

Top-down Ground Proof Procedure

Idea: search backward from a query to determine if it is a logical consequence of KB .

An **answer clause** is of the form:

$$yes \leftarrow a_1 \wedge a_2 \wedge \dots \wedge a_m$$

The **SLD Resolution** of this answer clause on atom a_i with the clause:

$$a_i \leftarrow b_1 \wedge \dots \wedge b_p$$

is the answer clause

$$yes \leftarrow a_1 \wedge \dots \wedge a_{i-1} \wedge b_1 \wedge \dots \wedge b_p \wedge a_{i+1} \wedge \dots \wedge a_m.$$

Derivations

An **answer** is an answer clause with $m = 0$. That is, it is the answer clause $yes \leftarrow$.

A **derivation** of query “ $?q_1 \wedge \dots \wedge q_k$ ” from KB is a sequence of answer clauses $\gamma_0, \gamma_1, \dots, \gamma_n$ such that

- γ_0 is the answer clause $yes \leftarrow q_1 \wedge \dots \wedge q_k$,
- γ_i is obtained by resolving γ_{i-1} with a clause in KB , and
- γ_n is an answer.



Top-down definite clause interpreter

To solve the query $?q_1 \wedge \dots \wedge q_k$:

$ac := \text{“yes} \leftarrow q_1 \wedge \dots \wedge q_k\text{”}$

repeat

 select a conjunct a_i from the body of ac ;

 choose clause C from KB with a_i as head;

 replace a_i in the body of ac by the body of C

until ac is an answer.



Example: successful derivation

$$a \leftarrow b \wedge c. \quad a \leftarrow e \wedge f. \quad b \leftarrow f \wedge k.$$

$$c \leftarrow e. \quad d \leftarrow k. \quad e.$$

$$f \leftarrow j \wedge e. \quad f \leftarrow c. \quad j \leftarrow c.$$

Query: ?a

$$\gamma_0 : \text{yes} \leftarrow a \quad \gamma_4 : \text{yes} \leftarrow e$$

$$\gamma_1 : \text{yes} \leftarrow e \wedge f \quad \gamma_5 : \text{yes} \leftarrow$$

$$\gamma_2 : \text{yes} \leftarrow f$$

$$\gamma_3 : \text{yes} \leftarrow c$$



Example: failing derivation

$$a \leftarrow b \wedge c. \quad a \leftarrow e \wedge f. \quad b \leftarrow f \wedge k.$$

$$c \leftarrow e. \quad d \leftarrow k. \quad e.$$

$$f \leftarrow j \wedge e. \quad f \leftarrow c. \quad j \leftarrow c.$$

Query: ?a

$$\gamma_0 : \text{yes} \leftarrow a$$

$$\gamma_4 : \text{yes} \leftarrow e \wedge k \wedge c$$

$$\gamma_1 : \text{yes} \leftarrow b \wedge c$$

$$\gamma_5 : \text{yes} \leftarrow k \wedge c$$

$$\gamma_2 : \text{yes} \leftarrow f \wedge k \wedge c$$

$$\gamma_3 : \text{yes} \leftarrow c \wedge k \wedge c$$

