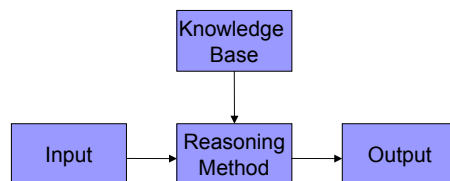


# VU @ D2.1.1

## Part 1: Approximation



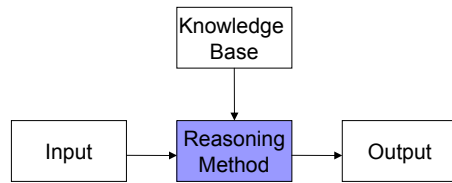
- Reasoning method

- Knowledge base
  - A-Box (UoM) and
  - T-Box

- Input



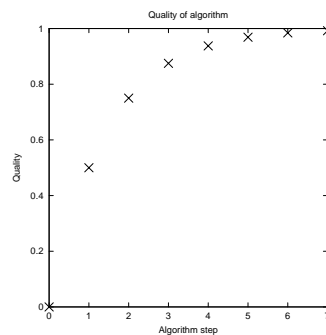
## Guidelines for Reasoning Methods



- **Semantically well-founded** providing a clear answer to the problem
- **Computationally attractive** resulting in an easier computation of approximate answers
- **Improvable** approximate answers
- **Dual** sound and complete
- **Flexible** to apply to different problems



## Reasoning Methods: Anytime Algorithms



- **Measurable Quality** of the approximate result
- **Recognizable Quality** can be determined at run time
- **Monotonicity** over time and input quality
- **Consistency**
- **Diminishing returns** with more improvements in the beginning
- **Interruptibility** at any time
- **Preemptability** ensures algorithm can be suspended and resumed

# Anytime Algorithms for logical entailment

- Boolean Constraint Propagation (BCP)

sound but incomplete

- Clausal BCP (restricted to clauses)

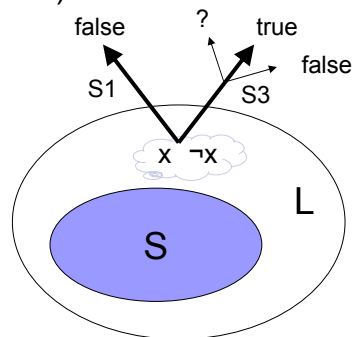
- CNF-BCP
- Prime-BCP (intractable)

- Formula BCP (intractable)

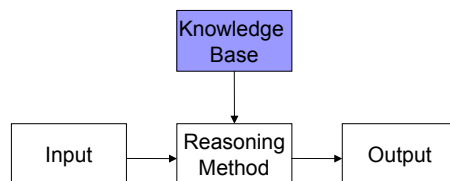
- Fact Propagation

- S1-/S3-entailment

sound and complete  
semantic approach



# Approximation for knowledge bases



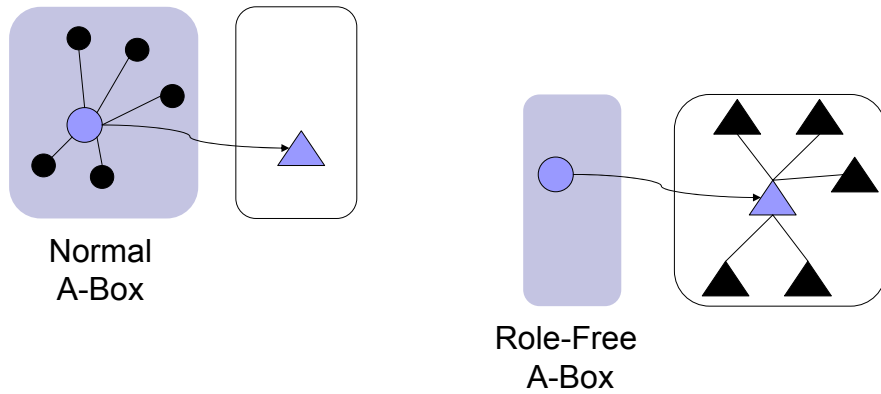
- “Compile”

