

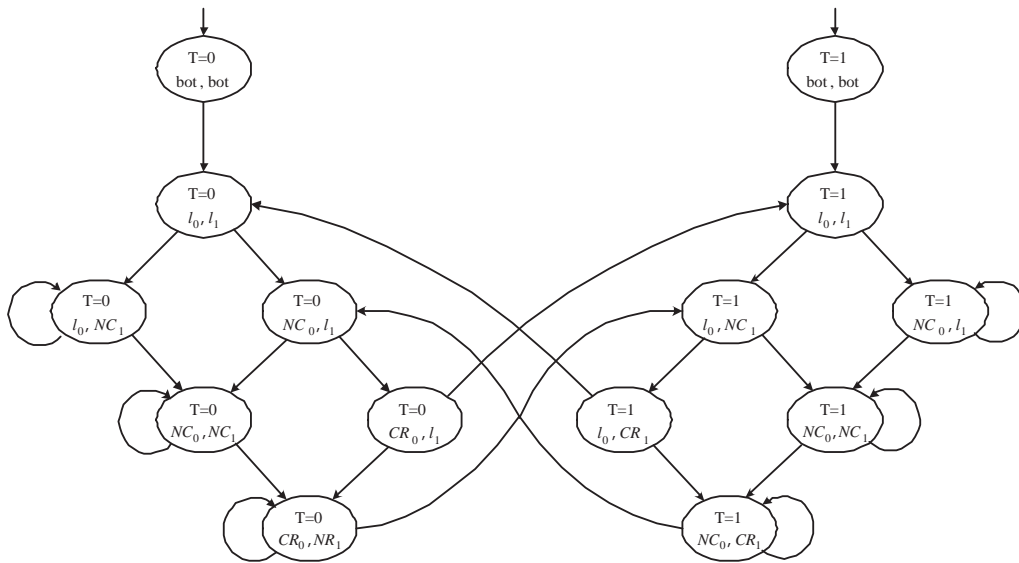
Homework Assignment #1

Note

This assignment is due 12:20PM Thursday, March 26, 2015. Please write or type your answers on A4 (or similar size) paper. Late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers is strictly forbidden.

Problems

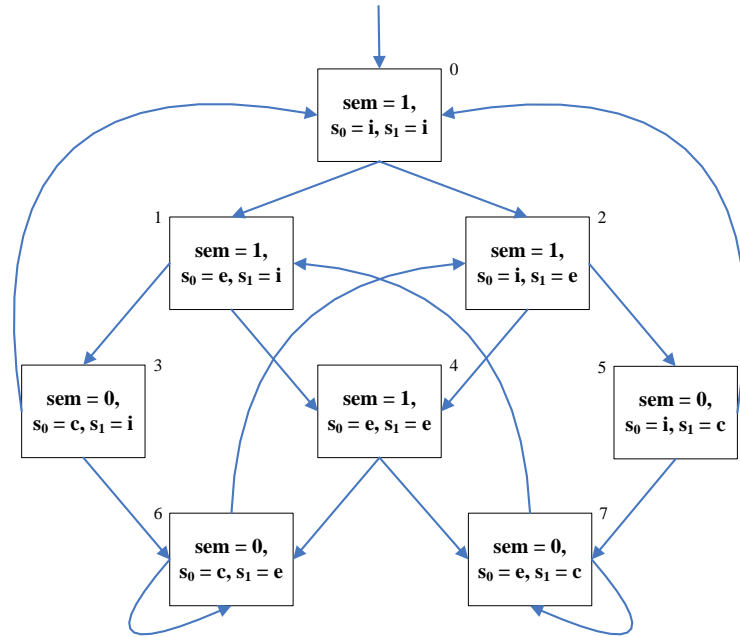
- (60 points) Consider model checking the CTL property $\mathbf{AG}((at\ l_0) \rightarrow \mathbf{AF}(at\ CR_0))$ (using the CTL model checking procedures in Chapter 4.1 of [CGP]) against the following Kripke structure which represents a two-process mutual exclusion algorithm using an atomic read/write variable.



(Source: redrawn from [CGP, Fig 2.2])

Please illustrate the steps of labeling the states with sub-formulae during the execution of the model checking algorithm. As you will see, the property does not hold (i.e., there is possibility of starvation). What fairness constraints should be added?

- (40 points) Consider another two-process mutual exclusion algorithm via the arbitration of a binary semaphore. The Kripke structure representing this system is as follows.



Check if the system at state 1 satisfies the LTL formula $\mathbf{A}((s_0 = e) \mathbf{U} (s_0 = c))$ (using the LTL model checking procedures in Chapter 4.2 of [CGP]). Please illustrate the model checking steps by giving the closure of the formula, relevant parts of the product graph (composed from the Kripke structure and the implicit tableau), etc.