EL query易于解决原因:

reduce knowledge base querying to relational database querying

使用解释来reduce ontology based reasoning to database querying.

After this, construction database technology can be used to process queries.

EL一定satisfiable，TBox一定consistent

Ontology

- formal：固定语法、语义、字母表（Alphabet）（自然语言无确定的语义解释，模糊性fuzziness很难用计算机建立）
- explicit：显性的表达出来，清晰仔细不留模糊空间，人类认知是隐式的
- shared：统一的看待事物方式，每个人不一样
- conceptualization：现实的抽象化模型概念化东西，认识世界的语言
- specification：formal description标准化真实化描述

Ontology是可计算模型

Question 1. Basic Understanding of KR and Ontologies
In Philosophy, *ontology* is the study of existence and being as such, and of the fundamental classes and relationships of existing things. In Computer Science and Artificial Intelligence, *ontology* is a formal description of knowledge about a domain of interest based on a fixed vocabulary of terms. Explain in 3-5 sentences as to why a logic-based ontology can be used as a "computational" KR model? (3 marks)

Model Solution. Ontologies can be interpreted by computers thanks to a formal (logical) semantics that defines the terms and logical statements using the usual Tarski-style set-theoretic semantics, which enables automated reasoning — the domain is interpreted as a set of elements, an individual as an element in the domain, a class as a subset of the domain, and a relationship as a pair of elements in the domain. This provides human users and computers with a shared understanding of domain knowledge.

Marking Scheme. Award 2 marks when students have, somehow, mentioned the idea of "ontologies are equipped with formal semantics", and unlock the remaining 1 mark when students have (briefly) described the Tarski-style set-theoretic semantics.

Ontologies are equipped with formal semantics.

Use Tarski-style set-theoretic semantics to define the terms and fomal statements, which enables automated reasoning.

And it provides human and computers with a shared understading of domain knowledge.

Expressive&computable

Question 2. Expressivity & Computability
Make up a natural language sentence that is unable to be modelled in the formal languages you learnt in the lecture, say in Description Logics or First-Order Logic. Following this example, there may come naturally a belief that a logic-based KR language should be designed as expressive as possible in any circumstances to capture as much domain knowledge as possible. Say in 3-5 sentences your opinion? (3 marks)

Model Solution. A logic-based KR language should be designed as expressive as is able to satisfy the modelling requirements of an application. More expressivity brings more power and flexibility for making statements about domain knowledge. However, on the other hand, such power and flexibility come with a computational cost. The expressive power of the language is invariably constrained so as to at least ensure that reasoning is decidable, i.e., reasoning can always be correctly completed within a finite amount of time.

Marking Scheme. Award 1 mark for a FOL-unmodellable natural language sentence, another 1 mark when students have, somehow, pointed out that there is a trade-off between the expressive power of a language available for making statements and the computational complexity of various reasoning tasks for the language, and unlock the remaining 1 mark when students have mentioned that the expressiveness of a language is due to the fulfillment of the modelling requirements.

There is a trade-off between the expressive power and the computational complexity.
Making more statements means more complex the reasoning task and more computational cost
On the one hand, a logic-based language should be as expressive as possible to satisfy the modelling requirements.
On the other hand, the expressive power should be constrained to ensure the reasoning is deciadable.

data complexity比combined complexity实用

input to the query answering problems: data D, query q
However, queries are typically very small compared to the data.
data: query is fixed, only D grows
combined: both q and D grows

data-driven&&knowledge-driven

KR:

- explainable and trasparent（透明，可解释的）,absolute accurency
- mostly built manually, unable to take advantage of big data
- **intensional definition**

ML:

- handle big dataset, more easily built by computer
- high but not absolute acurrency, barely not explainable and trasparent
- **extensional definition**

Non-Boolen questions通过枚举转化Boolen解决?

因为concepts中包含complex concept，无限，可造出无穷个表达式

NNF的意义

为了让clash以atomic concept形式出现，更加明显
tableau中无需设置针对negation的规则

算法是decision procedure的三条件

Termination：有限步终止
Correctness：Tableau返回yes，则一定consistent
soundness：所有satisfiable都能返回yes

为什么FOL有解释还要引入变量

解释将现实实体constant function和关系predicate对应
变量的range永远是domain
表达式真值由I和变量函数variable assignment共同决定

syntactic

the order of ontology axioms or existence of redundant axioms,

structural

regards them as structured objects, such as a concept hierarchy or a set of concept definitions.

semantic

follow from $\boldsymbol{O1}$ but not from $\boldsymbol{O2}$, or vice versa