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June 28, 2022

Tutorials for “Automated Reasoning II”
 Exercise sheet 7

Exercise 7.1:

Refute the following set of clauses using AVATAR:

$$f(x) \approx c \vee g(y) \approx d \quad (1)$$

$$f(g(b)) \not\approx f(g(b')) \vee h(x, y) \approx x \quad (2)$$

$$h(z, c) \not\approx h(d, w) \vee h(w, d) \not\approx h(c, z) \quad (3)$$

Exercise 7.2:

Let \succ be an LPO with the precedence $f > g > h > b > c$; let N be the set of constrained clauses

$$f(b) \approx c \llbracket \top \rrbracket \quad (1)$$

$$g(x) \approx x \llbracket x = b \rrbracket \quad (2)$$

We define redundancy as on page 68 of the lecture notes: A clause C is redundant w. r. t. N , if for every confluent ground rewrite system R contained in \succ every R -variable irreducible ground instance of C follows from smaller R -variable irreducible ground instances of clauses in N and smaller rules in R .

Are the following clauses redundant w. r. t. N ?

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

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

$$f(g(x)) \approx c \llbracket x = b \rrbracket \quad (5)$$

Exercise 7.3:

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 7.4:

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 5.