Backward Chaining Algorithm

1 Backward Chaining Process

Given a query Q, the goal is to determine if Q is entailed by the knowledge base (KB). The algorithm works by recursively trying to prove the subgoals required to infer Q.

1.1 Step 1: Query Q

Check if Q is a known fact in the KB. If it is, the query is trivially true. Otherwise, find rules that conclude Q. For example, consider:

$$\text{Clause 1:} \quad P \Rightarrow Q$$

Here, we reduce our goal to proving P, so our new subgoal becomes P.

1.2 Step 2: Subgoal P

Check if P is a known fact in the KB. If not, find rules that conclude P. Consider the rule:

$$\text{Clause 2:} \quad L \wedge M \Rightarrow P$$

Thus, the new subgoals become L and M.

1.3 Step 3: Subgoal L

Check if L is a known fact in the KB. If not, find rules that conclude L. Consider the rules:

$$\text{Clause 4:} \quad A \wedge P \Rightarrow L$$

$$\text{Clause 5:} \quad A \wedge B \Rightarrow L$$

First, try the subgoals from Clause 4: $A \wedge P$.

1.4 Step 4: Subgoal A

Check if A is a known fact. If A is true, continue.

1.5 Step 5: Subgoal P (Again)

Since P is already being evaluated, avoid entering an infinite loop by skipping this subgoal and trying the new subgoals from Clause 5: $A \wedge B$.

1.6 Step 6: Subgoal B

Check if B is a known fact. If B is true, then both subgoals for L are true. Therefore, L is true.

1.7 Step 7: Subgoal M

Check if M is a known fact in the KB. If not, find rules that conclude M. Consider the rule:

$$\text{Clause 3:} \quad B \wedge L \Rightarrow M$$

Thus, the new subgoals become B and L.

1.8 Step 8: Subgoal B

Since B is known to be true, continue.

1.9 Step 9: Subgoal L

Since L has already been established as true, M is true.

1.10 Step 10: Return to Subgoal P

Now that both L and M are true, the subgoal P is true.

1.11 Step 11: Return to Query Q

Since P is true, the original query Q is true.