

# FORWARD CHAINING

## Inference Engine

- Its is the component of the intelligent system in artificial intelligence which applies logical rules to the Knowledge Base to infer information from known facts.
  - The first inference engine was part of the expert system. Inference engine commonly proceeds in two modes, which are:
  - Forward chaining
  - Backward Chaining
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## Horn clause and Definite Clause

- Horn clause and definite Clause are the forms of sentences which enables knowledge base to use a more restricted and efficient inference algorithm.
- Logical inference algorithms use forward and backward chaining approaches which require KB in the form of the first-order definite clause.
- Definite clause: A clause which is a disjunction of literals with exactly one positive literal is known as definite clause or strict horn clause
- Horn clause: A clause which is a disjunction of literals with at most one positive literal is known as horn clause .Hence all definite clauses are horn clauses.
- Example(negation p  $\vee$  negation q  $\vee$  k).It has only one positive literal

# Backward Chaining

- Backward-chaining is also known as a backward deduction or backward reasoning method when using an inference engine.
- A backward chaining algorithm is a form of reasoning, which starts with the goal and works backward, chaining through rules to find known facts that support the goal.
- It is known as a top-down approach.
- Backward-chaining is based on modus ponens inference rule.
- In backward chaining, the goal is broken into sub-goal or sub-goals to prove the facts true.
- It is called a goal-driven approach, as a list of goals decides which rules are selected and used.

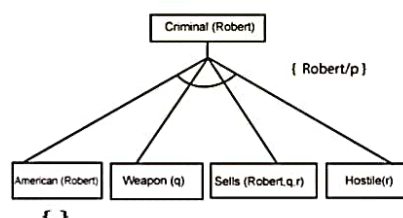
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## Backward-Chaining proof:

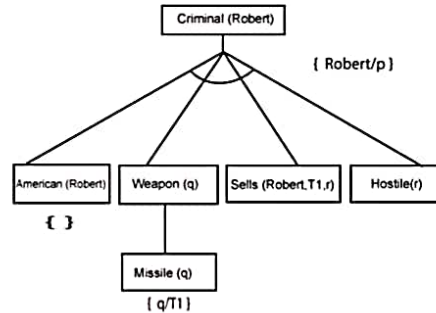
- In Backward chaining, we will start with our goal predicate, which is **Criminal(Robert)**, and then infer further rules.
- **Step-1:**
- At the first step, we will take the goal fact. And from the goal fact, we will infer other facts, and at last, we will prove those facts true. So our goal fact is "Robert is Criminal," so following is the predicate of it.

Criminal (Robert)

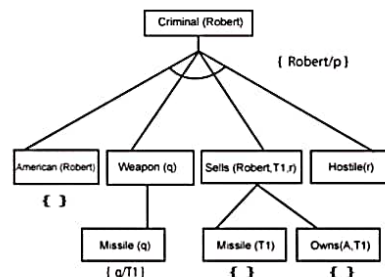
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- **Step-2:**
  - At the second step, we will infer other facts from goal fact which satisfies the rules. So as we can see in Rule-1, the goal predicate Criminal (Robert) is present with substitution {Robert/P}. So we will add all the conjunctive facts below the first level and will replace p with Robert.
  - **Here we can see American (Robert) is a fact, so it is proved here.**



- **Step-3:** At step-3, we will extract further fact Missile(q) which infer from Weapon(q), as it satisfies Rule-(5). Weapon (q) is also true with the substitution of a constant T1 at q.



- **Step-4:**
- At step-4, we can infer facts Missile(T1) and Owns(A, T1) from Sells(Robert, T1, r) which satisfies the **Rule- 4**, with the substitution of A in place of r. So these two statements are proved here.



- **Step-5:**
- At step-5, we can infer the fact **Enemy(A, America)** from **Hostile(A)** which satisfies Rule- 6. And hence all the statements are proved true using backward chaining.

