Truth Maintenance System (TMS)

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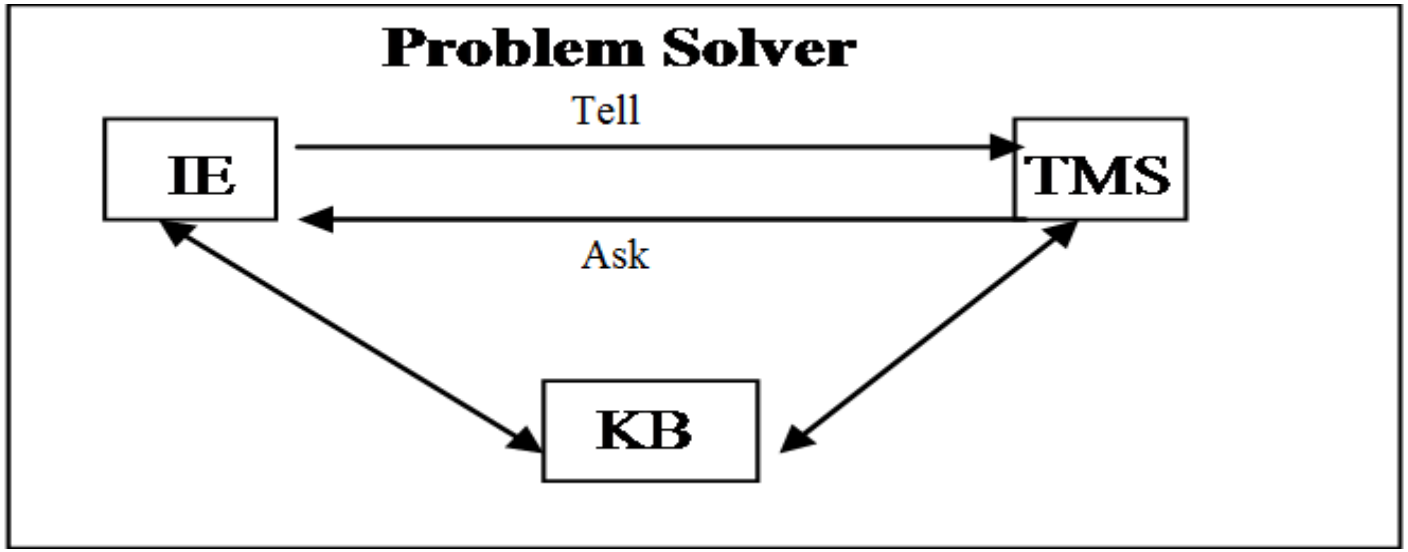
Truth Maintenance System (TMS)

- **Definition of TMS:**
- **Truth maintenance system (TMS) works with inference engines for solving problems within large search spaces.**
- **The TMS and inference engine both put together can solve problems where algorithmic solutions do not exist.**
- TMS maintains the beliefs for general problem solving systems.
- IE – Inference Engine
- KB – Knowledge Base



TMS – Cont …

- **TMS can be used to implement monotonic or non-monotonic systems.**
- **In monotonic system**, once a fact or piece of knowledge is stored in KB, it can **not change**.
  - In monotonic reasoning, the world of axioms continually increases in size and keeps on expending.
  - Predicate logic is an example of monotonic form of reasoning. It is a deductive reasoning system where new facts are derived from the known facts.
- **Non-monotonic system** allows **retraction** of truths that are present in the system whenever contradictions arise.
  - So number of axioms can both increase and decrease and depending upon the changes in KB, it can be updated.

Monotonic TMS Methods

- Using Predicate logic – Resolution.
- Natural deduction.
- Logic Programming.
- Forward and Backward reasoning.
- Matching

Monotonic TMS

Monotonic Reasoning

- Once the conclusion is taken, then it will remain same even if we add some other information to existing information in our knowledge base.
- Decision are not affected by new facts, not suitable for real time system.
- Example:

