CS 321, Assignment 6

Cody Malick
malickc@oregonstate.edu

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a

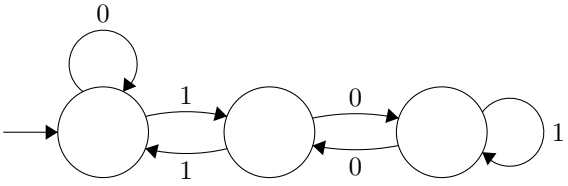
Base case: Given some machine $M = \{Q, \Sigma, \delta, s, F\}$ and a CFG $G = \{A_p \to cA_q | \delta(p, c)\} \cup \{A_p \to \epsilon | p \in F\}$ with a start state $A_s = S$ where the start state has not read any characters.

$A_s = A_p \to cA_q$, where $|w| = 1$

Inductive Step: We need to show that

b

Original:



CFG:
$S \to 0S|1T|\epsilon$
$T \to 1S|0U$
$U \to 0T|1U$

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Starting state:
$S \to aSddd \mid T$
$T \to bTdd \mid R$
$R \to cR \mid \epsilon$

Step 1, add new start symbol S^*, add rule $S^* \to S$
$S^* \to S$
$S \to aSddd \mid T$
$T \to bTdd \mid R$
$R \to cR \mid \epsilon$

Step 2, Shorten RHS rules for each rule $A \to \alpha_1, \alpha_2, ..., \alpha_k$ where $k \geq 3$
$S^* \to S$

$S \to MN \mid T$
$M \to aS$
$N \to dO$
$O \to dd$
$T \to PO \mid R$
$P \to bT$
$R \to cR \mid \epsilon$

Step 3, Clean up mixed RHS
$S^* \to S$
$S \to MN \mid T$
$M \to AS$
$N \to DO$
$O \to DD$
$T \to PO \mid R$
$P \to BT$
$R \to CR \mid \epsilon$
$A \to a$
$B \to b$
$C \to c$

Step 4, determine which nonterminal are "nullable" ($A \Rightarrow^* \epsilon$)
The only rule that goes to ϵ is R, so:
$S^* \to S$
$S \to MN \mid T$
$M \to AS$
$N \to DO$
$O \to DD$
$T \to PO \mid C$
$P \to BT$
$A \to a$
$B \to b$
$C \to c$

Step 5, for each rule $A \to B$, copy all $B \to \alpha$ rules to $A \to \alpha$. Repeat until no more changes, then delete $A \to B$
$S^* \to MN \mid TS$
$M \to AS$
$N \to DO$
$O \to DD$
$T \to PO \mid c$
$P \to BT$
$A \to a$
$B \to b$
$C \to c$

3

a

b