SW06

Prince Prince

21 June 2023

1 Questions

1.1 Using the schema for naming members of the family of description logics, find the name for the following logics:

Naming Scheme for Expressive Description logics : $((ALC|S)[H]|SR)[O][I][F|N|Q]$, taking this information from slides.

1. ALC with Inverse and Functional Roles:

The name for this logic would be ALCIF. Here, 'ALC' is the basic description logic, 'I' represents the inverse roles and 'F' indicates functional roles.

2. ALC with Role Chains and Role Disjointness:

As role chains represent the transitive closure of roles, the name for this logic would be SRO+. 'S' is used here because it subsumes 'ALC', 'R' represents role chains or transitivity, 'O' signifies role disjointness.

3. ALC with closed classes, Transitivity and Subroles/Role Hierarchies:

Considering 'SH' includes role hierarchies, and 'T' stands for transitivity, the name would be SHT. There isn't a specific symbol for closed classes in the naming scheme provided, so it's omitted.

4. ALC with Transitivity, Inverse Roles and Qualified Cardinalitiy Restrictions:

Transitivity and Inverse roles are covered under 'SR', and 'Q' stands for qualified cardinality restrictions. Therefore, the name for this logic would be SRIQ.

1.2 KB question:

Given: Let KB be a knowledge base, α be an axiom. Let $I(KB)$ be the set of interpretations that satisfy KB. Let $I(\alpha)$ be the set of interpretations that satisfy α. Which of the following two conditions needs to hold for KB to entail α, that is $KB| = \alpha : \bullet\ A : I(KB) \subseteq I(\alpha)$

$\bullet\ B : I(\alpha) \subseteq I(KB)$

solution: the condition $A : I(KB) \subseteq I(\alpha)$ needs to hold. Because if an interpretation satisfies (or makes true) all axioms in the knowledge base, it must also satisfy the axiom in question.So, if I(KB) is the set of all interpretations that satisfy KB, and $I(\alpha)$ is the set of all interpretations that satisfy α, then every interpretation in I(KB) must also be in $I(\alpha)$ for α to be entailed by KB. This is precisely the condition $I(KB) \subseteq I(\alpha)$.If we considered condition $B : I(\alpha) \subseteq I(KB)$, it would mean that every interpretation that makes α true also makes KB true. This is a stronger condition, equivalent to saying that KB is entailed by α, not the other way around. So, for KB to entail α, condition A must hold, not condition B.

1.3 Model the following facts:

Not much sure about these solutions, couldn't properly understand.

1. Mammal and fish are disjoint classes: Mammal ⊥ Fish.
2. Every farmer owns at least a donkey: Farmer ⊑ ∃owns.Donkey.
3. Smart farmers only grow potatoes: SmartFarmer ⊑ ∀grows.Potato.
4. Every person has exactly two biological parents of which one is (biologically) male and the other is (biologically) female: Person ⊑ (=2 hasParent.Person) ⊓ (∃hasParent.Male ⊓ ∃hasParent.Female).

1.4 Translate the following expressions into Negated Normal Form (NNF)

below are the NNF:

1. A ⊓ ¬∃r.C := A ⊓ ∀r.¬C
2. A ⊔ ∀r.¬(B ⊓ C) := A ⊔ ∀r.(¬B ⊔ ¬C)
3. ¬(A ⊔ ¬≤nr.C) := ¬A ⊓ ≤nr.C
4. ¬∀r.¬(A ⊔ B)) := ∃r.(A ⊔ B)