1.) (a) Give an automata description $A_3$ (without using variables) for a modulo 3 counter, which has the following 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). 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 $dec$ and $inc2$.

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

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 $free2$.

Note that the book has the following off-by-one errors in the definition of the set $Sync$ 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 $Sync$ in the book.

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