- a knowledge base
- into another one
- with better computational properties

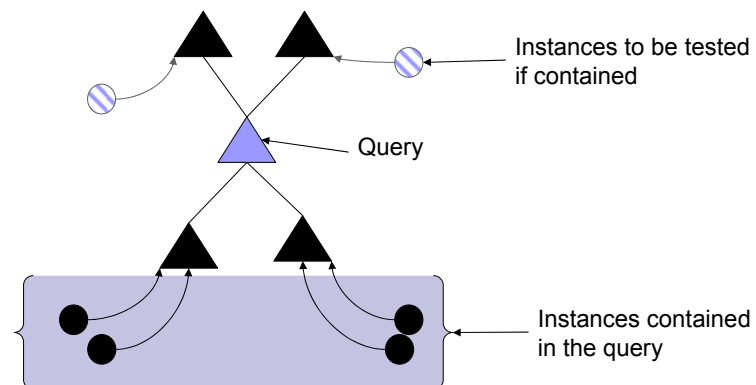
- Possibilities

- Translate A-Box into a role-free ABox
- Knowledge compilation

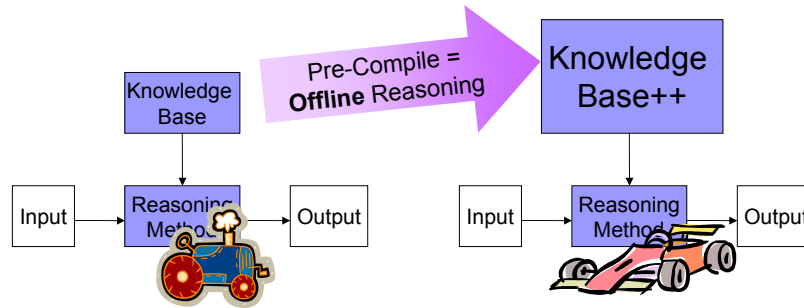
# Approximation on A-Boxes



# Querying in Role-Free A-Boxes



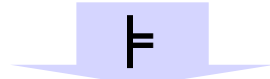
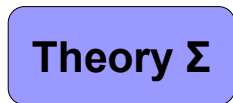
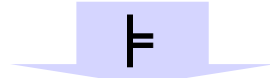
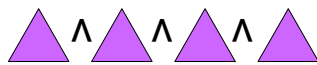
# Compiling the knowledgebase



- Exact Knowledge Compilation
- Approximate Knowledge Compilation

# Exact Knowledge Compilation

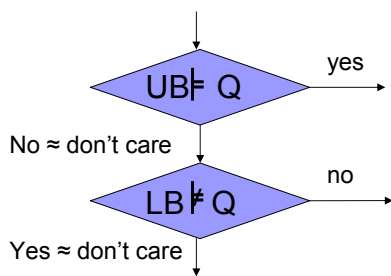
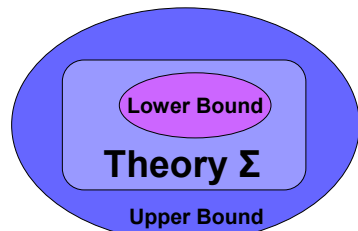
Implicants D



Implicants C

- Prime implicants  $D \vDash \Sigma$  and Prime implicates  $\Sigma \vDash C$   
Con-/Disjunction of Literals
- How to compute
  - Directly
  - Derviable by unit resolution
  - W.r.t. a tractable theory

# Approximate Knowledge Compilation



- Classical approaches
  - Language Restriction (c.f. Role-Free A-Boxes)
  - Theory Approximation (TA)
- Methods for TA:
  - Upper bound: if  $UP \not\models Q$  then  $\Sigma \not\models Q$
  - Lower bound: if  $LB \not\models Q$  then  $\Sigma \not\models Q$

# Anytime Variants of Exact Methods

