Target Based Accepting Networks of Evolutionary Processors with Regular Filters

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Workshop on Non-Classical Models of Automata and Applications
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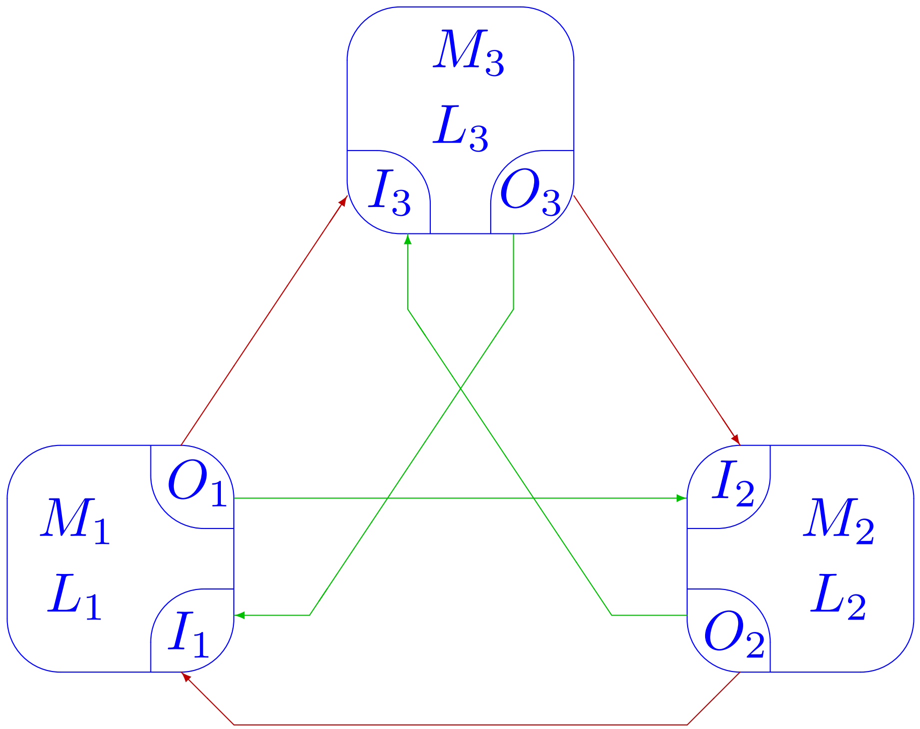
Introduction



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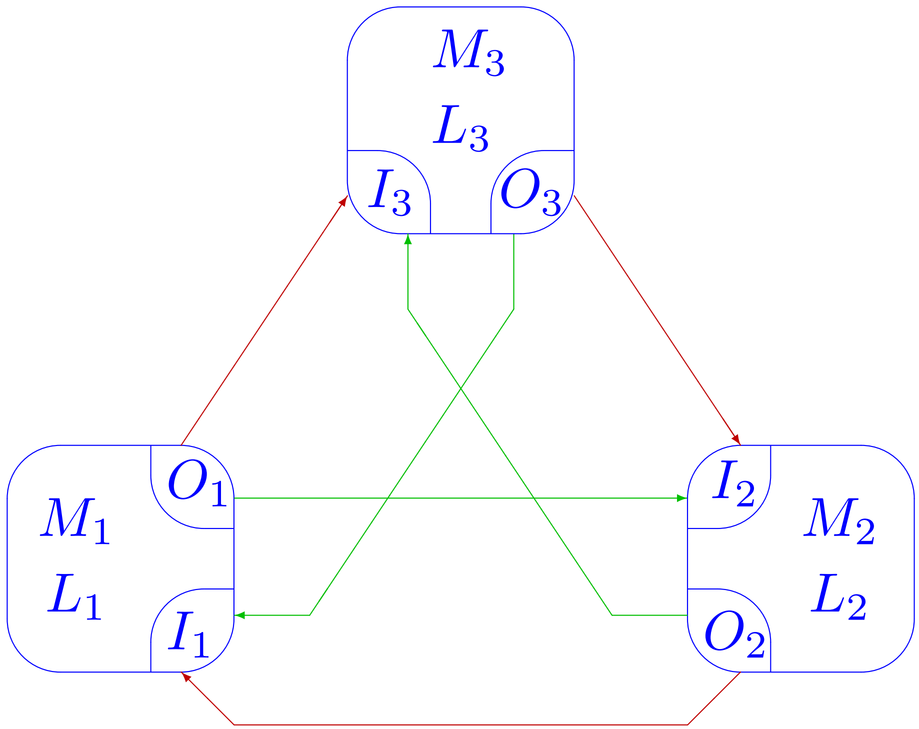

