TU Braunschweig
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Out: January 24 Due: January 30

Submit your solutions until Wednesday, January 30, 12:00am.

Exercise 1

Consider two traces $\tau = \alpha.a.b.\gamma$ and $\tau' = \alpha'.a.\beta.b.\gamma'$ where $\text{thread}(c) \neq \text{thread}(a)$ and $\text{thread}(c) \neq \text{thread}(b)$ for all c in β. Prove the following:

$$\text{If } a \rightarrow_{\text{hb}} b \text{ in } \text{Tr}_{\text{TSO}}(\tau) \text{ then } a \rightarrow_{\text{hb}}^{+} b \text{ in } \text{Tr}_{\text{TSO}}(\tau')$$

Exercise 2

Consider the following program implementing an instance of the **non-blocking write** protocol by H. Kopetz and J. Reisinger:

Thread 1	Thread 2
ℓ_1 : $h \leftarrow mem[g];$ goto ℓ_2	ℓ_9 : $h \leftarrow mem[g];$ goto ℓ_{10}
ℓ_2 : $mem[g] \leftarrow h + 1;$ goto ℓ_3	ℓ_{10} : $mem[g] \leftarrow h + 1;$ goto ℓ_{11}
ℓ_3 : $mem[x] \leftarrow 42;$ goto ℓ_4	ℓ_{11} : $mem[x] \leftarrow 43;$ goto ℓ_{12}
ℓ_4 : $mem[g] \leftarrow h + 2;$ goto ℓ_5	ℓ_{12} : $mem[g] \leftarrow h + 2;$
ℓ_5 : $r \leftarrow mem[g];$ goto ℓ_6	
ℓ_6 : $v \leftarrow mem[x];$ goto ℓ_7	
ℓ_7 : $s \leftarrow mem[g];$ goto ℓ_8	
ℓ_8 : assert $r \neq s \lor r$ is odd; goto ℓ_5	
ℓ_8 : assert $r = s \land r$ is even;	

Note that there are two instructions labeled by ℓ_8. Assume that when executing goto ℓ_8, the execution non-deterministically jumps to any of them.

Prove that the program is not robust under TSO. Initially assume $mem[g] = 0$ and $g \neq x$.

Exercise 3

Consider a computation $\tau = \tau_1.act_1.\tau_2 \in \text{C}_{\text{SC}}(P)$ where for all act_2 in τ_2 we have $act_1 \rightarrow_{hb}^{*} act_2$. Show that the computation $\tau.act$ satisfies $act_1 \rightarrow_{hb}^{*} act$ if and only if

1. there is an action act_2 in $act_1.\tau_2$ with $thread(act_2) = thread(act)$, or
2. act is a load whose address is stored in $act_1.\tau_2$, or
3. act is a store (with issue) whose address is loaded or stored in $act_1.\tau_2$.