Ex 4.4.)

_c.)_

$$\vDash (\forall x \; P(x) \land \forall x \; Q(x)) \equiv \forall x \; [\; P(x) \land Q(x)\;]$$

<u>correct</u>

_Note:_

$$KB \vDash \alpha \equiv \beta \quad \text{iff} \quad KB \vDash (\alpha \supset \beta) \text{ and}$$
$$KB \vDash (\beta \supset \alpha)$$
$$\underset{\text{"implies"}}{\uparrow}$$

_f.)_

$$\{\forall x \exists y \; P(x,y), \; \neg \exists z \; P(z,a)\}$$
$$\vDash \exists y \forall x \; P(x,y)$$

$$\{\forall x \exists y \; P(x,y), \; \neg \exists z \; P(z,a)\} \; \cup \; \{\neg \exists y \forall x \; P(x,y)\}$$
$$\widehat{=} \; \forall x \exists y \; P(x,y) \land \neg \exists z \; P(z,a) \land \neg \exists y \forall x \; P(x,y)$$

2.)
$$\equiv \; \forall x \exists y \; P(x,y) \land \forall z \; \neg P(z,a) \land \forall y \exists x \; \neg P(x,y)$$

3.)
$$\equiv \; \forall x \exists y \; P(x,y) \land \forall z \; \neg P(z,a) \land \forall v \exists w \; \neg P(w,v)$$

4.)
$$\rightsquigarrow \; \forall x \; P(x, f(x)) \land \forall z \; \neg P(z,a) \land \forall v \; \neg P(f'(v), v)$$

5.)
$$\equiv \; \forall x \forall z \forall v \; [\; P(x, f(x)) \land \neg P(z,a) \land \neg P(f'(v), v)\;]$$
$$\widehat{=} \; \{[\; P(x, f(x))\;], \; [\sim P(z,a)\;], \; [\sim P(f'(v), v)\;]\}$$

$$[\; P(x, \overbrace{f(x)}^{f(f'(v))})\;] \qquad [\underset{\underset{a}{\downarrow}}{\overset{\text{constant value}}{\sim}} P(z, a)\;] \qquad [\sim P(f'(v), v)\;]$$

s/z/x/

s/x/f'(v)

not unifiable!

not unifiable!

1

$I = <D, \phi>$ , $D = \{1, 2, 3\}$

$\phi(a) = 1$

$\phi(P) = \{<1,2>, <2,2>, <3,3>\}$

$I \vDash \forall x \exists y\ P(x,y)$     holds

$I \vDash \neg \exists z\ P(z, a)$     holds    (there is no $<\_, 1>$ tuple)

$I \nvDash \exists y \forall x\ P(x,y)$

### Ex 5.1.)

a.)