- E. Csuhaj-Varjú, A. Salomaa: In *New Trends in Formal Languages*, 1997
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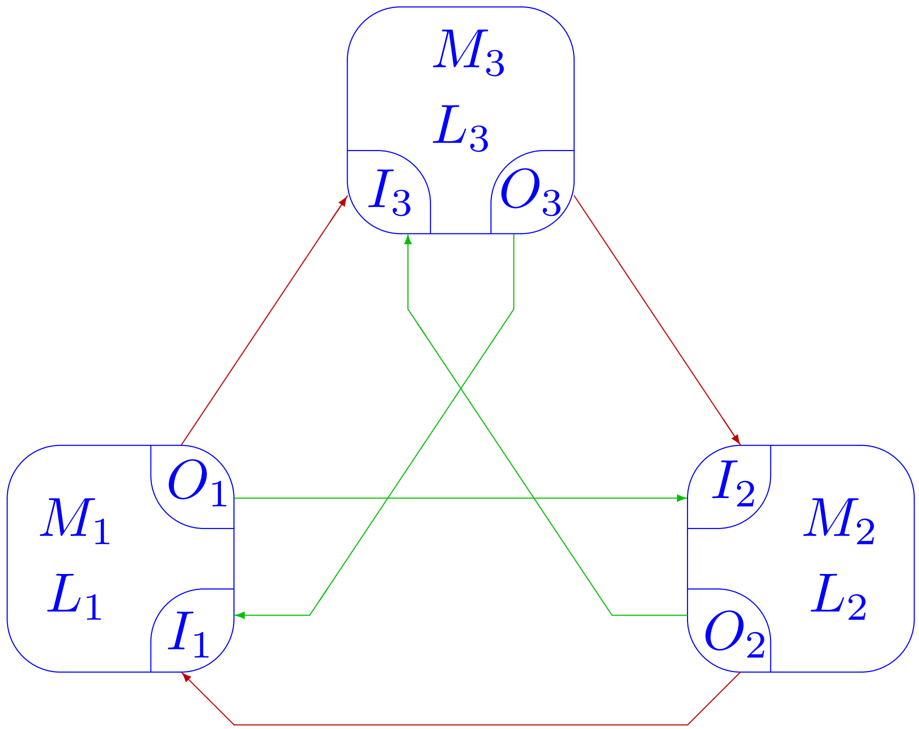

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- A. Alhazov, J. Dassow, C. Martín-Vide, Y. Rogozhin, B. Truthe: Fundamenta Informaticae 91 (2009)
- J. Dassow, V. Mitrana: NCGT'08
- V. Mitrana, B. Truthe: LATA'09

Definitions

ANEP: $\mathcal{N} = (U, V, N_1, N_2, \ldots, N_n, E, j, O)$

Processor: $N_i = (M_i, I_i, O_i)$

substituting: $M_i \subseteq \{ a \to b \mid a, b \in V \}$
deleting: $M_i \subseteq \{ a \to \lambda \mid a \in V \}$
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Evolution: $C_{2t}^w(i) \Longrightarrow^{M_i} C_{2t+1}^w(i)$

Communication: $C_{2t+2}^w(i) = C_{2t+1}^w(i) \setminus O_i \cup \bigcup_{(k,i) \in E} C_{2t+1}^w(k) \cap O_k \cap I_i$

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Language accepted: $L(\mathcal{N}) = \{ w \in U^* \mid \exists t \geq 0\, \exists o \in O : C_t^w(o) \neq \emptyset \}$

Previous Work

Theorem: *For accepting any context-sensitive language, one substituting processor and one output processor are sufficient.*

