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January 27, 2021

**Tutorials for “Automated Reasoning WS20/21”**  
**Exercise sheet 10**

**Exercise 10.1:**

Apply the Knuth-Bendix procedure to the set of equations

$$E = \{ f(f(x)) \approx g(x), f(a) \approx b \}$$

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  $g \succ f \succ a \succ b$ .

**Exercise 10.2:**

Apply  $\Rightarrow_{\text{KBC}}$  to the following set of equations. Choose an appropriate ordering. As usual one sort for everything.

$$E = \{ f(g(x), x) \approx h(x), f(g(x), h(y)) \approx f(x, y), h(a) \approx a \}$$

**Exercise 10.3:**

Use the congruence closure algorithm to check whether the equational clause

$$\forall x. \forall y. f(f(x)) \not\approx x \vee f(x) \not\approx y \vee f(f(y)) \not\approx g(y) \vee x \approx y \vee h(x, y) \approx h(x, g(y))$$

is valid.

**Exercise\* 10.4:**

Show that for any equation  $(l \approx r) \in E$  and  $\text{vars}(l) \not\supseteq \text{vars}(r)$  the rewrite relation  $\rightarrow_E$  is not terminating.

Is is not encouraged to prepare joint solutions, because we do not support joint exams.