

# Formleg mál og reiknanleiki

Pétur

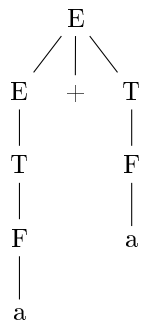
October 7, 2018

1.

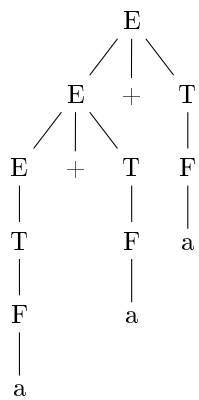
a)



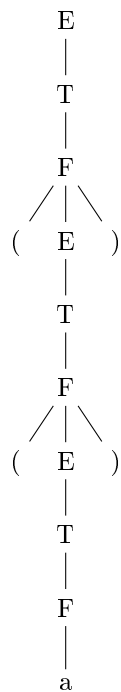
b)



c)



d)



2.

$$\begin{aligned} A &\rightarrow BAB \mid B \mid \epsilon \\ B &\rightarrow 00 \mid \epsilon \end{aligned}$$

I use the first rule from the Chomsky algorithm. Add a new start so that the new start state dose not appear on the right hand side.

$$\begin{aligned} S &\rightarrow A \\ A &\rightarrow BAB \mid B \mid \epsilon \\ B &\rightarrow 00 \mid \epsilon \end{aligned}$$

Second rule from Chomsky algorithm. Get rid of the  $\epsilon$ . Fyrst i take it from the rule

$$B \rightarrow 00 \mid \epsilon$$

After that modification the CFG looks like this.

$$\begin{aligned} S &\rightarrow A \\ A &\rightarrow BAB \mid B \mid \epsilon \mid BA \mid AB \\ B &\rightarrow 00 \end{aligned}$$

Then i move the last  $\epsilon$  to the start state because the CFL has also the empty string in it.

$$\begin{aligned} S &\rightarrow A \mid \epsilon \\ A &\rightarrow BAB \mid B \mid BA \mid AB \\ B &\rightarrow 00 \end{aligned}$$

Third rule, remove all unit rules

$$\begin{aligned} S &\rightarrow A \mid \epsilon \\ A &\rightarrow BAB \mid B \mid BA \mid AB \\ B &\rightarrow 00 \end{aligned}$$

After third rule has been applied then the CFG looks like this.

$$\begin{aligned} S &\rightarrow BAB \mid \emptyset \emptyset \mid BA \mid AB \mid \epsilon \\ A &\rightarrow BAB \mid \emptyset \emptyset \mid BA \mid AB \\ B &\rightarrow \emptyset \emptyset \end{aligned}$$

Then I add new rules and make sure its in the form of Chomsky normal form.

$$\begin{aligned} S &\rightarrow BC \mid DD \mid BA \mid AB \mid \epsilon \\ A &\rightarrow BC \mid DD \mid BA \mid AB \\ B &\rightarrow DD \\ C &\rightarrow AB \\ D &\rightarrow \emptyset \end{aligned}$$

### 3.

Here is the CFG for the CFL F.

$$\begin{aligned} F &\rightarrow A \\ A &\rightarrow aA \mid B \mid aD \\ B &\rightarrow bB \mid C \\ C &\rightarrow cC \mid \epsilon \\ D &\rightarrow bDc \mid \epsilon \end{aligned}$$

### 5.

a)

$$\begin{aligned} R &\rightarrow aA \mid bB \mid cC \\ A &\rightarrow aR \mid bD \mid cE \\ B &\rightarrow aE \mid bR \mid cD \\ C &\rightarrow aD \mid bE \mid cR \\ D &\rightarrow aE \mid bE \mid cE \mid \epsilon \\ E &\rightarrow aE \mid bE \mid cE \end{aligned}$$

b)

