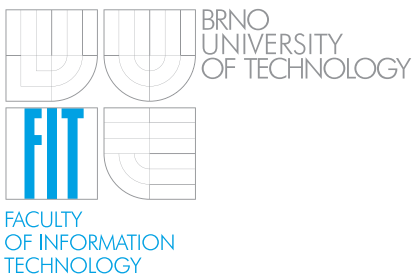
On the Nonterminal Complexity of Left Random Context E0L Grammars

Petr Zemek

Brno University of Technology, Faculty of Information Technology
Božetěchova 2, 612 00 Brno, CZ
http://www.fit.vutbr.cz/∼izemek



Student EEICT 2011

Outline

- Nonterminal Complexity
- Left Random Context E0L Grammars
- Main Result

Nonterminal Complexity

Natural question

Can we bound the number of nonterminals of a grammar?

Natural question

Can we bound the number of nonterminals of a grammar?

Context-free grammars:

- cannot be bounded

Natural question

Can we bound the number of nonterminals of a grammar?

Context-free grammars:

- cannot be bounded

Some other grammars:

- Semi-conditional grammars: 7 nonterminals
- Phrase-structure grammars: 4 nonterminals
- Programmed grammars: 3 nonterminals
- Scattered context grammars: 2 nonterminals

(1) Simulation of a phrase-structure grammar in the so-called Geffert normal form

$$G = (N, T, P, S)$$

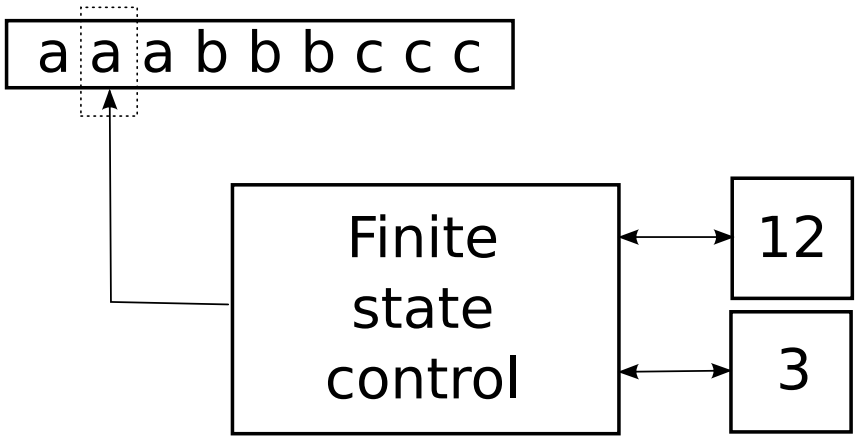
with $N = \{S, A, B, C\}$.

(1) Simulation of a phrase-structure grammar in the so-called Geffert normal form

$$G = (N, T, P, S)$$

with $N = \{S, A, B, C\}$.

(2) Simulation of a Counter machine (a variant of a Turing machine)



Left Random Context E0L Grammars

Idea:

- parallel grammars
- rules of the form $(A \to x, \mathit{Permit}, \mathit{Forbid})$
- presence/absence of symbols is checked only to the left of the rewritten symbol

Left Random Context E0L Grammars

Idea:

- parallel grammars
- rules of the form $(A \to x, \mathit{Permit}, \mathit{Forbid})$
- presence/absence of symbols is checked only to the left of the rewritten symbol

Example

A can be rewritten to x by

$$(A \to x, \{B, C\}, \{D\})$$

in

$$\mathit{CBefAccD}$$

Idea:

- parallel grammars
- rules of the form $(A \to x, \mathit{Permit}, \mathit{Forbid})$
- presence/absence of symbols is checked only to the left of the rewritten symbol

Example

A can be rewritten to x by

$$(A \to x, \{B, C\}, \{D\})$$

in

$$\underline{CBef}AccD$$

Main Result

Theorem

For every recursively enumerable language K, there exists a left random context E0L grammar G such that

- *G generates K, and*
- *G has only 9 nonterminals.*

The thank you slide.