- B. Truthe, V. Mitrana: In LATA 2009, *LNCS 5457*, 2009

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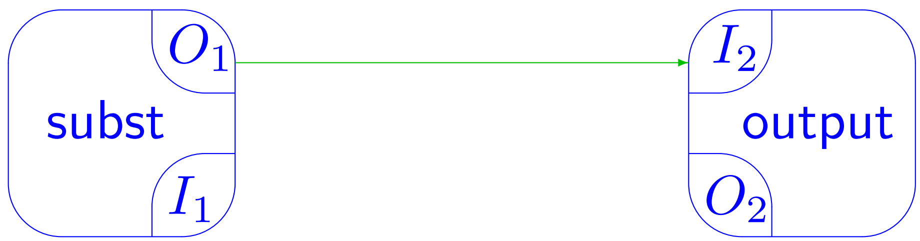

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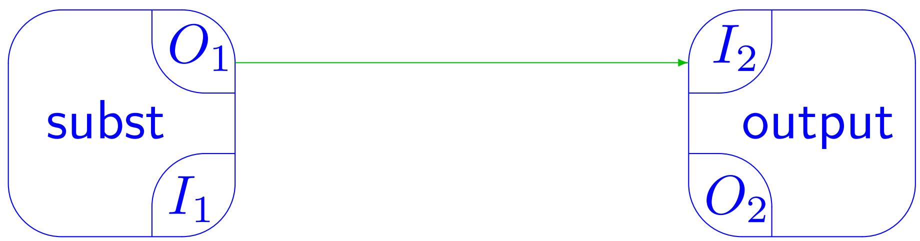

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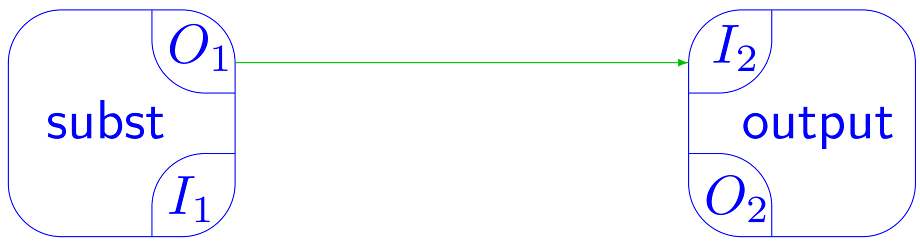

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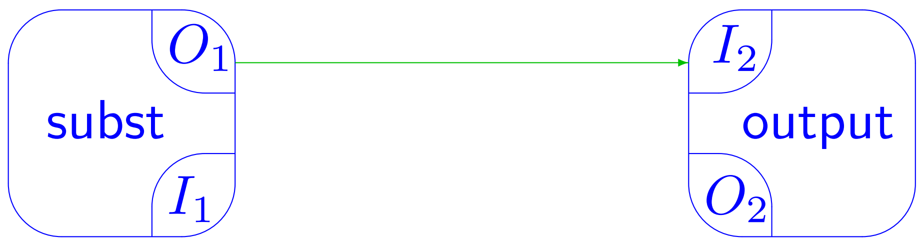

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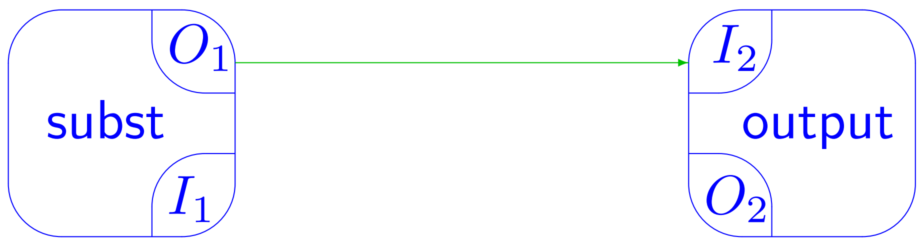

