



Christoph Weidenbach

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Tutorials for “Automated Reasoning”
Exercise sheet 10

Exercise 10.1: (4 P)

Refute the following set of clauses using resolution. As usual one sort S serves all.

$$N = \{P(a) \vee P(b), \neg P(x) \vee \neg P(f(x)) \vee Q(f(a)), \neg P(x) \vee P(f(x)), \\ Q(a), \neg Q(f(x)) \vee \neg Q(x), Q(f(x)) \vee \neg P(x)\}$$

Exercise 10.2: (4 P)

Let a, b, c be constants, f be a binary function symbol and P and Q be binary predicates. As usual one sort S serves all. Apply the resolution calculus on the following two clauses:

$$C_1 = \neg Q(f(x, z), f(y, z)) \vee Q(x, y) \vee Q(z, c) \vee \neg P(x, y) \\ C_2 = \neg Q(f(a, c), b) \vee \neg P(a, x) \vee Q(a, b).$$

How many different possibilities to apply the resolution calculus (resolution, factoring, condensation) are there? Show all resulting clauses with respective substitutions.

Exercise 10.3: (2+2 P)

Consider a signature with constants a, b , unary function g , and unary predicates P, Q . As usual one sort S serves all.

1. Find some Knuth-Bendix ordering (i.e., define weight function and precedence) in such a way that the following will hold:

$$P(a) \succ_{\text{kbo}} Q(g(b)) \succ_{\text{kbo}} P(g(b)) \succ_{\text{kbo}} P(b)$$

2. Do the same for LPO:

$$P(a) \succ_{\text{lpo}} Q(g(b)) \succ_{\text{lpo}} P(g(b)) \succ_{\text{lpo}} P(b)$$

Justify your definitions.

Exercise 10.4: (2+2 P)

Prove or provide a counter example for the following statements.

1. If two terms are comparable with respect to an LPO instance, then they are comparable with respect to a KBO instance.
2. If two terms are comparable with respect to a KBO instance, then they are comparable with respect to an LPO instance.

Submit your solution in lecture hall E1.3, Room 001 during the lecture on January 31. Please write your name and the date/time of your tutorial group (Wed-Fabian, Wed-Tobias) on your solution.

Joint solutions, prepared by up to three persons together, are allowed (but not encouraged). If you prepare your solution jointly, submit it only once and indicate all authors on the sheet.