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Tutorials for "Automated Reasoning II"
Exercise sheet 7

Exercise 7.1:
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:

$$h(y) \not\approx y \vee h(f(y)) \approx f(y) \qquad (1)$$
$$g(g(x)) \approx x \qquad (2)$$
$$f(b) \approx c \qquad (3)$$
$$g(g(c)) \approx f(c) \vee g(g(c)) \approx f(b) \qquad (4)$$

Exercise 7.2:
Let N be the set of constrained clauses

$$f(g(x)) \approx x \; [\![\top]\!] \qquad (1)$$
$$h(b) \approx c \; [\![\top]\!] \qquad (2)$$

Are the following clauses redundant w. r. t. N, if we define redundancy as on page 66 of the lecture notes?

$$f(h(x)) \approx f(c) \; [\![x = b]\!] \qquad (3)$$
$$h(f(g(b))) \approx c \quad [\![\top]\!] \qquad (4)$$
$$h(f(g(x))) \approx h(x) \; [\![\top]\!] \qquad (5)$$

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.

$$f(f(x+1)) \approx x \qquad (1)$$
$$f(b) \approx c \qquad (2)$$
$$f(c) \approx b+1 \qquad (3)$$

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 June 6.