T-79.5102 **Syksy 2005**
Laskennallisen logiikan erikoiskurssi
Laskuharjoitus 7
Ratkaisut

1. a)

$$
\begin{aligned}
T_S(\emptyset) \uparrow 0 &= \{R\} \\
T_S(\emptyset) \uparrow 1 &= \{R, Q_1\} \\
T_S(\emptyset) \uparrow 2 &= \{R, Q_1, P_1\} \\
T_S(\emptyset) \uparrow 3 &= \{R, Q_1, P_1, S_1\} \\
T_S(\emptyset) \uparrow 4 &= \{R, Q_1, P_1, S_1\}
\end{aligned}
$$

Siis $M_S = \{R, Q_1, P_1, S_1\}$.

b)

R	$[R]$
Q_1	$[Q_1 \leftarrow R]$
P_1	$[P_1 \leftarrow Q_1]$
S_1	$[S_1 \leftarrow P_1 \wedge Q_1]$

c)

$$
\begin{aligned}
T_S(\emptyset) \uparrow 0 &= \{Q(a)\} \\
T_S(\emptyset) \uparrow 1 &= \{Q(g^i(a))\}_{i=0}^{1} \\
T_S(\emptyset) \uparrow 2 &= \{Q(g^i(a))\}_{i=0}^{2} \\
&\vdots \\
T_S(\emptyset) \uparrow n &= \{Q(g^i(a))\}_{i=0}^{n} \\
&\vdots \\
T_S(\emptyset) \uparrow \omega &= \{Q(g^i(a))\}_{i=0}^{\infty}
\end{aligned}
$$

2. a) Klausuulijoukon S Herbrand-instantiaatio S_H on:

$$\begin{aligned}
\{\ & d(1) \leftarrow\ a(1), b(1); d(2) \leftarrow\ a(2), b(2); \\
& d(3) \leftarrow\ a(3), b(3); d(4) \leftarrow\ a(4), b(4); \\
& e(1,1) \leftarrow\ d(1), d(1); e(1,2) \leftarrow\ d(1), d(2); \\
& e(1,3) \leftarrow\ d(1), d(3); e(1,4) \leftarrow\ d(1), d(4); \\
& e(2,1) \leftarrow\ d(2), d(1); e(2,2) \leftarrow\ d(2), d(2); \\
& e(2,3) \leftarrow\ d(2), d(3); e(2,4) \leftarrow\ d(2), d(4); \\
& e(3,1) \leftarrow\ d(3), d(1); e(3,2) \leftarrow\ d(3), d(2); \\
& e(3,3) \leftarrow\ d(3), d(3); e(3,4) \leftarrow\ d(3), d(4); \\
& e(4,1) \leftarrow\ d(4), d(1); e(4,2) \leftarrow\ d(4), d(2); \\
& e(4,3) \leftarrow\ d(4), d(3); e(4,4) \leftarrow\ d(4), d(4); \\
& a(1); a(2); b(2); b(3); c(4)\ \}
\end{aligned}$$

b) Ja sen minimimalli:

$$\begin{aligned}
T_{S_H}(\emptyset) \uparrow 0 &= \{a(1), a(2), b(2), b(3), c(4)\} \\
T_{S_H}(\emptyset) \uparrow 1 &= \{d(2), a(1), a(2), b(2), b(3), c(4)\} \\
T_{S_H}(\emptyset) \uparrow 3 &= \{e(2,2), d(2), a(1), a(2), b(2), b(3), c(4)\}
\end{aligned}$$

c) Pienin instantiaatio G saadaan S_H:sta jättämällä pois kaikki säännöt, joiden vartalossa esiintyy totutumattomia atomeita:

$$\begin{aligned}
G = \{\ & d(2) \leftarrow\ a(2), b(2), e(2,2) \leftarrow\ d(2), d(2); \\
& a(1); a(2); b(2); b(3); c(4)\}
\end{aligned}$$