## Milner's scheduler (Esparza/Meyer TUM)

We want to specify a simple scheduler for a set of n agents P1, …, Pn. Each agent Pi performs a task repeatedly, and the scheduler is required to ensure that they begin the task in cyclic order starting with P1. The different task-performances need not exclude each other in time - for example P2 can begin before P1 finishes, but the scheduler is required to ensure that each agent finishes one performance before it begins another.

We assume that Pi requests task initiation by an action ai and signals completion by an action bi. The scheduler can then be specified by requiring that:

* It must perform a1,...,an cyclically, starting with a1.
* It must perform ai and bi alternately, for each i.

However, a scheduler which imposes a fixed sequence, say a1b1a2b2... is not good enough, the scheduler must allow any sequence of actions compatible with the two conditions above. For example, for n=2, the sequences a1a2b1b2a1 and a1b1a2a1b2b1 are compatible with the specification, but the sequences a1b1a1 and a1b1a2a1a2 are not.

1. For n=2 agents, give a Petri net which models a scheduler satisfying the given requirements. The Petri net must have transitions {a1,a2,b1,b2} from T. Firing one of these transitions is equivalent to the execution of the corresponding actions. Further, for any firing sequence σ enabled at M0, the requirements above must hold when interpreting the firing sequence as a sequence of actions. The Petri net may also have additional transitions, which do not correspond to an action and may occur at any time. The Petri net should also be live and bounded.
2. How many reachable markings does the Petri net have?
3. How can this solution be generalized to any number of n agents?
4. How does the number of reachable markings grow as n increases?