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Tutorials for Decision Procedures Exercise sheet 13

(Hint: There is a bonus exercise on page 2.)

Exercise 1: Interpolation for T_E

Compute the Craig interpolant for each of the following T_E -formula pairs.

- (a) $F: g(f(x)) = a \wedge f(g(x)) = a \wedge a \neq x$
 $G: f(g(f(b))) = x \wedge f(b) = x$
- (b) $F: a = f(f(f(a))) \wedge f(a) = x \wedge p(a)$
 $G: f(f(b)) = f(b) \wedge b = x \wedge \neg p(f(b))$

Exercise 2: Interpolation for T_Q

Compute the Craig interpolant for the following T_Q -formula pair.

$$F: x \geq a \wedge a \geq -2y + 1 \wedge 2a + y \geq 1$$
$$G: x + y \leq \frac{1}{2}$$

Exercise 3: Interpolation for non-conjunctive formulas

Compute the Craig interpolant for the following propositional formula pair (in clause form).

$$F: \{\{P_3, P_9\}, \{\overline{P_2}, \overline{P_4}, P_9\}, \{\overline{P_2}, \overline{P_5}\}, \{P_2, P_5\}, \{\overline{P_3}, \overline{P_9}\}, \{P_4, \overline{P_5}\}, \{P_9, \overline{P_5}\}\}$$
$$G: \{\{\overline{P_3}, P_6\}, \{P_3, \overline{P_6}, P_7\}, \{\overline{P_4}, \overline{P_6}, \overline{P_9}\}, \{P_4, \overline{P_7}\}, \{\overline{P_4}, P_7\}, \{P_4, P_9\}, \{P_6, \overline{P_7}\}, \{P_6, P_9\}\{P_7, \overline{P_9}\}\}$$

Exercise 4: DPLL(T_A)

4 Bonus Points

Use DPLL(T_A) to decide satisfiability formula F_6 on slide 259 in the slide set on the array theory (printed below).

$$\begin{aligned} F_6 : & (\lambda \neq k \rightarrow a[\lambda] = b[\lambda]) \\ & \wedge (k \neq k \rightarrow a[k] = b[k]) \\ & \wedge (j \neq k \rightarrow a[j] = b[j]) \\ & \wedge b[k] = v \wedge a'[j] \neq b[j] \wedge a'[k] = v \\ & \wedge (\lambda \neq k \rightarrow a'[\lambda] = a[\lambda]) \\ & \wedge (k \neq k \rightarrow a'[k] = a[k]) \\ & \wedge (j \neq k \rightarrow a'[j] = a[j]) \\ & \wedge \lambda \neq k \wedge \lambda \neq j \end{aligned}$$