

CS 720, Fall 2016
Homework 7

Due Date: November 2

1. Baier and Katoen, Exercise 5.2.
Explain your answers.
2. Baier and Katoen, Exercise 5.3.
In this exercise, you are just being asked to write down LTL formulas for (a)-(d). You cannot determine if the circuit satisfies the formulas since the circuit is not given.
3. Let φ_1, φ_2 be any two LTL formulas. Which of the following equivalences are correct (that is, they hold no matter what formulas φ_1 and φ_2 are)?
 - (a) $\Box(\varphi_1 \mathbf{U}\varphi_2) \equiv \Box(\varphi_1 \vee \varphi_2)$.
 - (b) $\Box(\varphi_1 \mathbf{W}\varphi_2) \equiv \Box(\varphi_1 \vee \varphi_2)$.
 - (c) $\varphi_1 \mathbf{W}\varphi_2 \equiv \varphi_1 \mathbf{W}(\varphi_1 \mathbf{W}\varphi_2)$;
 - (d) $\bigcirc\Diamond\varphi_1 \equiv \Diamond\varphi_1$.

When the two formulas are not equivalent, give a specific example of formulas for the φ_i 's and a trace that satisfies one of the formulas but not the other.

4. Consider a new temporal operator \mathbf{L} where $\varphi\mathbf{L}\psi$ means that φ holds as long as ψ holds. Formally, $A_0A_1\cdots \models \varphi\mathbf{L}\psi$ if and only if for every $i \geq 0$ if $A_jA_{j+1}\cdots \models \psi$ for all j with $0 \leq j \leq i$, then $A_jA_{j+1}\cdots \models \varphi$ for all j with $0 \leq j \leq i$.

Give an expansion law for \mathbf{L} .

5. Baier and Katoen, Exercise 5.9a.