **logical inference mechanisms** in Artificial Intelligence.