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July 18, 2016

Tutorials for “Automated Reasoning II”
Exercise sheet 9

Exercise 9.1:

Show that the following set of equational clauses can be finitely saturated up to redundancy, if the parameters of the superposition calculus and the strategy are chosen appropriately:

$$h(y) \not\approx y \vee h(f(y)) \approx f(y) \quad (1)$$

$$g(g(x)) \approx x \quad (2)$$

$$f(b) \approx c \quad (3)$$

$$g(g(c)) \approx f(c) \vee g(g(c)) \approx f(b) \quad (4)$$

Exercise 9.2:

Let N be the set of constrained clauses

$$f(g(x)) \approx x \llbracket \top \rrbracket \quad (1)$$

$$h(b) \approx c \llbracket \top \rrbracket \quad (2)$$

Are the following clauses redundant w. r. t. N , if we define redundancy as on page 64 of the lecture notes?

$$f(h(x)) \approx f(c) \llbracket x = b \rrbracket \quad (3)$$

$$h(f(g(b))) \approx c \llbracket \top \rrbracket \quad (4)$$

$$h(f(g(x))) \approx h(x) \llbracket \top \rrbracket \quad (5)$$

Exercise 9.3:

Refute the following set of clauses by hierarchic superposition; use linear rational arithmetic as base specification. The constants b and c are assumed to be Skolem constants of the base signature.

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

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

$$f(c) \approx b+1 \quad (3)$$

Exercise 9.4:

Compute minimal complete sets of unifiers for the following equality problems. (There is no need to construct and solve diophantine equation systems; the solutions are relatively obvious.)

(1) $\{x + y \approx a + b\}$ w. r. t. ACU.

(2) $\{x + y \approx a + b\}$ w. r. t. AC.

(3) $\{x + y \approx x\}$ w. r. t. ACU.

(4) $\{x + y \approx x\}$ w. r. t. AC.

(5) $\{x + y + a \approx z + b\}$ w. r. t. ACU.

(6) $\{x + y + a \approx z + z\}$ w. r. t. ACU.

(7) $\{a + x + x \approx y + b\}$ w. r. t. A.

Bring your solution (or solution attempt) to the tutorial on July 25.