CIS 525 Software Development of Parallel and Distributed Systems

Three properties of Petri nets: Reversibility, Boundedness, and Liveness

1. REVERSIBILITY of Petri net with initial marking (N, m_0):

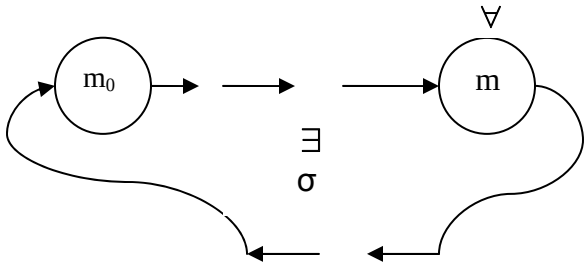

Figure 1. Illustration of the definition of reversibility of Petri net.

Petri net N with initial marking (N, m_0) is reversible $\Leftrightarrow$

$$\forall_{m \in RG(m_0)} \; \exists_{\sigma} \quad s.t. \quad m \xrightarrow{\sigma} m_0$$

Fact: From every reachable marking $m \in RG(N, m_0)$ there is a sequence of actions that reverses the sequence that lead us to m.

2. BOUNDEDNESS of Petri net with initial marking (N, m_0):

(N, m_0) is **bounded** if all the places are bounded.

Place P is **bounded** in (N, m_0) if and only if $m(p) < \infty$

3. LIVENESS of Petri net with initial marking (N, m_0):

Net (N, m_0) is **live** if all transitions are live. Transition t is **live** in (N, m_0) if and only if

$$\forall_{m \in RG(m_0)} \; \exists_{\sigma} \quad s.t. \quad m \xrightarrow{\sigma t} m'$$

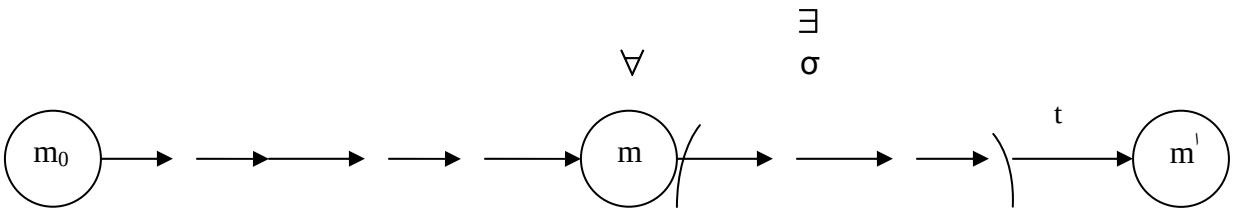

Figure 2. Illustration of the definition of live transition.

4. A HOME STATE:

m ϵ RG (N, m_0) is a **home state** ⇔

$$\forall_{m' \in RG(m_0)} \; \exists_{\sigma} \quad s.t. \;\; m' \xrightarrow{\sigma} m$$

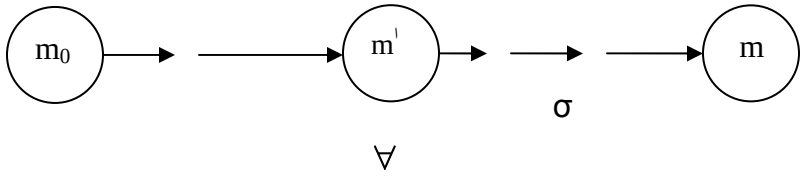

Figure 3. Illustration of the definition of home state.

THE LOAN PROTOCOL:

L = apply**.** (est1**.** grant + est2**.** refuse + est3**.** (grant + refuse))

Abstracting from estimate:

$\bar{L}$ = apply**.** (τ**.** grant + τ**.** refuse + τ**.** (grant + refuse))

Omitting τ:

$\bar{L}$ = apply (grant + refuse + (grant + refuse)) ≡

apply**.** (grant + refuse)

different moments of choice

External choice a + b (influenced from outside organization)

Internal choice τ**.** a + τ**.** b (decision taken within organization)

↓

Importance of where the point is taken