**Assignment 1**

**Title: Perform parsing of family tree using Knowledge Base**

**Theory**

A **Knowledge Base System (KBS)** is an artificial intelligence model that stores information (facts) and applies logical rules to deduce new information (inferences). It represents knowledge in a structured form and allows reasoning similar to human thought processes.

In this assignment, a **Family Relationship Knowledge Base** is implemented. The system captures relationships such as *father*, *mother*, and *children* and uses logical reasoning to infer additional relationships like *siblings* and *grandchildren*.

Knowledge-based systems are an essential part of symbolic AI, where data and logic are used to perform inference rather than numerical computation.

**Definition**

A **Family Relationship Knowledge Base** is a logical model that defines and infers relationships among family members. It consists of:

* **Facts**: Known relationships such as who is a father or mother of whom.
* **Rules**: Logical expressions that derive new relationships (e.g., if two people share the same parents, they are siblings).
* **Inference Engine**: A mechanism that applies rules to known facts to infer new knowledge automatically.

**Explanation of Implementation**

The system is designed using basic data structures and logical rules. It follows a sequence of defining, storing, and inferring relationships.

**Step 1: Knowledge Representation**

The system maintains two sets of relationships:

* **Father–Child Relationship**
* **Mother–Child Relationship**

Each parent is linked to a list of their children.

*Example:*

John → [Alice, Bob]

Mary → [Alice, Bob]

Bob → [Charlie, Daisy]

Sara → [Charlie, Daisy]

**Step 2: Insertion of Facts**

Facts are manually entered into the knowledge base.  
*Pseudo code:*

ADD\_FATHER("John", "Alice")

ADD\_FATHER("John", "Bob")

ADD\_MOTHER("Mary", "Alice")

ADD\_MOTHER("Mary", "Bob")

ADD\_FATHER("Bob", "Charlie")

ADD\_MOTHER("Sara", "Charlie")

ADD\_FATHER("Bob", "Daisy")

ADD\_MOTHER("Sara", "Daisy")

These statements define the family structure.

**Step 3: Rules for Inference**

**Rule 1: To Find Children of a Person**

If a person appears as a parent in the knowledge base,  
all names linked to them are their children.

*Pseudo code:*

FUNCTION GET\_CHILDREN(person):

children\_list = []

IF person in FATHER\_LIST:

ADD all children to children\_list

IF person in MOTHER\_LIST:

ADD all children to children\_list

RETURN children\_list

**Rule 2: To Find Siblings of a Person**

If two or more individuals share the same parent,  
they are siblings.

*Pseudo code:*

FUNCTION GET\_SIBLINGS(name):

sibling\_list = []

FOR each parent in FATHER\_LIST and MOTHER\_LIST:

IF name exists in parent's children:

ADD all other children (excluding name) to sibling\_list

RETURN sibling\_list

**Rule 3: To Find Grandchildren of a Person**

If a person’s children have their own children,  
those become the person’s grandchildren.

*Pseudo code:*

FUNCTION GET\_GRANDCHILDREN(person):

grandchild\_list = []

child\_list = GET\_CHILDREN(person)

FOR each child in child\_list:

grandchildren = GET\_CHILDREN(child)

ADD all grandchildren to grandchild\_list

RETURN grandchild\_list

**Step 4: Query and Inference**

The system queries relationships by applying rules to stored facts.  
*Example Queries:*

GET\_CHILDREN("John")

GET\_SIBLINGS("Alice")

GET\_GRANDCHILDREN("Mary")

**Output**

**Sample Results:**

Children of John: Alice, Bob

Siblings of Alice: Bob

Grandchildren of John: Charlie, Daisy

Grandchildren of Mary: Charlie, Daisy

**Explanation:**

* John and Mary are the parents of Alice and Bob.
* Alice and Bob share the same parents, hence they are siblings.
* Bob’s children (Charlie and Daisy) become the grandchildren of John and Mary.

**Conclusion**

The **Family Relationship Knowledge Base** effectively represents and infers family relationships using logical rules.  
By defining a small set of parent–child facts, the system can automatically determine relationships such as *children*, *siblings*, and *grandchildren*.

This implementation demonstrates the foundational principle of **knowledge representation and inference** in artificial intelligence. It highlights how structured logic and simple rule-based reasoning can simulate intelligent understanding of relational data.