Chapter 8

Logic, rules and inference

Logic and inference

Logic

- Study of the principles of reasoning
- Constructs formal languages for expressing knowledge, semantics, and automatic reasoners to deduce conclusions.
- Predicate logic - set of axioms and rules that can be used to derive a set of true statements.
- RDF and OWL

Logic and inference

Inference rules

- A rule is a scheme for constructing valid inferences
- Two forms of deductively valid argument:
  - Modus ponens
    - If today is Tuesday, then John will go to work.

      Today is Tuesday.

      Therefore, John will go to work.
  - Modus tolllens
    - If I am the axe murderer, then I can use an axe.

      I cannot use an axe.

      Therefore, I am not the axe murderer.
  - The order of the premises is immaterial
- A rule can be either conditional or biconditional

Conditional Transformation Rules

Disjunctive syllogism

- p or q
  not p / not q
  q / p
- Example:
  John ate breakfast or he went running
  John did not eat breakfast
  he went running

Monotonic and nonmonotonic rules

Monotonic

- If a conclusion remains valid after new information becomes available within predicate logic, then we refer to this case as a monotonic rule.
- If, the conclusion may become invalid with the introduction of new knowledge, then the case is called a nonmonotonic rule.

DESCRIPTIVE LOGIC

Inference and Classes

- A subsumes B when it is the case that any instance of B must necessarily be an instance of A.

Inference and Individuals

Closed and Open Worlds

- Reasoning in DLs is monotonic

Inference Engines

An expert system has three levels of organization: a working memory, an inference engine, and a knowledge base.

Two kinds of inference:

1. Forward chaining
2. Backward chaining

Forward chaining/Backward Chaining

Rule1: IF A and C THEN F

Rule2: IF A and E THEN G

Rule 3: IF B THEN E

Rule 4: IF G THEN D

Given A, B = true

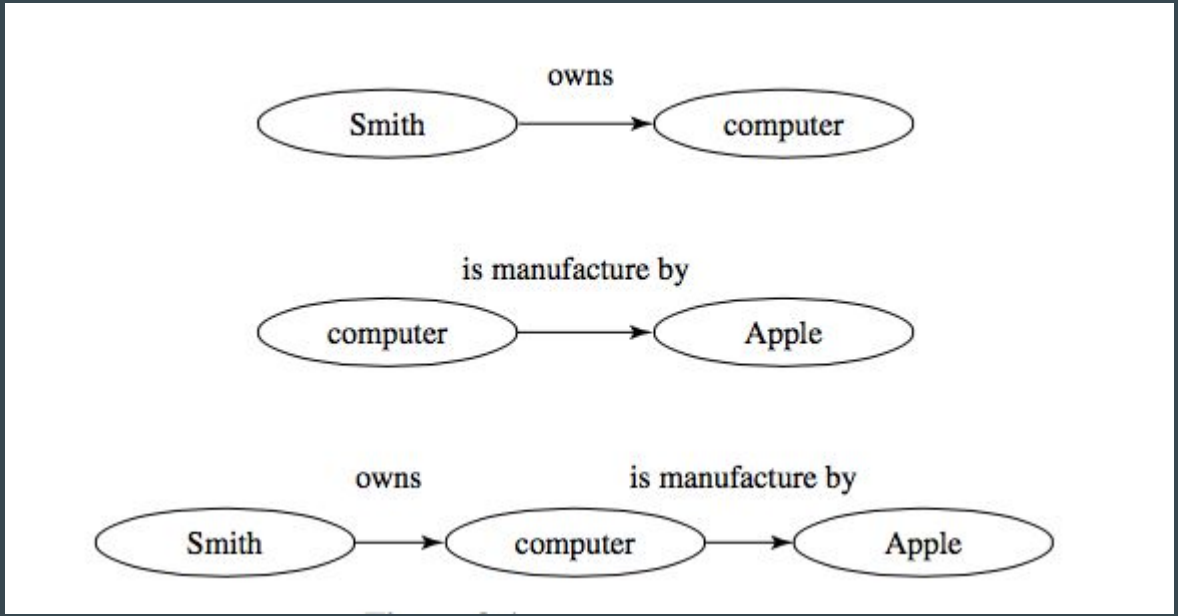
Tree Searches

A knowledge base can be represented as a branching network or tree

Two basic approaches are depth-first search and breadth-first search.

RDF INFERENCE ENGINE

RDF is a system meant for stating meta-information through triples composed of a subject, a property, and an object.



If X owns a computer, then X must buy software