

Recitation 1: Rule-Based Systems

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- **Forward Chaining**

ASSERTIONS \Rightarrow CONCLUSIONS

Below is pseudocode for a naive implementation of forward chaining.

FORWARD-CHAINING

repeat

for every rule **do**

if antecedents match assertions in the working memory **and** consequents would change the working memory **then**

 Create triggered rule instance

end if

end for

 Pick one triggered rule instance, using conflict resolution strategy if needed, and fire it (throw away other instances)

until no change in working memory, or no STOP signal

Note that this is a general implementation that applies to both deduction and production/reaction systems. Be aware that many variations are possible. For instance, in deduction systems, forward chaining *usually* fires a rule (instance) as soon as it is triggered. Note also that even in deduction systems forward chaining might use a conflict resolution strategy to decide the order in which it considers the rules for matching (in the for-loop). In class examinations, it will be made clear which implementation you should use.

- **Backward Chaining**

CONCLUSIONS (HYPOTHESES) \Rightarrow ASSERTIONS

Below is a naive implementation of backward chaining.

BACKWARD-CHAINING(H)

if H matches an assertion in working memory **then**

return true

end if

if there is no rule with a consequent that matches H **then**

 ASK USER or ASSUME **false**

end if

for every rule R with a consequent that matches H **do**

if for all antecedents A of rule R , we have BACKWARD-CHAINING(A) = **true** **then**

return true

end if

end for

return false

Note the recursive nature of backward chaining. Note also that the for-loop creates the *or-nodes* of the goal (and/or) tree, while the if-statement inside that for-loop creates the *and-nodes*.

Other more efficient implementations are possible. For instance, we might add assertion to the working memory for later reuse as we find them to be true during the backward chaining process. Also, many variants resulting from different implementation decisions are possible. For example, the system can ask the user even after all rules with a consequent that match the hypothesis fail. Another option is to use conflict resolution to decide the order in which the system will consider the rules with consequents that match the hypothesis (in the for-loop). Once again, in class examinations, it will be made clear which implementation you should use.