

Talen en Automaten

Additional assignments for exercise class on Fri 22nd Dec, 2017

1 Constructing CFGs

Give a grammar generating the language of all strings over $A = \{ (,), [,] \}$ where brackets and parentheses are nested correctly; so, for instance, $()()([()])$ is in the language but $([])$ is not.

Solution:

$$S \rightarrow (S) \mid [S] \mid SS \mid \lambda$$

□

2 Ambiguity and regular grammars

Consider the grammar

$$\begin{aligned} S &\rightarrow UaabaU \\ U &\rightarrow aU \mid bU \mid \lambda \end{aligned}$$

a) Show that this grammar is ambiguous.

Solution:

Here are two (leftmost) derivations for the word $aabaaaba$:

$$\begin{aligned} S &\Rightarrow UaabaU \Rightarrow abaU \Rightarrow aabaaU \Rightarrow aabaaaU \\ &\Rightarrow aabaaabU \Rightarrow aabaaabaU \Rightarrow aabaaaba \end{aligned}$$

$$\begin{aligned} S &\Rightarrow UaabaU \Rightarrow aUaabaU \Rightarrow aaUaabaU \Rightarrow aabUaabaU \\ &\Rightarrow aabaUaabaU \Rightarrow aabaaabaU \Rightarrow aabaaaba \end{aligned}$$

□

b) Is the language generated by this grammar regular? If so, give a regular grammar.

Solution:

It is regular; for instance, it is not difficult to make an NFA for it. A possible regular grammar:

$$\begin{aligned} S &\rightarrow aS \mid bS \mid aU \\ U &\rightarrow aV \\ V &\rightarrow bW \\ W &\rightarrow aZ \\ Z &\rightarrow aZ \mid bZ \mid \lambda \end{aligned}$$

□