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TACD

Tutorial 7

- i). Convert the following CFG to PDA,
 $S \rightarrow OS1 | A^k A \rightarrow 1A0 | S18.$

Step 1: For each variable $A \in V$, include
a transition $\delta(q, \epsilon, A) \rightarrow \{q, a\}$ if $A \rightarrow \alpha$ is a
production in γ

$$\delta(q, \epsilon, S) \Rightarrow \{(q, OS1), (q, A)\}$$

$$\delta(q, \epsilon, A) \Rightarrow \{(q, 1A0), (q, S), (q, \epsilon)\}$$

Step 2: For each terminal $a \in T$, include
a transition $\delta(q, a, a) \rightarrow (q, \epsilon)$

$$\therefore \delta(q, 0, 0) = \{(q, \epsilon)\}$$

$$\delta(q, 1, 1) = \{(q, \epsilon)\}$$

therefore, the PDA is given by:

$$M = (\{q\}, \{0, 1\}, \{S, A, 0, 1\}, \delta, q, S, \emptyset)$$

where δ is: $\delta(q, 0, S) = \{(q, 0S1), (q, A)\}$

$$\begin{aligned}\delta(q, \epsilon, A) &= \{(q, 1A0), (q, S), (q, \epsilon)\} \\ \delta(q, 0, 0) &= \{(q, \epsilon)\} \\ \delta(q, 1, 1) &= \{(q, \epsilon)\}\end{aligned}$$

Now, to convert NFA of L into PDA

$$(S, p) \xrightarrow{\text{NFA word } w} (S, S, p) \beta$$

$$\begin{aligned}\{(S, p)\} &= (0, 0, p) \beta \quad \dots \\ \{(S, p)\} &= (1, 1, p) \beta\end{aligned}$$

2). Convert following PDA to CFG.

$T = \{0, 1\}$ same as sigma from PDA.
We will start symbol $0S$.

$V = (S, [q_0, X, q_0], [q_0, X, q_1], [q_1, X, q_0], [q_1, X, q_1], [q_0, 20, q_0], [q_0, 20, q_1], [q_1, 20, q_0], [q_1, 20, q_1])$

\rightarrow First generate productions from S :

$$S \rightarrow [q_0, 20, q_0]$$

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The first 2 components of RHS are fixed,
the last piece is every possible state from
machine.

We will drive forward.

$$[q_0, 20, q_1] \xrightarrow{0} [q_0, X, q_0] [q_0, 20, q_0]$$

$$\xrightarrow{0} [q_0, X, q_1] [q_1, 20, q_0]$$

Next come the matching production from second variable:

$$\begin{aligned} [q_0, z_0, q_1] &\rightarrow 0[q_0, x, q_0] [q_0, z_0, q_1] \\ &\rightarrow 0[q_0, x, q_1] [q_1, z_0, q_1] \end{aligned} \quad (1a'')$$

Working from last two variables that mention x , a matching rule 1b,

$$\begin{aligned} [q_0, x, q_0] &\rightarrow 0[q_0, x, q_0] [q_1, x, q_0] \quad (1b') \\ &\rightarrow 0[q_0, x, q_1] [q_1, x, q_0] \quad (1b'') \end{aligned}$$

$$\begin{aligned} [q_0, x, q_1] &\rightarrow 0[q_0, x, q_0] [q_0, x, q_1] \quad (1b''') \\ &\rightarrow 0[q_0, x, q_1] [q_1, x, q_1] \quad (1b''') \end{aligned}$$

Then for the other delta moves,

$$[q_0, x, q_1] \rightarrow l \quad (2a')$$

$$[q_1, z_0, q_1] \rightarrow e \quad (2b')$$

Then, working from the Q variables,

$$[0, p, q_0] [1, p, x, q_0] \leftarrow$$

$$\begin{aligned} [q_0, X, q_0] &\rightarrow O[q_0, X, q_0] [q_0, X, q_0] (1b') \\ &\rightarrow O[q_0, X, q_1] [q_1, X, q_0] (1b'') \end{aligned}$$

$$\begin{aligned} [q_0, X, q_1] &\rightarrow O[q_0, X, q_0] [q_0, X, q_1] (1b''') \\ &\rightarrow O[q_0, X, q_1] [q_1, X, q_1] \cancel{[q_1, X, q_1]} (1b''') \end{aligned}$$

Then for the other 4 delta moves,

$$\begin{aligned} [q_0, X, q_1] &\rightarrow I \quad (2a') \\ [q_1, 20, q_1] &\rightarrow C \quad (2b') \\ [q_1, X, q_1] &\rightarrow E \quad (2c') \\ [q_1, X, q_1] &\rightarrow I \quad (2d') \end{aligned}$$

The variables $[q_1, X, q_0]$ & $[q_1, 20, q_0]$ never appear in LHS so we can drop $1a''$ & $1b''$.

Similarly $[q_0, X, q_0]$ & $[q_0, 20, q_0]$ appears on RHS, so we can drop them, i.

\therefore This leaves,

$$\begin{aligned} S &\rightarrow [q_0, 20, q_1] \\ [q_0, 20, q_1] &\rightarrow O[q_0, X, q_1] [q_1, 20, q_1] \\ [q_0, X, q_1] &\rightarrow O[q_0, X, q_1] [q_1, X, q_1] \end{aligned}$$

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(iii) All mod. can be renamed to,

(iii) $S \rightarrow A$
(iii) $A \rightarrow OBC$
(iii) $B \rightarrow OBD$ | I
(iii) $C \rightarrow \cancel{E}$
(iii) $D \rightarrow IIE.$

(iv) $T \leftarrow [I, P, X, O, P]$
(iv) $S \leftarrow [I, P, O, S, O, P]$
(iv) $O \leftarrow [I, P, X, I, O, P]$
(iv) $I \leftarrow [I, P, X, I, O, P]$

$[O, P, O, S, O, P] \& [O, P, X, I, O, P]$ behavior will
change now SW OZ UN in memory when
"P" & "O"

message $[O, P, O, S, O, P] \& [O, P, X, I, O, P]$ will change
when P and SW OZ, UN are

$[I, P, O, S, O, P] \leftarrow ?$
 $[I, P, O, S, I, O, P] \leftarrow [I, P, O, S, O, P]$
 $[I, P, I, O, P] [I, P, X, I, O, P] \leftarrow [I, P, X, I, O, P]$