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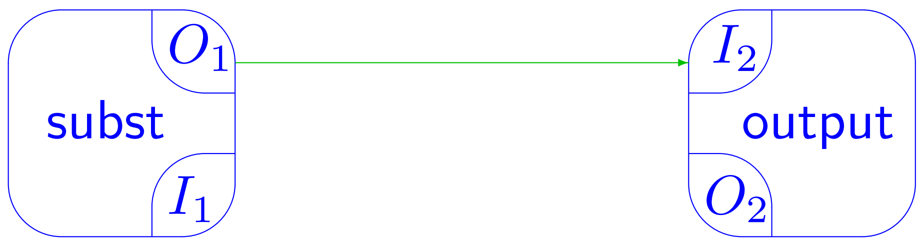

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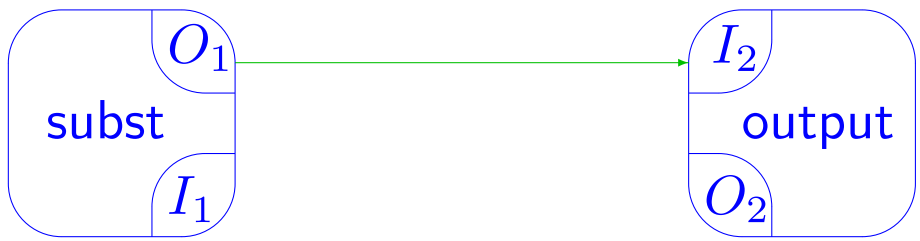

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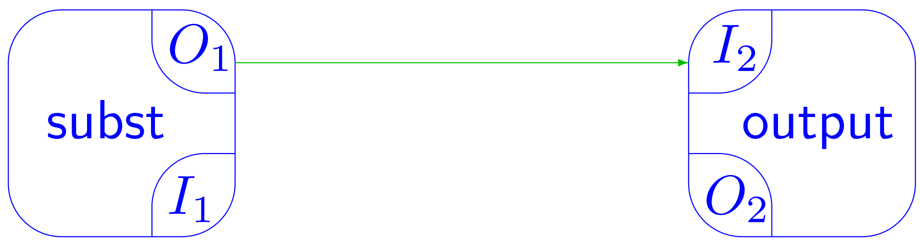

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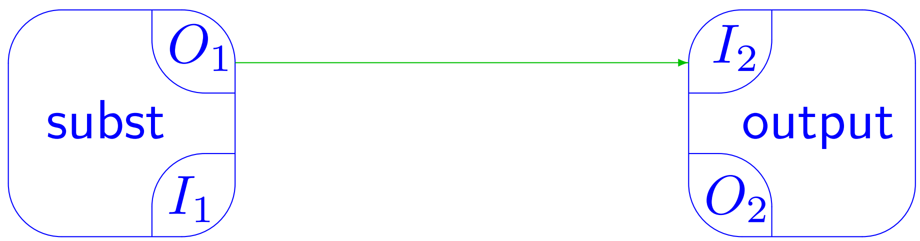

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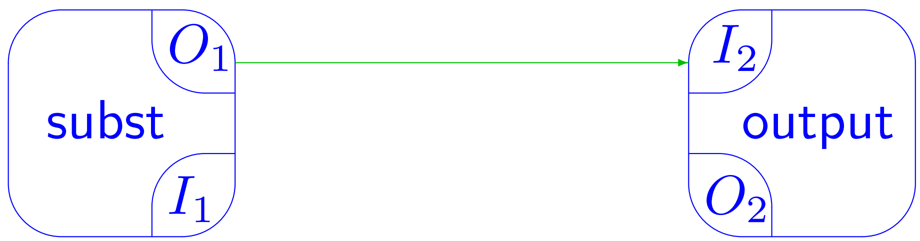

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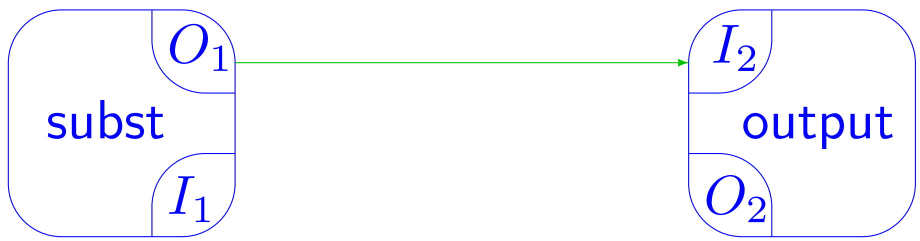

