

Introduction to Logic Programming – WS 2023
Exercise Sheet 7

1 Exercises

Exercise 1 (Lecture – Inverted Classroom)

Watch the lecture video *LP 14 UninformedSearch*¹ in the HHU Mediathek. The corresponding slides are uploaded in ILIAS: 9_Prolog_Search.pdf (slides 1-56) Furthermore, read the slides 8_Prolog_Cut_Negation.pdf (there is no corresponding video).

The complete playlist is available at: <https://mediathek.hhu.de/playlist/691>.

Note: you have to log in with your HHU account (Uni-Kennung) to see the lecture videos!

The exercises will be discussed on 5th December 2023.

Exercise 2 (CNF in FOL)

Transform the following predicate to conjunctive normalform.

$$\forall n : (n \in \mathbb{N} \Rightarrow (\exists m : m \in \mathbb{N} \wedge m > n)) \quad (1)$$

Exercise 3 (Proof by Contradiction, CNF in FOL)

Prove by contradiction that the following predicate is true:

$$(\forall x : (\neg P(x) \Rightarrow Q(x)) \wedge \exists x : \neg Q(x)) \Rightarrow \exists x : P(x) \quad (2)$$

Note that there are three different variables called x which are locally quantified.

Hint: Negate the formula, transform the formula to CNF (including Skolemization), find a contradiction.

Exercise 4 (Proof by Contradiction, CNF and Resolution in FOL)

Define the following statements in predicate logic:

- For all humans it applies: If they lie in the sun for too long and don't use sunscreen, they get sunburn.
- All children are humans.
- Billy is a child.
- Billy has been in the sun too long and doesn't use sunscreen.

¹<https://mediathek.hhu.de/watch/791fc654-3f8a-4cce-b803-32f87fc7ac23>

Note: You can use abbreviations for the predicate names.

Prove by contradiction and resolution that Billy gets sunburn. Specify the most general unifier for each resolution step.