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Exercise 1

a)

Exercise 2

i)

$\lozenge winter$ <u>oder</u> $\emptyset \bigcup winter$

ii)

$\square awesome$

iii)

$(here \bigcup \emptyset) \bigcup here$

iv)

$((live \wedge hero) \bigcup hero) \vee ((live \wedge hero) \bigcup live)$

v)

$form_1 \bigcirc (day \wedge form_2 \vee kiss \wedge true\_form) \bigcup (kiss \wedge true\_form \bigcirc \square (true\_form \bigcirc (true\_form \wedge day))$

vi)

$\square(in\_debt \rightarrow \lozenge \emptyset)$

vii)

$true$

viii)

$legen \bigcirc (wait\_for\_it \bigcup dairy)$

Exercise 3

φ_1)

$TS \not\models \varphi_1$, because of $\pi_1 = s_2 s_4 s_2 s_4 \ldots$ with $trace(\pi_1) = (\{c\}\{b\})^\omega$ is a counterexample.

φ_2)

$TS \models \varphi_2$, because of there exists no loop in TS only visiting s_1 and s_4, which are the only states not having a c in their label.

φ_3)

$TS \models \varphi_3$, because in order to find a counterexample we have to fulfill the premise so from either s_1 or s_2 we have to move to s_4 and from there we cannot find a neighbor not containing a c in their label.

φ_4)

$TS \not\models \varphi_4$, because for $\pi_4 = s_1 s_4 s_2 s_4 s_2 \ldots$ with $trace(\pi_4) = \{a\}(\{b\}\{c\})^\omega$ is a counterexample.

φ_5)

$TS \models \varphi_5$, because if we start with s_1 this is obviously fulfilled. However if we start with s_2 it is also fulfilled, since $\bigcup$ is defined (slide 35), such that $j \geq 0$. So we can also directly start in the $\Box(b \vee c)$ phase. Since we don't have to a loop towards s_1, which is the only state not fulfilling $b \vee c$, the statement holds.

φ_6)

$TS \not\models \varphi_6$, because of $\pi_6 = s_1 s_4 s_2 s_4 s_2 \ldots$ with $trace(\pi_6) = \{a\}(\{b\}\{c\})^\omega$ is a counterexample

φ_7)

$TS \not\models \varphi_7$, because of $\pi_7 = s_2 s_4 s_2 s_4 \ldots$ with $trace(\pi_7) = (\{c\}\{b\})^\omega$ is a counterexample.