Laboratory for Theoretical Computer Science — Tutorial 5

T-79.231 Parallel and Distributed Digital Systems — 24th October 2003

1. For each LTL formula shown below, give a finite automaton where the formula holds in the initial state and an automaton where the formula does not hold. State the which propositions hold in which states.

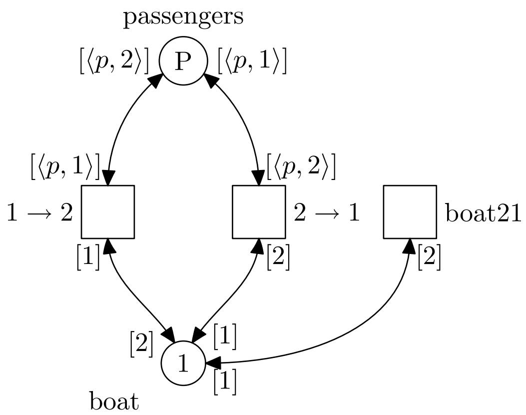
   (a) $\Box(p \rightarrow \Diamond q)$

   (b) $(p \,\mathsf{U}\, q) \vee (\Box \neg q)$

   (c) $\Box\Diamond p$

   (d) $\Diamond p \rightarrow (\neg p \,\mathsf{U}\, q)$

2. Consider the following algebraic net modelling the ferryman's problem. Present LTL formulae for the following properties. Do the formulae hold in the model? If not, give a counterexample.



   (a) All passengers reach the opposite shore

   (b) The wolf eats the goat

   (c) It is not possible that any of the passengers will be eaten

3. Solve the following problem with modulo 22 arithmetics:
   Traverse all numbers $0 \leq i \leq 21$ by doing 22 additions in modulo 22 arithmetics. The numbers in the additions are restricted in such a way that only some numbers are allowed, and even then only a restricted number of times. The numbers allowed are: 18 three times, 17 five times, 14 four times, 8 three times, 6 three times, and 5 four times. Start the additions from 0.

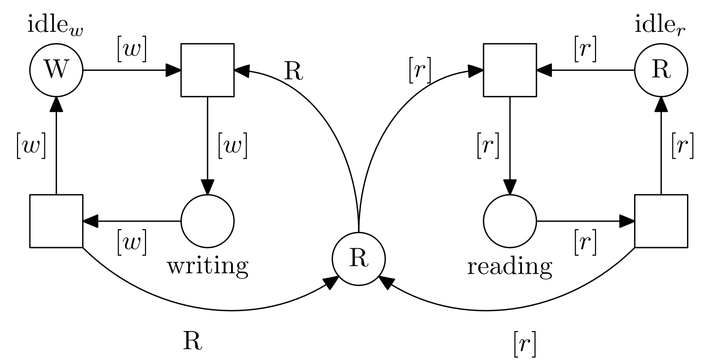
   (a) Design an algebraic net to solve the problem

   (b) Write a Maria description of the net

   (c) Use a reject statement to find a solution

   (d) From a computational point of view, was this a sensible approach to solving the problem?

4. A demonstration whose parts b) and c) are beyond the scope of the course. Below is presented a net modelling a reader/writer problem. Let $W = [1]$ ja $R = [1, 2]$.



   (a) Perform reachability analysis for the net

   (b) Construct a Büchi automaton corresponding to the reachability graph with atomic propositions are p = "reader 1 is reading" and q = "reader 2 is reading"

   (c) Model check the formula $\Diamond(p \wedge q)$.