

Ausgewählte Kapitel der Logik

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Aufgabe 1

a)

$$\begin{aligned}\varphi_{on}(z, z_1, \dots, z_k) &:= z = z_1 + \underline{1} \vee z = z_1 + z_2 + \underline{2} \vee \dots \vee z_1 + \dots + z_k + k \\ \varphi_{start}^M(x, y, z_1, \dots, z_k) &:= \varphi_{Kopf}^M(x, y) \wedge \varphi_\beta(x, \underline{0}, \underline{q_0}) \wedge \\ &\quad \exists z < y. \underline{0} < z \wedge \\ &\quad (\varphi_{on}(z, z_1, \dots, z_k) \rightarrow \varphi(x, z, \underline{2})) \wedge \\ &\quad (\neg \varphi_{on}(z, z_1, \dots, z_k) \rightarrow \varphi(x, z, \underline{1}))\end{aligned}$$

c)

$$\begin{aligned}\varphi_{schritt}^M(x, y, x', y') &:= \varphi_{Kopf}(x, y) \wedge \varphi_{Kopf}(x', y') \wedge \\ &\quad \exists z < y \exists w \leq x \exists w' \leq x \exists \alpha \leq x \exists \alpha' \leq x \\ &\quad (\forall z' z \neq z' \wedge z + 1 \neq z' \wedge z \neq z' + 1 \rightarrow \exists b \leq \varphi_\beta(x, z', b) \wedge \varphi_\beta(x', z', b)) \wedge \\ &\quad \bigvee_{\substack{q \in Q, \alpha \in \{0,1,2\} \\ \delta(q, \alpha) = (w', \alpha', p)}} w = q \wedge \varphi_\beta(x, z, w) \wedge \varphi_\beta(x, z + 1, \alpha) \wedge \chi_p(x, x', z, w', \alpha')\end{aligned}$$

$$\begin{aligned}
\chi_{\leftarrow}(x, x', z, w', \alpha') := & \exists z' < z \wedge z_{-1} + 1 = z \wedge \\
& \varphi_{\beta}(x', z_{-1}, w') \wedge \\
& \exists l \leq x. \varphi_{\beta}(x', z, l) \wedge \varphi_{\beta}(x, z_{-1}, l) \wedge \\
& \varphi_{\beta}(x', z + 1, \alpha')
\end{aligned}$$

$$\begin{aligned}
\chi_{\downarrow}(x, x', z, w', \alpha') := & \varphi_{\beta}(x', z, w') \\
& \varphi_{\beta}(x', z + 1, \alpha')
\end{aligned}$$

$$\begin{aligned}
\chi_{\rightarrow}(x, x', z, w', \alpha') := & \varphi_{\beta}(x', z + 1, w') \\
& \varphi_{\beta}(x', z, \alpha')
\end{aligned}$$

Aufgabe 2

Aufgabe 3

Aufgabe 4