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Advanced Model Checking
Summer term 2009

– Series 12 –

Hand in before July 27'th.

Exercise 1 (0 points)

Consider two parallel processes, A and B, each of which can be in 3 states, say $\{0, 1, 2\}$, and is initially in state 0. Periodically, each process can (independently) receive a request that requires action. When this occurs, a process moves to state 1. A third process C will observe that process A or B is in state 1 and take the request to be executed. When this occurs, A or B moves to state 2. When A and B are both in state 1, process C selects either A or B at random (with equal probability). From state 2, A or B moves back to state 0.

a) Draw an MDP with state space $\{0, 1, 2\} \times \{0, 1, 2\}$ representing the system described above.

b) Give a PCTL formula to express the statement "if either of the two processes is in state 1, then with probability 1, both processes will eventually be simultaneously in state 0". Is this statement true? Justify your answer.

c) Give PCTL* formulae for the statements "with probability 1, process A is in state 2 infinitely often" and "with probability 1, a process is in state 2 infinitely often". Are these formulae satisfied in all states of the model? Justify your answer.

Exercise 2 (0 points)

Show whether each of the two PCTL formulae below is *satisfiable*. That is, either provide an example of an MDP for which at least one state satisfies the formula, or prove that this is impossible.

a) $\mathrm{P}_{>0.5}[\,\mathrm{X}\,a\,] \wedge \mathrm{P}_{<0.5}[\,\mathrm{F}\,a\,]$

b) $\neg\mathrm{P}_{\leq 0.6}[\,\mathrm{X}\,a\,] \wedge \neg\mathrm{P}_{\geq 0.4}[\,\mathrm{F}\,a\,]$