



A Petri Net – based solution to ARGESIM Comparison C10 ‘Dining Philosophers II’ using MATLAB and PetriSim

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Simulator. This comparison solution was performed with a MATLAB toolbox “PetriSim”, which is freely available. This toolbox offers a GUI for modelling classical and timed state / transition Petri nets and three operation modes: net analysis (P/T invariants, coverability tree, etc.) for S/T nets, simulation with conflict resolution strategies for S/T nets, and time simulation with conflict resolution, prioritisation and control of firing sequences for timed S/T nets.

Petri Net model. Five philosophers are sitting around a table. They are all going through the same cycles, starting with a thinking-phase, followed by a hungry state and then eating-phase (Figure 1). The problem is that every philosopher needs two chopsticks to eat, but between the philosophers it is only one available: each philosopher must share chopsticks with his neighbours, leading to simultaneous access to the same chopstick and occurrence of deadlock.

Task a: Single simulation run. Time for thinking and eating follows a discrete uniform distribution in the interval (1,10), whereby for modelling timed S/T nets were used. The toolbox allows gathering statistical data from a simulation, given in Table 1.

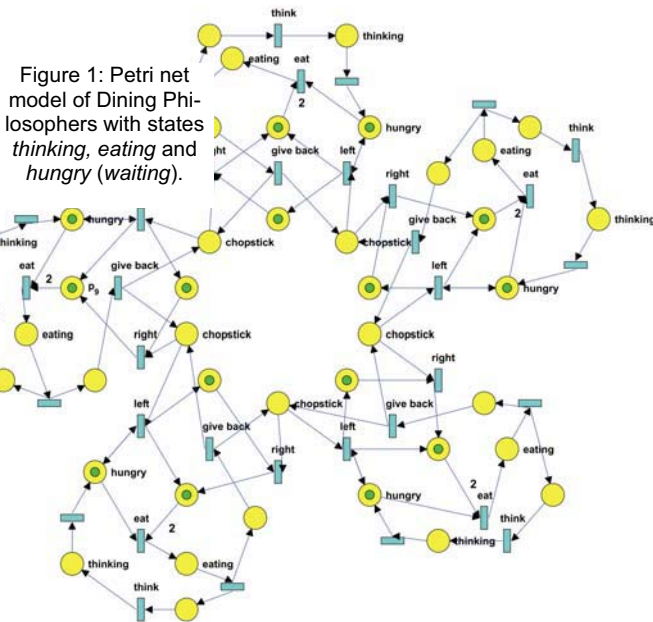


Figure 1: Petri net model of Dining Philosophers with states thinking, eating and hungry (waiting).

	thinking	eating	waiting		util.
P1	5,50+/- 2,87	5,44+/- 2,86	11,50+/- 8,08	C1	92,07%
P2	5,48+/- 2,86	5,51+/- 2,86	11,46+/- 8,04	C2	91,73%
P3	5,54+/- 2,87	5,51+/- 2,85	11,39+/- 8,08	C3	91,95%
P4	5,52+/- 2,87	5,44+/- 2,85	11,53+/- 7,95	C4	91,84%
P5	5,50+/- 2,90	5,56+/- 2,89	11,45+/- 8,04	C5	91,86%
all	5,50+/- 2,87	5,49+/- 2,86	11,47+/- 8,04	all	91,89%

Table 1: Results Average times (+/- standard deviation) of thinking, waiting and eating periods; rate of chopstick utilisation:

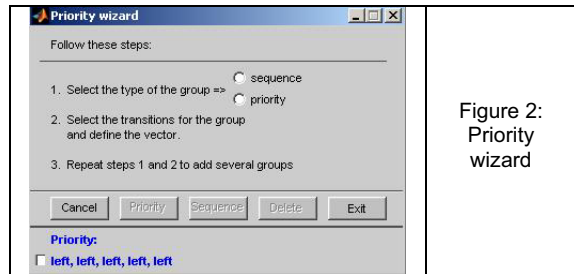


Figure 2: Priority wizard

Task b: Simultaneous access. In a simultaneous access situation the philosopher sitting on the right gets the chopstick first and the philosopher to his left must wait. In the Petri net model this was realized with the prioritisation wizard (Figure 2). In case of a conflict the transitions which take the left chopsticks are higher prioritized than those which take the right chopsticks.

Task c: 50 Simulation runs – deadlock detection. Due to the Petri net basis the simulation ends if a deadlock occurs. Therefore the deadlock detection is the end of the simulation.

In the present version the PetriSim toolbox is relatively slow, so that 50 simulation runs until a deadlock do not seem practicable

C10 Classification: Petri Net Approach
Simulator: MATLAB Rel.14, PetriSim Toolbox

