Chapter 2.12

Sherri Shulman
TESC

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- 1
  - a)

$$
\begin{aligned}
S_0 &= \{P(x,y), p(y,f(z))\} \\
D_0 &= \{x,y\} \\
\sigma_0 &= \{x.y\} \\
S_1 &= S_0\sigma_0 = \{P(y,y), P(y,f(z))\} \\
D_1 &= \{y, f(z)\} \\
\sigma_1 &= \{y/f(z)\} \\
S_2 &= S_1\sigma_1 = \{P(f(z), f(z))\}
\end{aligned}
$$

  - b)

$$
\begin{aligned}
S_0 &= \{P(a,y,f(y)), P(z,z,u)\} \\
D_0 &= \{a,z\} \\
\sigma_0 &= \{z/a\} \\
S_1 &= S_0\sigma_0 = \{P(a,y,f(y)), P(a,a,u)\} \\
D_1 &= \{y,a\} \\
\sigma_1 &= \{y/a\} \\
S_2 &= S_1\sigma_1 = \{P(a,a,f(a)), P(a,a,u)\} \\
D_2 &= \{f(a), u\} \\
\sigma_2 &= \{u/f(a)\} \\
S_3 &= S_2\sigma_2 = \{P(a,a,f(a))\}
\end{aligned}
$$

  - c)

$$
\begin{aligned}
S_0 &= \{P(x,g(x)), P(y,y)\} \\
D_0 &= \{x,y\} \\
\sigma_0 &= \{x/y\} \\
S_1 &= S_0\sigma_0 = \{P(y,g(y)), P(y,y)\} \\
D_1 &= \{g(y), y\} \\
&\text{fails the occurs check}
\end{aligned}
$$

– d)

$$
\begin{aligned}
S_0 &= \{P(x, g(x), y), P(z, u, g(a)), P(a, g(a), v)\} \\
D_0 &= \{x, z\} \\
\sigma_0 &= \{x/z\} \\
S_1 &= S_0\sigma_0 = \{P(z, g(z), y), P(z, u, g(a)), P(a, g(a), v)\} \\
D_1 &= \{z, a\} \\
\sigma_1 &= \{z/a\} \\
S_2 &= S_1\sigma_1 = \{P(a, g(a), y), P(a, u, g(a)), P(a, g(a), v)\} \\
D_2 &= \{g(a), u\} \\
\sigma_2 &= \{u/g(a)\} \\
S_3 &= S_2\sigma_2 = \{P(a, g(a), y), P(a, g(a), g(a)), P(a, g(a), v)\} \\
D_3 &= \{y, g(a)\} \\
\sigma_3 &= \{y/g(a)\} \\
S_4 &= S_3\sigma_3 = \{P(a, g(a), g(a)), P(a, g(a), g(a)), P(a, g(a), v)\} \\
D_4 &= \{g(a), v\} \\
\sigma_4 &= \{v/g(a)\} \\
S_5 &= S_4\sigma_4 = \{P(a, g(a), g(a)), P(a, g(a), g(a)), P(a, g(a), g(a))\}
\end{aligned}
$$

Now this is one term, so we are done.

– e) I'm not going to do the detail on this one. The first substitution is $\{y/g(x)$ giving us $\{P(g(x), g(x), P(g(x), f(u))\}$. Now the difference set is $\{g(x), f(u)\}$ which can't be unified.