Return your answers by email to Timo.Latvala@hut.fi, or on paper to the lecture.

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.

1.) (a) Give an automata description $A_3$ (without using variables) for a modulo 3 counter, which has the following actions: (i) $\text{dec}$ decreases the value of the counter by one (mod 3), and (ii) $\text{inc2}$ increases the value of the counter by two (mod 3). In the initial state of the automaton the value of the counter should be 0.

(b) Give another automaton $A_4$, which is a modulo 4 counter, and also has the actions $\text{dec}$ and $\text{inc2}$.

(c) Compute the synchronised product automaton $P = A_3 \times A_4$ using the synchronisation set $\text{Sync} = \{(\text{dec}, \text{inc2}), (\text{inc2}, \text{dec})\}$.

2) (a) In the book (Bérard et al., pages 21–23) an elevator system is described that is a synchronised product of five automata (3 doors, a cabin, and a controller). Give a partial execution of $P$, which ends in any state where the controller is in the state $\text{free2}$.

Note that the book has the following off-by-one errors in the definition of the set $\text{Sync}$ on page 23: the numbering of the doors should be from 0 to 2 instead from 1 to 3 as in the (faulty) definition of $\text{Sync}$ in the book.

(b) Give the set of reachable states of Peterson’s MUTEX-algorithm (Bérard et al., pages 25-26).