AI übung

üB5

Ex. 5.1) a)

⚠ always pos. preconditions, no negations in the precond.

On(x,y) Clear(x) Clear(z)

$\boxed{\text{Move}(x,y,z)}$

On(x,z) ¬On(x,y) ¬Clear(z)

On(x,y) Clear(x)

$\boxed{\text{MoveToTable}(x,y)}$

On(x,T) ¬On(x,y) Clear(y)

On(A,B) On(B,C)

$\boxed{\text{Finish}}$

$\boxed{\text{Start}}$

On(A,T) On(B,T) On(C,T)

Clear(A) Clear(B) Clear(C)

b) + c)

step I)

etc.

$\boxed{\text{Start}}$

On(A,T) On(B,T) On(C,T) Clear(A) Clear(B) Clear(C)

← ordering constraint

On(A,B) On(B,C)

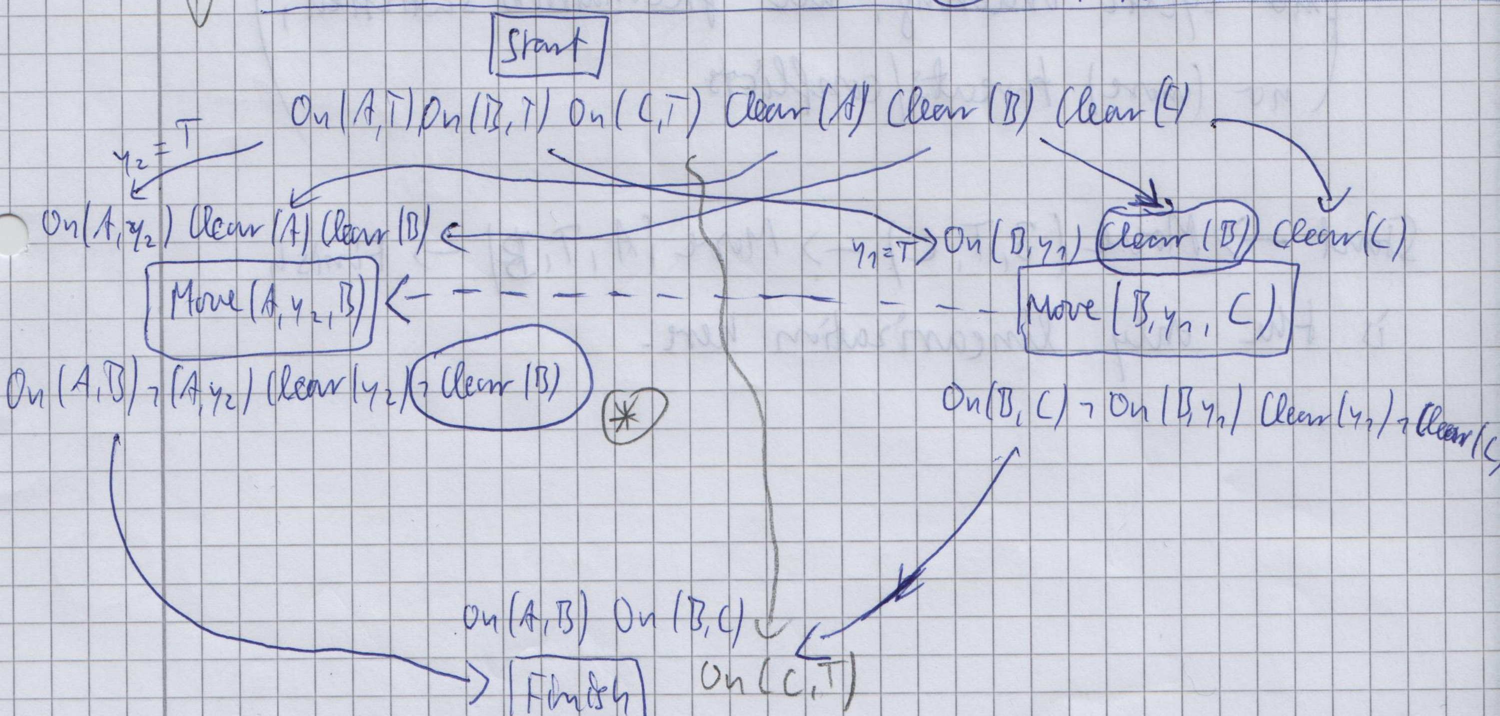
$\boxed{\text{Finish}}$

here: everything in on picture

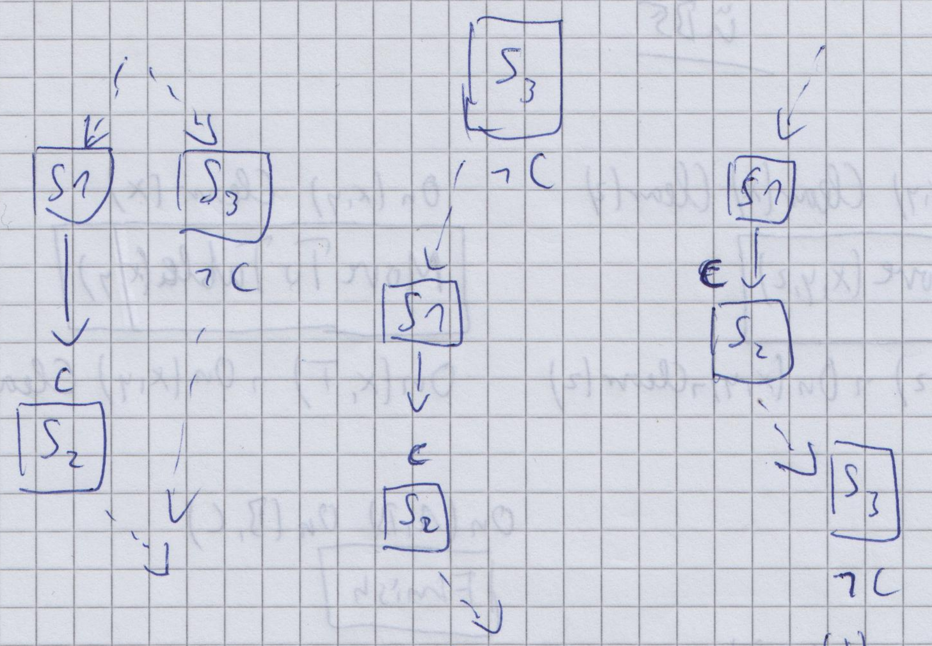
- - - -> ≙ ordering constraint

———> ≙ causal link

◯ ≙ threats



(*) right move is not executable after executing the left move ⇝ therefore: introduce a constraint in order to avoid conflicts.



(a) (b)

<u>Note:</u> Only threat resolution option (b) is possible because you cannot execute Move(A, y_2, B) before start.

$\Rightarrow$ consistent & complete

(no cyclic ordering, all preconditions satisfied, no (more) threats/conflicts)

Start $\rightarrow$ Move(B, T, C) $\rightarrow$ Move(A, T, B) $\rightarrow$ Finish is the only linearization here.

AI übung

ÜB5

Ex 5.2) a)

$P(toothache) = 0{,}108 + 0{,}012 + 0{,}016 + 0{,}064 = 0{,}2$

b) $\mathbf{P}(Cavity) = \langle P(cavity), P(\neg cavity) \rangle$

$= \langle 0{,}108 + 0{,}012 + 0{,}072 + 0{,}008, \underbrace{0{,}016 + 0{,}064 + 0{,}144 + 0{,}576}_{1 - P(cavity)} \rangle$

$= \langle 0{,}2, 0{,}8 \rangle$

c) $\mathbf{P}(Toothache \mid cavity) = \langle P(toothache \mid cavity), P(\neg toothache \mid cavity) \rangle$

$= \left\langle \frac{P(toothache \wedge cavity)}{P(cavity)}, \frac{P(\neg toothache \wedge cavity)}{P(cavity)} \right\rangle$

