T-79.186 **Spring 2003**
Reactive Systems
Home Exercise 2
Deadline 4.2-2003 8:45

Return your answer by email (Postscript or PDF) to Timo Latvala at Timo.Latvala@hut.fi, or on paper to the lecture. All rounds will be 6 points maximum.

Please remember to include your name and student number to your answer.

For this home exercise round use the definition of automata as given by Chapter 1 of the book Bérard et al.: Systems and Software Verification, (pages 5-26).

1.) a) Give an automata description $\mathcal{A}_3$ (without using variables in the automata) for a modulo 3 counter, which has the following two actions: (i) `dec` decreases the value of the counter by one (mod 3), and (ii) `inc2` increases the value of the counter by two (mod 3). The automaton should start in a state with a counter value 0.

b) Give another automaton $\mathcal{A}_4$, which is a modulo 4 counter, and also has the actions `dec` and `inc2` (both mod 4).

c) Create the synchronized product automaton $\mathcal{P}$, which is the synchronization $\mathcal{A}_3 \times \mathcal{A}_4$ using the synchronization set $Sync = \{(\texttt{dec}, \texttt{inc2}), (\texttt{inc2}, \texttt{dec})\}$. (Also giving only the reachable states suffice.)

2.) a) In the book (Berard et al., pages 21–23) an elevator system is described, which is a synchronized product of five automata (3 doors, a cabin, and a controller). Give a partial execution of the system (starting from the initial state), which ends in any state in which the controller is in state `free2`.

Note that the book has the following off-by-one errors in the definition of set *Sync* on page 23: The numbering of doors should be from 0 to 2 instead of from 1 to 3 as in the (buggy) definition of *Sync* in the book.

b) Give the set of reachable states of the Petersons MUTEX-algorithm (Berard et al., pages 25–26).