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Summer term 2013
Problem Set 6
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Verification

Problem 1: Intersection of Büchi Automata [4 Points]

Provide NBA $\mathcal{A}_1$ and $\mathcal{A}_2$ for the languages given by the expressions $(AC+B)^*B^\omega$ and $(B^*AC)^\omega$ and apply the product construction (using GNBA) to obtain an NBA $\mathcal{A}$ with $\mathcal{L}_\omega(\mathcal{A}) = \mathcal{L}_\omega(\mathcal{A}_1) \cap \mathcal{L}_\omega(\mathcal{A}_2)$.
Justify, why $\mathcal{L}_\omega(\mathcal{G}) = \emptyset$ where $\mathcal{G}$ denotes the GNBA accepting the intersection.

Problem 2: Fairness [2 Points]

Consider the transition system TS shown in Figure 1 with the set of atomic propositions $\{a\}$.

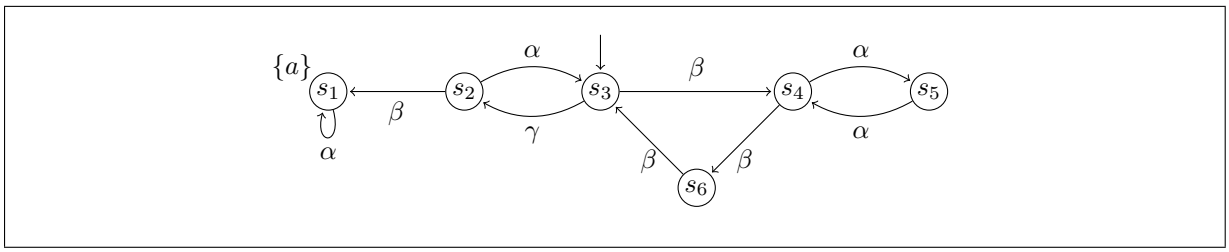

Figure 1: Transition system TS

Let the fairness assumption

$$\mathcal{F} = (\emptyset, \{\{\alpha\}, \{\beta\}\}, \{\{\beta\}\})$$

determine whether $TS \models_{\mathcal{F}}$ "eventually a". Justify your answer!

The following exercises belong to the afternoon session.

Problem 3: Model Checking with SPIN [10 Points]

Program TRY-MUX1 of Figure 2 is suggested as a tentative solution to the mutual exclusion problem. For this exercise we will use the Model Checker SPIN (`http://spinroot.com`) to automatically verify some of last week's properties. For now, use assertions appropriately to verify the presence of path or the absence of a path in the system.

(a) Implement TRY-MUX1 in Promela. Check basic functionality using simulation runs and printf-statements. [4 Points]

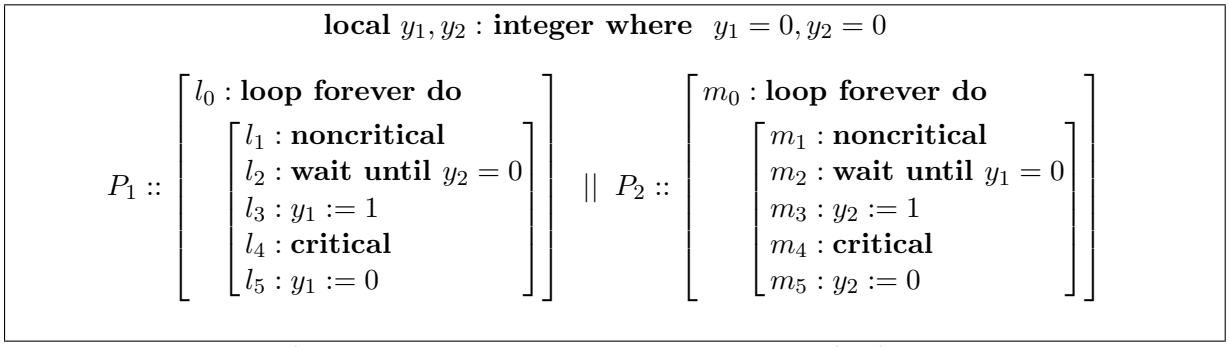

Figure 2: Program TRY-MUX1: proposed solution.

(b) Verify that both critical regions are accessible, i.e. that there exist paths to the critical regions of P1 and P2. [1 Point]

(c) Verify the mutual exclusion property. [2 Point]

(d) Answer questions (b) and (c) for a modified version of the program, TRY-MUX2, in which statements l_2 and l_3 are interchanged and so are statements m_2 and m_3. [3 Points]

Be prepared to demo your verification runs in the morning discussion slot on tuesday, either on your own laptop or by sending us all necessary files.