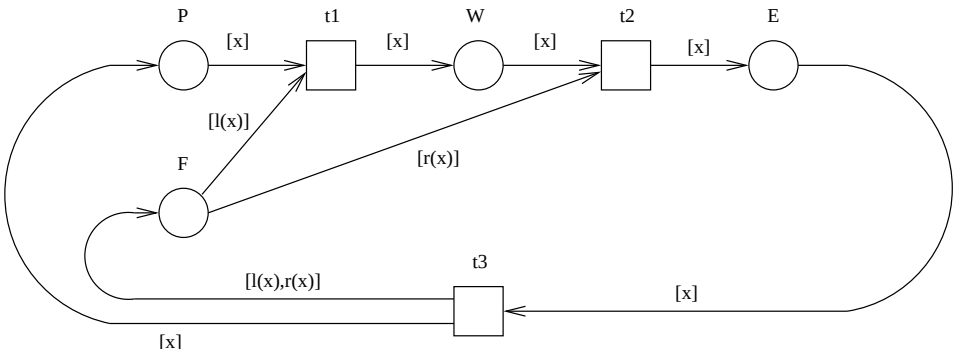
Department of Computer Science
Laboratory for Theoretical Computer Science
T-79.231 Parallel and Distributed Digital Systems

Tutorial 6
Oct 28th 2002

1. A solution to the 3 philosophers problem is given below:



Where the initial marking is $P = [ph_1, ph_2, ph_3]$, $F = [f_1, f_2, f_3]$ ja $l(ph_i) = f_i$, $r(ph_i) = f_{(i \bmod 3)+1}$.

Give the LTL formulae with which you can verify the properties given below. Give the formulae also in a form which can be input to Maria.

   (a) Two neighbouring philosophers cannot eat at the same time.
   (b) There exists a state where the philosopher ph_1 is dining.
   (c) The philosopher ph_1 may starve.
   (d) If the philosopher ph_1 us dining, the forks f_1 and f_2 are not free.
   (e) If the forks f_1 and f_2 are not free, the philosopher ph_1 is dining.

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

3. Demonstration which beyond the scope of the course. Let us examine again the dining philosophers net presented in the beginning of this tutorial:

   (a) Perform reachability analysis on the net.

   (b) Construct a Büchi automaton corresponding the reachability graph when the atomic propositions are $p =$ "Philosopher 1 is eating".

   (c) Do the model checking of the LTL formula $\Diamond p$ using the synchronous product of the formula and graph automata.