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February 1, 2016

**Tutorials for “Automated Reasoning”**  
**Exercise sheet 13**

**Exercise 13.1:** (4 P)

Apply the Knuth-Bendix procedure to the set of equations

$$f(f(x)) \approx g(x) \quad (1)$$

$$f(b) \approx c \quad (2)$$

and transform it into a finite convergent term rewrite system; use the Knuth-Bendix ordering with weight 1 for all function symbols and variables and the precedence  $g > f > b > c$ .

**Exercise 13.2:** (4 P)

Apply the Knuth-Bendix procedure to the set of equations

$$f(0, f(x, f(y, z))) \approx f(f(0, x), f(y, z)) \quad (1)$$

$$f(0, x) \approx 0 \quad (2)$$

$$f(x, 1) \approx x \quad (3)$$

and transform it into a finite convergent term rewrite system; use the Knuth-Bendix ordering with weight 1 for all function symbols and variables and the precedence  $f > 1 > 0$ . Start by orienting the first equation.

**Exercise 13.3:** (4 P)

If the set  $R$  in the Knuth-Bendix completion procedure contains two rules whose left-hand sides are equal up to variable renaming, then none of them can be simplified using the other one. In practice, such a situation should never occur. Why?

**Exercise 13.4:** (3 P)

Let  $\Sigma = (\Omega, \emptyset)$  with  $\Omega = \{b/0, f/1, g/1\}$ . Which ground terms are in  $T_\infty$  for the following TRS?

$$f(f(b)) \rightarrow g(b) \quad (1)$$

$$g(x) \rightarrow g(f(x)) \quad (2)$$

**Exercise 13.5:** (3 P)

Let  $\Sigma = (\Omega, \emptyset)$  with  $\Omega = \{f/2, g/1, h/1, b/0\}$ . Compute the dependency pairs of the following TRS  $R$ :

$$f(h(x), g(y)) \rightarrow f(x, g(g(y))) \quad (1)$$

$$g(h(x)) \rightarrow h(f(g(x), h(b))) \quad (2)$$

Submit your solution either in lecture hall E1.3, Room 003 during the lecture on February 4 or put it into the box next to E1.5, Room 638 before February 9, 12:00. (Note that Bldg. E1.5 (MPI-SWS) tends to be locked in the late afternoon and evening.) Please write your name and the time of your tutorial group (Mo 8–10 or Mo 12–14) 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.