1) Earth revolves around sun
2) Earth is not Round---new information

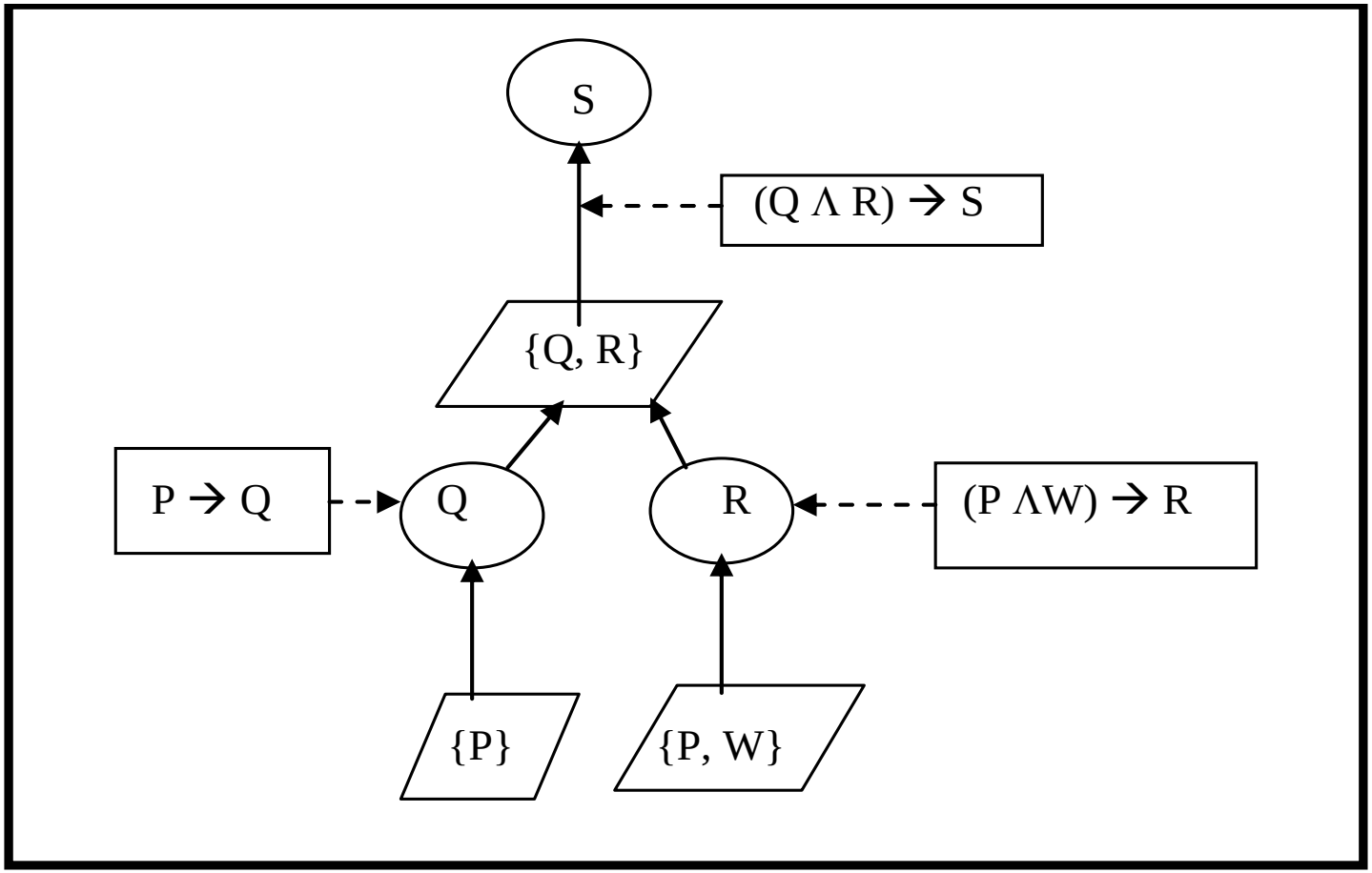
Example – Monotonic TMS

- Suppose we are given the premise set $\sum$ = {P, W} and the internal constraint set

  {P → Q, (P Λ W) → R, (Q Λ R) → S}.

- TMS are able to derive S from these constraints and the premise set $\sum$.
- TMS should provide the justifications of deriving S from constraints and premises.
- Therefore, for any given set of internal constraints and premise set $\sum$, if a formula S can be derived from these, then justification functions generate a justification tree for S.

Example # Justification Tree



Non Monotonic TMS

- **In a non-monotonic reasoning system new information can be added which will cause the deletion or alteration of existing knowledge.**
- **A logic is non-monotonic if some conclusions can be invalidated by adding more knowledge.**
- The logic of definite clauses with negation as failure is non-monotonic.
- Non-monotonic reasoning is useful for representing defaults.
- A default is a rule that can be used unless it overridden by an exception.

Non Monotonic TMS # Example

Non Monotonic Reasoning

- Conclusion may be invalidated if we add some more information to our knowledge base.
- Helpful in real world scenario.

Example:

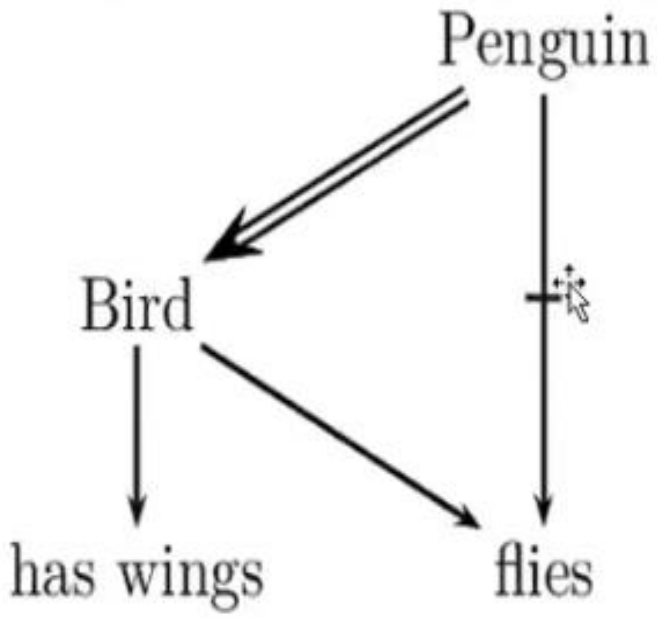
- Facts:
- Birds can fly.
- Penguins can't fly.
- Alex is bird
- Conclusion: Alex can Fly

Non Monotonic TMS # Example

Non Monotonic Reasoning

Example:

- Penguin cannot fly
- Birds has wings
- Birds can fly
- Penguin is a bird
- Conclusion: Penguin can fly



- **THE END**