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**Assignment 7**

**Problem Statement:** Implementation of Forward Chaining Algorithm

**Introduction:**

The **Forward Chaining algorithm** is a fundamental **inference technique** used in Artificial Intelligence, particularly in **rule-based expert systems**. It is a **data-driven reasoning** approach where the system starts with a set of known facts and applies inference rules to extract more information until a goal or conclusion is reached. Forward chaining is widely used in systems such as medical diagnosis, intelligent assistants, and decision-making systems.

**Objective:**

The objectives of this experiment are:

* To understand the working mechanism of the **Forward Chaining inference algorithm**.
* To implement the algorithm for deriving conclusions from a given set of facts and rules.
* To demonstrate how **knowledge-based systems** can perform automated reasoning.
* To explore real-world applications of forward chaining in **AI expert systems**.

**Theory:**

Forward chaining is a **data-driven reasoning method**, meaning it starts from the available data and uses inference rules to extract new facts until a goal is reached.

**Key Concepts:**

1. **Knowledge Base:**  
   It contains a set of **facts** and **rules** in the form:  
   IF (conditions) THEN (conclusion)  
   Example:
2. IF A and B THEN C
3. IF C and D THEN E
4. **Inference Engine:**  
   The engine continuously scans the rule base to check if the **antecedents (IF part)** of any rule match the current known facts.
   * If a rule is satisfied, the **consequent (THEN part)** is added to the set of facts.
   * This process continues iteratively until the goal is reached or no more rules can be applied.
5. **Algorithm Steps:**
   1. Start with an initial set of known facts.
   2. Match these facts with rule antecedents.
   3. If all conditions of a rule are true, infer the conclusion.
   4. Add the new fact to the knowledge base.
   5. Repeat the process until the goal is derived or no new facts are produced.
6. **Example:**
   1. Facts: A, B
   2. Rules:
      * IF A and B THEN C
      * IF C THEN D
   3. Result: From A and B → infer C → infer D.

**Applications:**

* Expert systems (e.g., MYCIN for medical diagnosis)
* Knowledge-based reasoning
* Decision support systems
* Automated control systems

**Conclusion:**

The **Forward Chaining algorithm** effectively demonstrates **data-driven reasoning** by deriving conclusions from a given set of facts using inference rules. It is widely used in **expert systems** were reasoning proceeds from known information to new insights. Through this implementation, we understand how AI systems can mimic human reasoning to make logical decisions automatically.