Randomized Scheduler Example (SPIN 2010)

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For the class of strongly distributed schedulers it may be the case, that the maximal or minimal reachability probability can not be attained by a deterministic scheduler, i.e. a scheduler that always chooses one action/component with probability one. We use a small example of such an I/O-IPC as depicted by Fig. 4 in [2]. In this example the maximal reachability probability for deterministic strongly distributed schedulers is $\frac{1}{2}$, while there exists a randomized strongly distributed scheduler with reachability probability $\frac{13}{24}$.

Table 1 shows the results of applying *PARAM* 2.0α [1], run on a 3GHz computer with 1GB of memory, to this example. We see that we can find a scheduler with maximal reachability probability 0.545, which is even greater than $\frac{13}{24}$. Note that we can express the maximal reachability probability as a time-bounded property because the example is acyclic. However, for this case, the result from *MATLAB* depends on the initial assignment given to the solver. For certain initial assignments the solver returns a maximal probability of only 0.500, indicating that further investigation is required in the appropriate nonlinear programming tool for our algorithm.

PMC			*PARAM*		NLP		
$\#S$	$\#T$	$\#V$	Time (s)	Mem (MB)	$\#V$	Time (s)	Pr
13	23	12	0.0396	1.39	11	0.241	0.545

Table 1: Results of Randomized Scheduler Case Study (For certain settings *MATLAB* reports a maximal probability of 0.500)

References

[1] Georgel Calin, Pepijn Crouzen, Pedro R. D'Argenio, Ernst Moritz Hahn, and Lijun Zhang. Time-Bounded Reachability in Distributed Input/Output Interactive Probabilistic Chains. In *SPIN*, pages 193–211, 2010.

[2] Sergio Giro and P. R. D'Argenio. On the expressive power of schedulers in distributed probabilistic systems. *ENTCS*, 253(3):45–71, 2009.