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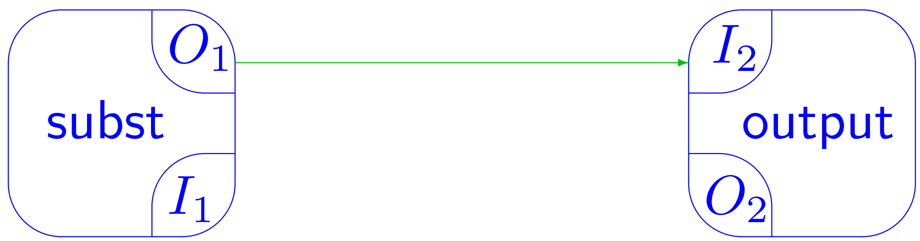

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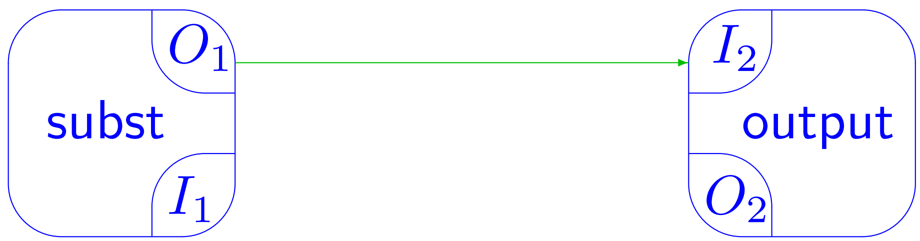

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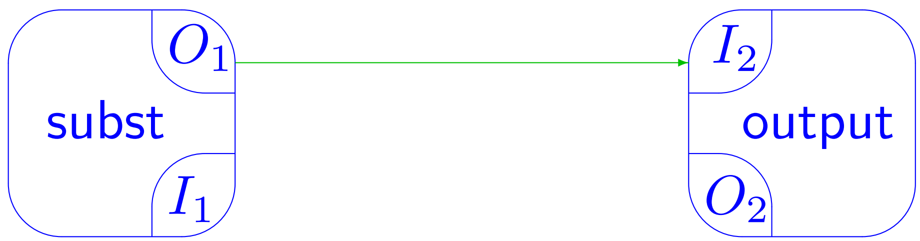

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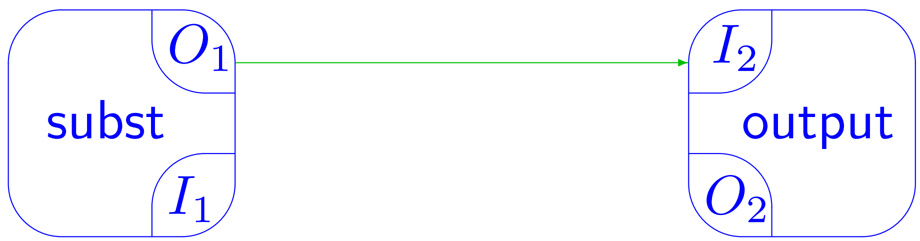
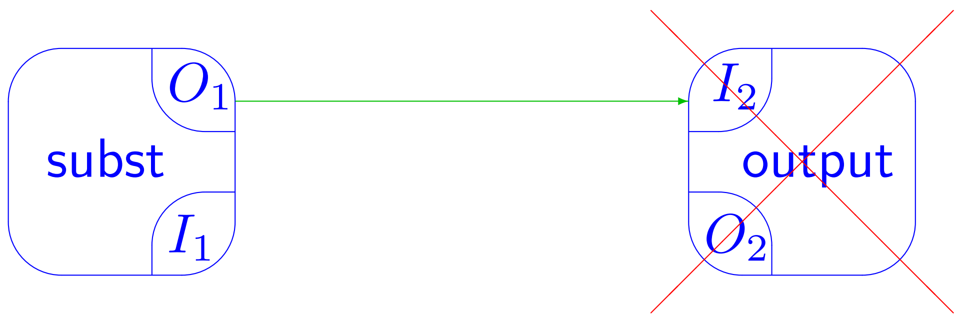


$$I_2 = \{\_\}^*\{S\}\{\_\}^*$$

- B. Truthe, V. Mitrana: In LATA 2009, *LNCS 5457*, 2009

New Idea



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Substitution and Insertion

Theorem: *Any recursively enumerable language can be accepted by a network of one substituting processor and one inserting processor.*