$$At(Shakey, x), Loc(x, w), Loc(y, w), Lit(w)$$

$$\boxed{Go(x,y)}$$

$$At(Shakey, y), \neg At(Shakey, x)$$

$$Mov(v)\ At(v,x), At(Shakey, x), Loc(x, w),$$
$$Loc(y, w), Lit(w)$$

$$\boxed{Push(v, x, y)}$$

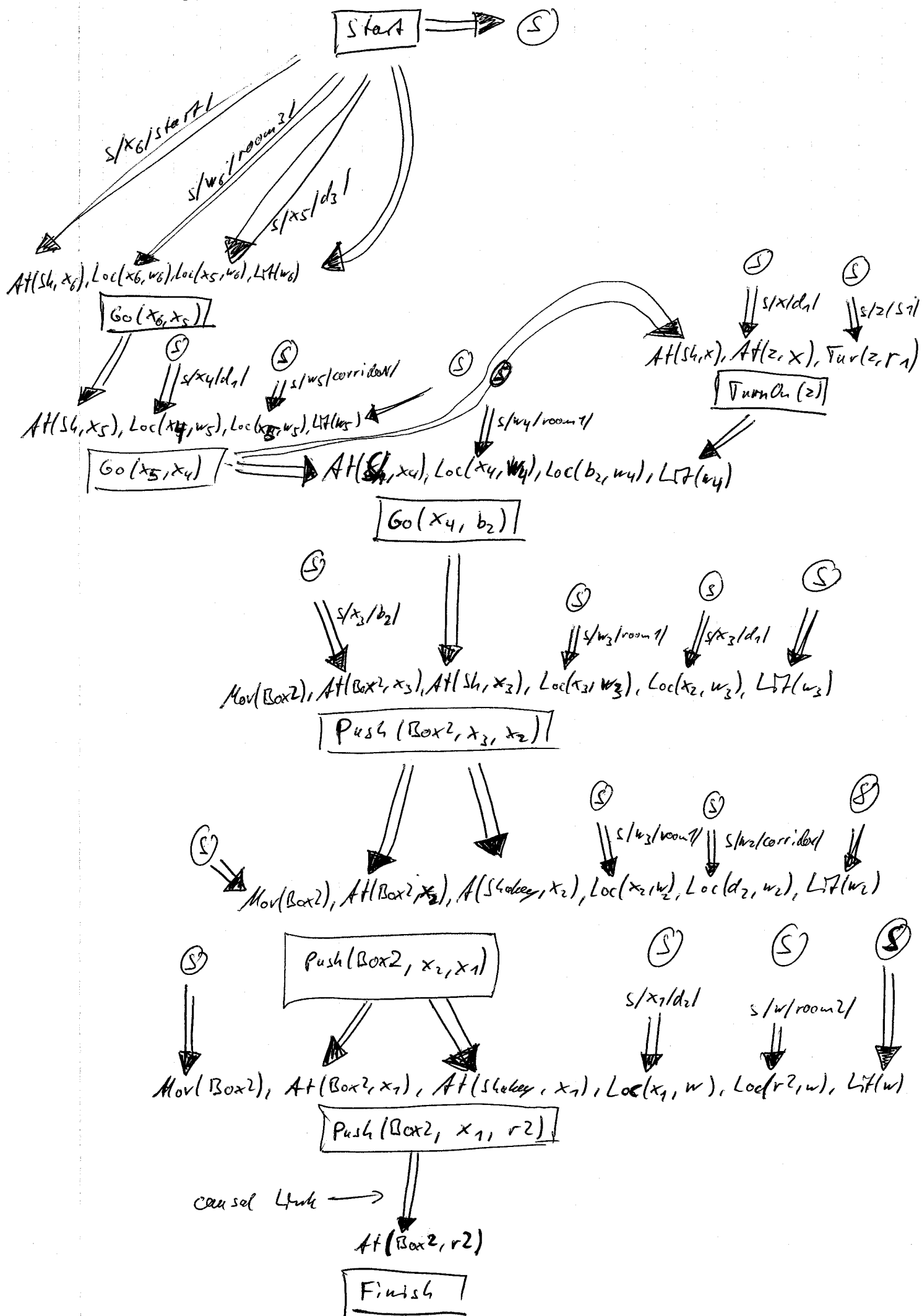$$At(v, y), At(Shakey, y), \neg At(v,x), \neg At(Shakey, x)$$

$$At(Shakey, x), A(z,x),$$

$$\boxed{TurnOn(z)}$$

$$Lit(w)$$

$$At(Shakey, x), At(z,x), \cancel{\quad} Tur(z,w)$$

$$\boxed{Turn\ Off(z)}$$

$$\neg Lit(w)$$

Start $\Longrightarrow$ (S)

$s/x_6/start/$

$s/w_6/room3/$

$s/x_5/d_3/$

$At(Sh, x_6), Loc(x_6, w_6), Loc(x_5, w_6), Lit(w_6)$

$Go(x_6, x_5)$

(S) $s/x_4/d_1/$

(S) $s/w_5/corridor/$

(S) (S) $s/w_4/room1/$

$s/x/d_1/$

$s/z/s1/$

$At(Sh, x), At(z, x), Tur(z, r_1)$

$TurnOn(z)$

$At(Sh, x_5), Loc(x_4, w_5), Loc(x_5, w_5), Lit(w_5)$

$Go(x_5, x_4)$

$At(Sh, x_4), Loc(x_4, w_4), Loc(b_2, w_4), Lit(w_4)$

$Go(x_4, b_2)$

(S) $s/x_3/b_2/$

(S) $s/w_3/room1/$

(S) $s/x_3/d_1/$

(S)

$Mov(Box2), At(Box2, x_3), At(Sh, x_3), Loc(x_3, w_3), Loc(x_2, w_3), Lit(w_3)$

$Push(Box2, x_3, x_2)$

(S)

$Mov(Box2), At(Box2, x_2), At(Shakey, x_2), Loc(x_2, w_2), Loc(d_2, w_2), Lit(w_2)$

(S) $s/w_3/room1/$

(S) $s/w_2/corridor/$

(S)

$Push(Box2, x_2, x_1)$

(S)

$Mov(Box2), At(Box2, x_1), At(Shakey, x_1), Loc(x_1, w), Loc(r2, w), Lit(w)$

(S) $s/x_1/d_2/$

(S) $s/w/room2/$

(S)

$Push(Box2, x_1, r2)$

causal Link $\longrightarrow$

$At(Box2, r2)$

Finish

Ex 5.2.)

    a.) $P(toothache) = 0,108 + 0,012 + 0,016 + 0,064$

                         $= 0,2$

  b.)