Prop Logic

Resolution

CDCL

Superposition

Syntax - Semantics $\rightsquigarrow$ Linear Arithmetic

SMT

CDCL(T)

First-Order Logic

If it rains $\rightarrow$ Street Wet

If it rains

$\Rightarrow$ Street Wet　　　Peirce

ru　　　　　　　　　　　　Frege

Socrates is a human

all humans are mortal

Socrates is mortal

Human(Socrates)

$\forall x \; Human(x) \rightarrow Mortal(x)$

One sort S

$$R(a, b)$$

$\mathcal{A}$: $a_{\mathcal{A}} = 1 \quad b_{\mathcal{A}} = 2$

$S_{\mathcal{A}} = \mathbb{Z} \quad R_{\mathcal{A}} = <$

$\mathcal{A}$: $a_{\mathcal{A}} = a$
$b_{\mathcal{A}} = b$
$S_{\mathcal{A}} =$ all strings from Σ $\quad R_{\mathcal{A}} = \{(a, b)\}$

$\mathcal{A}$: $a_{\mathcal{A}} =$ mehl $\quad b_{\mathcal{A}} =$ scholt

$S_{\mathcal{A}} =$ all humans being $\quad R_{\mathcal{A}} =$ follow in job

$\mathcal{A}$: $a_{\mathcal{A}} = 5 \quad b_{\mathcal{A}} = 6 \quad R_{\mathcal{A}} = >$

$S_{\mathcal{A}} = \mathbb{N}$

$$\forall x\,[\underline{P(x)} \to \underline{P(g(x))}]$$

$\mathcal{A}$: $\quad S_{\mathcal{A}} = \mathrm{Rat} \qquad P_{\mathcal{A}} = \mathrm{Nat}$

$\qquad g(x) = x+1$

$\mathcal{A}$: $\quad S_{\mathcal{A}} = \{1,2\} \qquad P_{\mathcal{A}} = \emptyset \qquad g_{\mathcal{A}}(x) = x$

$\qquad \vdots \qquad " \qquad P_{\mathcal{A}} = \{1\}$

$$\rightarrow \forall x \, \neg R(x,x)$$

$$\wedge \; \forall x \, [R(x,y) \wedge R(y,z) \rightarrow R(x,z)]$$

$$\wedge \; \forall x \, \exists y \, [R(x,y)]$$

$$\left(\forall x \exists y .\, R(x, y) \right) \longrightarrow R(a, b)$$

$$\left(\underline{P(a)} \wedge \forall x \left(P(x) \to P(g(x)) \right) \right)$$

$$\longrightarrow P(g(g(a)))$$

$a_A \in P_A$

$g_A(a_A) \in P_A$

$g_A(g_A(a_A)) \in P_A$

$$(\exists x . P(x)) \to P(b)$$

$$b_A = 1$$

$$P_A = \{2\}$$

$$\left[(\exists x . P(x)) \to P(b)\right]$$
$$\land \left[\forall x, y\, (x \approx y)\right]$$

$$\left[\forall x, y\, (x \approx y)\right] \to \left[(\exists x . P(x)) \to P(b)\right]$$

$$P(b) \to (\exists x . P(x))$$

$$\mathcal{A} \overset{?}{\models} [\exists x . P(x)] \quad \text{true}$$

$$S_{\mathcal{A}} = \mathbb{N} \qquad P_{\mathcal{A}} = \{5\}$$

$$\mathcal{A} \overset{?}{\models} [\forall x . P(x)] \quad \text{false}$$

$$\mathcal{A} \overset{?}{\models} P(x) \quad \text{satisfiable}$$

$$\xrightarrow{\qquad} \forall x,y\,(\cancel{g}(x) \approx x \wedge R(x,y) \to R(y,x))$$

$$\Longrightarrow$$

$$\forall x\,y\,(E(g(x),x) \wedge R(x,y) \to R(y,x))$$

$$\forall x \quad E(x,x) \qquad \forall x,y,z\,(E(x,y) \wedge E(y,z) \to E(x,z))$$

$$\forall x,y\,(E(x,y) \to E(y,x))$$

$$\forall x\,x'\,y\,y' \quad (E(x,x') \wedge E(y,y') \wedge R(x,y) \to R(x',y'))$$

$$\forall x,x' \quad (E(x,x') \to E(g(x),g(x')))$$