Construction of NFHA from TDTA: FCNS Encoding of unranked trees

June 13, 2013

1 The problem

Given a BUTA $\mathcal{A} = (Q, \Sigma \cup \{\#\}, \delta, F)$, construct a NFHA $\mathcal{A}'$ s.t. $\mathcal{L}(\mathcal{A}') = \mathrm{fcns}^{-1}(\mathcal{L}(\mathcal{A}))$.

2 The solution

The intuition of the construction of the NFHA $\mathcal{A}'$ is to define horizontal languages of a node v as a simulation of the partial run of $\mathcal{A}$ over the subpath $v01^*$.

The NFHA $\mathcal{A}' = (Q', \Sigma, \delta', F')$ is defined as follows.

- $Q' = Q \times Q$: The first component denotes the state of $\mathcal{A}$ assigned to a node, and the second component denotes the state assigned to the right child of the node,
- $F' = \{(q_1, q_2) \mid q_1 \in F, (\#, q_2) \in \delta\}$,
- δ' is defined as follows: For every pair $(a, (p_1, p_2)) \in \Sigma \times Q'$, $R_{(a,(p_1,p_2))} \subseteq (Q')^*$ is defined as follows:
  - If there exist $q \in Q$ s.t. $(\#, q), (q, p_2, a, p_1) \in \delta$, then $\varepsilon \in R_{a,(p_1,p_2)}$,
  - For every state sequence $(q_1, q_1') \ldots (q_n, q_n')$ $(n \geq 1)$, $(q_1, q_1') \ldots (q_n, q_n') \in R_{a,(p_1,p_2)}$ iff it satisfies the following conditions,
    * $\forall i : 1 \leq i < n$, $q_i' = q_{i+1}$,
    * $(q_1, p_2, a, p_1) \in \delta$,
    * $(\#, q_n') \in \delta$.