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Signature:

BLG311E – FORMAL LANGUAGES AND AUTOMATA
2015 FALL
QUIZ 5

For the following grammar:

$S \rightarrow aAb$
$A \rightarrow aB \mid bB \mid \varepsilon$
$B \rightarrow A \mid c$

a) Eliminate ε-productions.

> A is nullable which makes B nullable as well ($B \rightarrow A \mid c$).
>
> $S \rightarrow aAb \mid ab$
> $A \rightarrow aB \mid bB \mid a \mid b$
> $B \rightarrow A \mid c$

b) Eliminate any unit productions in the resulting grammar.

> The only unit production is $B \rightarrow A$.
>
> $S \rightarrow aAb \mid ab$
> $A \rightarrow aB \mid bB \mid a \mid b$
> $B \rightarrow aB \mid bB \mid a \mid b \mid c$

c) Eliminate any useless symbols in the resulting grammar.

> No useless symbols (All symbols are both reachable and generating).

d) Put the resulting grammar into Chomsky normal form.

> Introduce variables and productions $C \rightarrow a$ and $D \rightarrow b$:
>
> $S \rightarrow CAD \mid CD$
> $A \rightarrow CB \mid DB \mid a \mid b$
> $B \rightarrow CB \mid DB \mid a \mid b \mid c$
> $C \rightarrow a$
> $D \rightarrow b$
>
> Split CAD by introducing $E \rightarrow AD$
>
> $S \rightarrow CE \mid CD$
> $A \rightarrow CB \mid DB \mid a \mid b$
> $B \rightarrow CB \mid DB \mid a \mid b \mid c$
> $C \rightarrow a$
> $D \rightarrow b$
> $E \rightarrow AD$

Duration: 15 mins