

Pushdown automaton criterion for completeness of coverability sets

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1 Introduction

Consider a set of nodes , S for which we need to check completeness for a given Petri Net P . Also , consider another set I of nodes. We aim to construct a pushdown automaton ξ to verify the completeness of the set S as the coverability set for P .

2 Construction

2.1 Start State

There is only one start state labelled "Start".



2.2 Set of States

The set of states comprise of the following

1. The start state (discussed in the earlier section)
2. The set of states - S
3. The set of states - I

2.3 Acceptance and Final states

A word is accepted if a run on the word ends in an empty stack and a state belonging to the set S . Thus , the set of final states is S and acceptance is by empty stack.

2.4 Input Alphabet

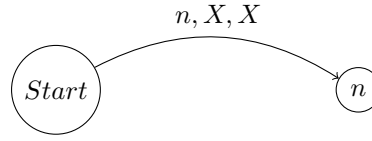
The input alphabet is the set of nodes(their names/symbols) belonging to set S and the set of transitions of the Petri Net P .

2.5 Stack Alphabet

The set of Transitions(their names/symbols).

2.6 Transitions

1. From the start state, for every node alphabet(i.e. alphabets which represent nodes in S), We have a transition from the start state to the node represented by the alphabet. No change is affected in the stack.

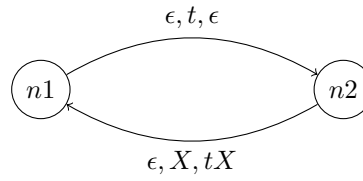


These are the only transitions from the start state.

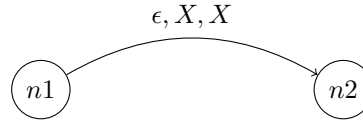
Also after this point ,in our context we do not expect any input letters from the alphabets representing nodes in S.

2. The label of n_2 is exactly $n_1 + \text{Action}(t)$.

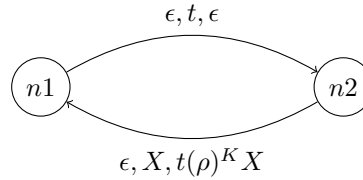
- The transition from n_1 to n_2 : t is popped out from the stack. Nothing is pushed.
- The transition from n_2 to n_1 : t is pushed to the stack. Nothing is popped.



3. The label of $n_2 \geq n_1$. No change is affected in the stack in this case.



4. The label of n_2 is $n_1 + \text{Action}(t)$, with extra Ω in some places.



Where $\rho \in T^*$ & $\text{Action}(\rho)$ yields positive tokens in the places where Ω are put and 0 elsewhere , for all $K \geq K_0$ (for a given K_0).

T is the set of transitions.

2.7 Initial Stack Alphabet

Initially , the stack is empty.