$= \left\langle \frac{0{,}108 + 0{,}012}{0{,}2}, \frac{0{,}072 + 0{,}008}{0{,}2} \right\rangle = \langle 0{,}6, 0{,}4 \rangle$

d) $P(toothache \vee catch) = 0{,}108 + 0{,}012 + 0{,}072 + 0{,}016 + 0{,}064 + 0{,}144$

$= 0{,}416 \quad (= 1 - (0{,}008 + 0{,}576))$

$\Rightarrow \mathbf{P}(Cavity \mid toothache \vee catch) = \langle P(cavity \mid toothache \vee catch),$
$P(\neg cavity \mid toothache \vee catch) \rangle$

$= \left\langle \frac{0{,}108 + 0{,}012 + 0{,}072}{0{,}416}, \frac{0{,}016 + 0{,}064 + 0{,}144}{0{,}416} \right\rangle$

$= \langle 0{,}4615\ldots, 0{,}5384\ldots \rangle$

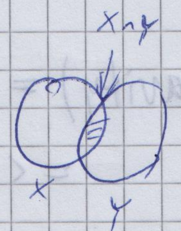
$\mathbf{P}(toothache \mid cavity)$: $P(toothache \mid cavity) \neq 1 - P(toothache \mid \neg cavity)$

Ex 5.3) $P(A|B_i)\cdot P(B_i) = P(A\cap B_i)$ (Product Rule)

~~$P(A\cap B_1)+P(A\cap B_2) =$~~ Axiom 3:

$$P(X\cup Y) = P(X)+P(Y)-P(X\cap Y)$$

$$\Leftrightarrow P(X)+P(Y) = P(X\cup Y)+P(X\cap Y)$$



$$P(A\cap B_1)+P(A\cap B_2) \overset{\text{Axiom 3}}{=} P\Big(\underbrace{[A\cap B_1]\cup[A\cap B_2]}_{A\cap[B_1\cup B_2]}\Big) + \underbrace{P\Big(\underbrace{[A\cap B_1]\cap[A\cap B_2]}_{A\cap[B_1\cap B_2]}\Big)}_{=0}$$

$= 0$ ↑ $P(B_1\cap B_2)=0$ Hint 1

$$= P(A\cap[B_1\cup B_2])$$

$$P(A\cap[B_1\cup B_2]) + P(A\cap B_3) = P([A\cap[B_1\cup B_2]]\cup[A\cap B_3]) + P([A\cap[B_1\cup B_2]]\cap[A\cap B_3])$$

$$= P(A\cap[B_1\cup B_2\cup B_3]) + \underbrace{P([A\cap[B_1\cap B_3]]\cup[A\cap[B_2\cap B_3]])}_{\overset{(*)}{=} P(A\cap[B_1\cap B_3]) \overset{(**)}{=} 0}$$

(*) $P(A\cap[B_2\cap B_3]) = 0$ ↑ $P(B_2\cap B_3)=0$ Hint 1

(**) $P(B_1\cap B_3)=0$ Hint 1

In general: $P(A\cap B_1)+\dots+P(A\cap B_k) = P(A\cap[B_1\cup\dots\cup B_k])$ (***)

$$\Rightarrow P(A\cap B_1)+\dots+P(A\cap B_n) = P(A\cap[B_1\cup\dots\cup B_n]) = P(A)$$

↑ $P(B_1\cup\dots\cup B_n)=1$ Hint 2

Proof of (***): by induction on k

(...)