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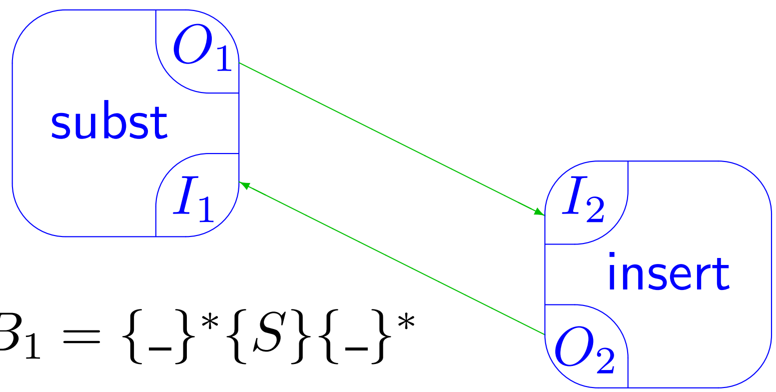
$A \to x$

$A \to BC$

$AB \to CD$



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$$A \to \lambda$$

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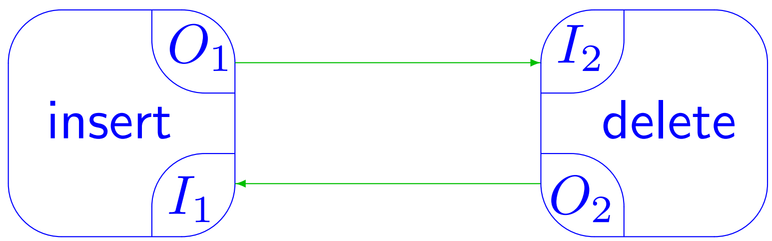

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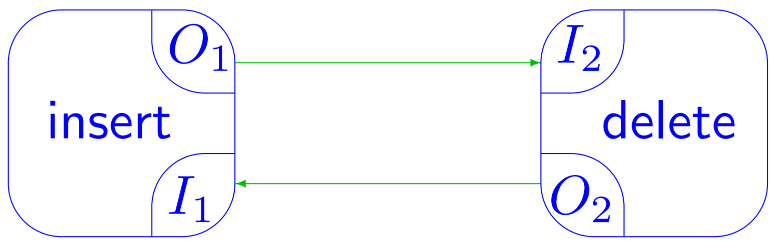

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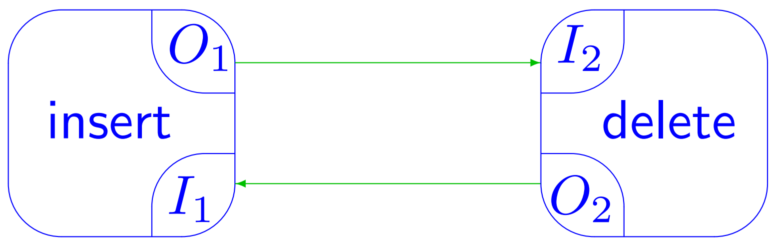

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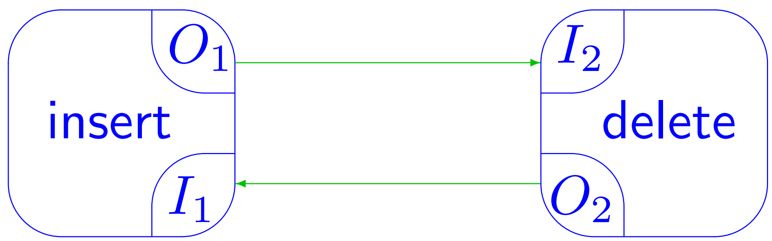

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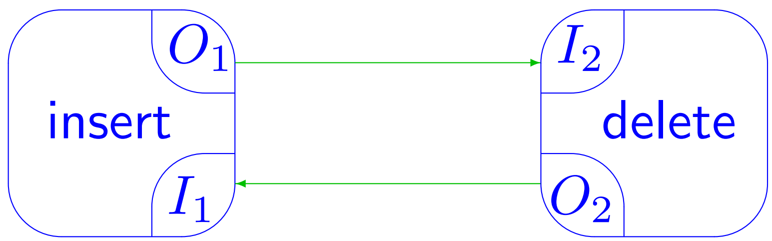

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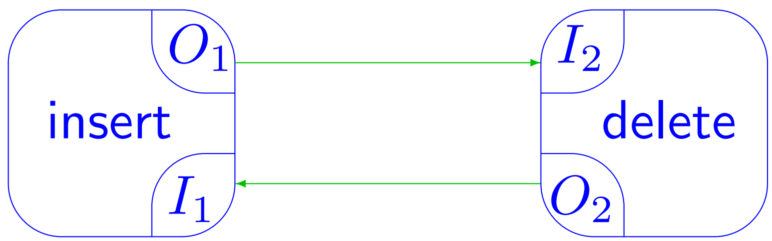

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Definition of Target Based ANEPs

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Theorem: Every conventional network can be transformed into a target based network that accepts the same language.

Equivalence

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TB-ANEP is called *acceptance uniform* if all nodes $N_o = (M_o, I_o, O_o, B_o)$ with $B_o \neq \emptyset$ satisfy $M_o = \emptyset$.

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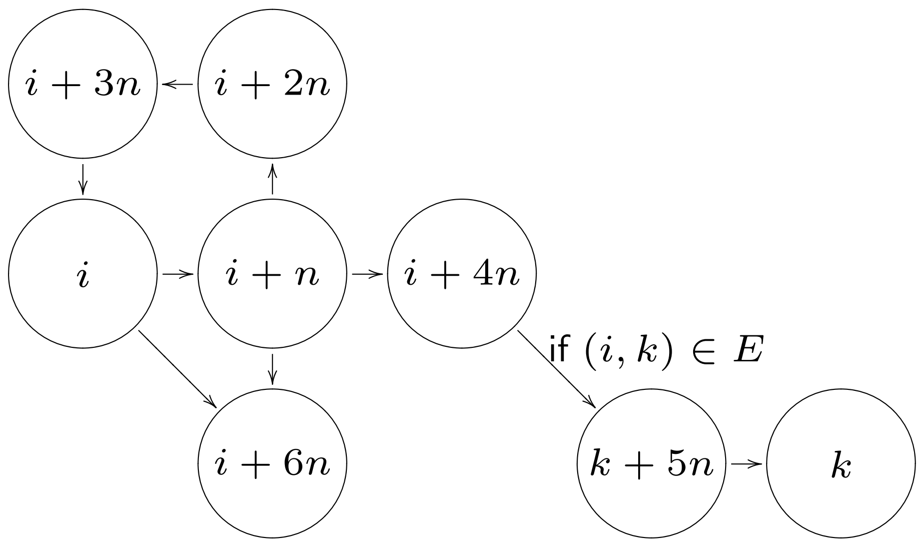
$$
\begin{aligned}
N'_i &= (\emptyset, V^*, V^*, \emptyset),\\
N'_{i+n} &= (M_i, V^*, V^*, \emptyset),\\
N'_{i+2n} &= (\emptyset, V^* \setminus O_i, V^*, \emptyset),\\
N'_{i+3n} &= (\emptyset, V^*, V^*, \emptyset),\\
N'_{i+4n} &= (\emptyset, O_i, V^*, \emptyset),\\
N'_{i+5n} &= (\emptyset, I_i, V^*, \emptyset),\\
N'_{i+6n} &= (\emptyset, B_i, V^*, B_i).
\end{aligned}
$$



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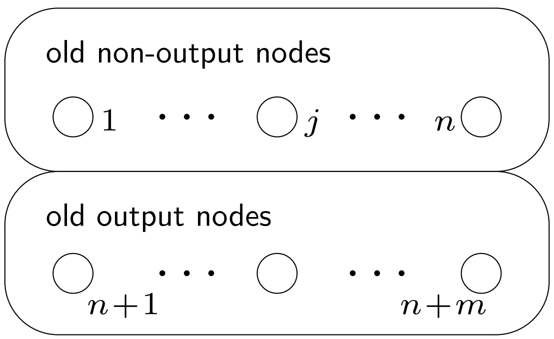

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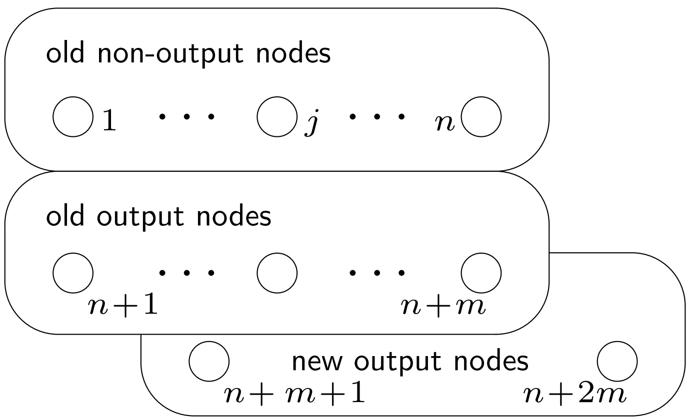

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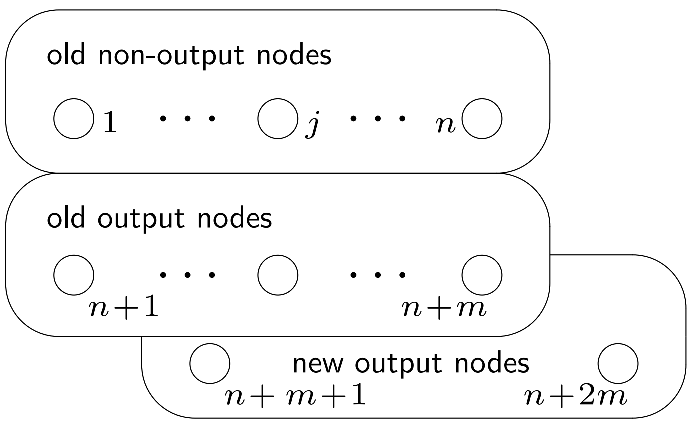

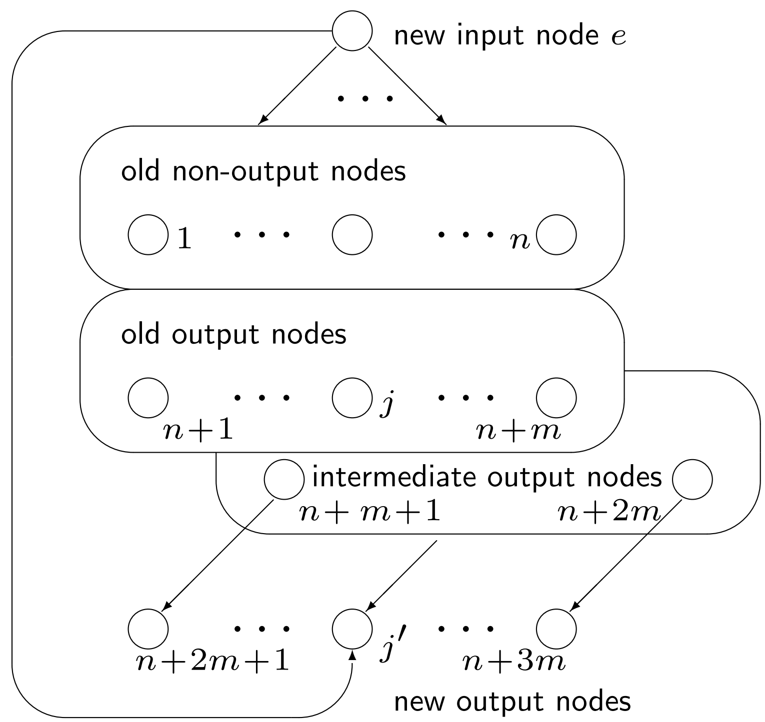

Summary

Target based accepting networks and conventional ones have the same computational power.

The number of processors a target based network needs for accepting a language is not higher than the number of processors that a conventional network needs for the same language.