

Script generated by TTT

Title: Petter: Compiler Construction (11.06.2020)
-29: Another LR2-to-LR1 Example

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LR(2) to LR(1)

Example 2:

$$S \rightarrow \begin{array}{l} bSS^0 \\ a^1 \\ aac^2 \end{array}$$

LR(2) to LR(1)

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S rightmost-derives these forms among others:

$bSS, bSa, bSaac, baa, baaca, baacac, \dots \Rightarrow$ min. $LR(2)$

in $LR(1)$, you will have (at least) Shift-/Reduce-Conflicts between the items $[S \rightarrow a \bullet, a]$ and $[S \rightarrow a \bullet ac]$

$[S \rightarrow a]$'s right context is a nonterminal \Rightarrow perform *Right-context-extraction*

$$S \rightarrow \begin{array}{l} bSS^0 \\ a^1 \\ aac^2 \end{array} \Rightarrow$$

LR(2) to LR(1)

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$$S \rightarrow \begin{array}{l} bSS^0 \\ a^1 \\ aac^2 \end{array} \Rightarrow \begin{array}{l} S \rightarrow bSa \langle a/S \rangle^0 | bSb \langle b/S \rangle^{0'} \\ a^1 | aac^2 \end{array}$$

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LR(2) to LR(1)

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LR(2) to LR(1)

Example 2 cont'd:

$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

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LR(2) to LR(1)

Example 2 cont'd:

$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

$$\begin{array}{l}
 S \rightarrow b \boxed{Sa} \langle a/S \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle^{0'} \\
 \quad | \quad a^1 | a a c^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | a c^1 \\
 \langle b/S \rangle \rightarrow \boxed{Sa} \langle a/S \rangle^0 | S b \langle b/S \rangle^{0'}
 \end{array}
 \Rightarrow$$

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LR(2) to LR(1)

Example 2 cont'd:

$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

$$\begin{array}{l}
 S \rightarrow b S a \langle a/S \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle^{0'} \\
 \quad | \quad a^1 | a a c^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | a c^1 \\
 \langle b/S \rangle \rightarrow S a \langle a/S \rangle^0 | S b \langle b/S \rangle^{0'}
 \end{array}
 \Rightarrow
 \begin{array}{l}
 S \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle^{0'} \\
 \quad | \quad a^1 | a a c^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | a c^1 \\
 \langle b/S \rangle \rightarrow \langle Sa \rangle \langle a/S \rangle^0 | S b \langle b/S \rangle^{0'} \\
 \langle Sa \rangle \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \boxed{a^0} \\
 \quad | \quad b S b \langle b/S \rangle \boxed{a^0} \\
 \quad | \quad a \boxed{a^1} | a a c \boxed{a^2}
 \end{array}$$

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LR(2) to LR(1)

Example 2 cont'd:

$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

$$\begin{array}{l}
 S \rightarrow b S a \langle a/S \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle^{0'} \\
 \quad | \quad a^1 | a a c^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | a c^1 \\
 \langle b/S \rangle \rightarrow S a \langle a/S \rangle^0 | S b \langle b/S \rangle^{0'}
 \end{array}
 \Rightarrow
 \begin{array}{l}
 S \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle^{0'} \\
 \quad | \quad a^1 | a a c^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | a c^1 \\
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LR(2) to LR(1)

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$$\begin{array}{l}
 S \rightarrow b S a \langle a/S \rangle^0 \\
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 \langle Sa \rangle \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \langle a \rangle^0 \\
 \quad | \quad b S b \langle b/S \rangle a^{0'} \\
 \quad | \quad a a^1 | a a c a^2 \\
 \boxed{\langle \langle a/S \rangle a \rangle} \rightarrow a^0 | a c a^1
 \end{array}$$

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LR(2) to LR(1)

Example 2 cont'd:

$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

$$\begin{array}{l}
 S \rightarrow bSa \langle a/S \rangle^0 \\
 \quad | bSb \langle b/S \rangle^{0'} \\
 \quad | a^1 | aac^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | ac^1 \\
 \langle b/S \rangle \rightarrow Sa \langle a/S \rangle^0 | Sb \langle b/S \rangle^{0'} \\
 \langle Sa \rangle \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \\
 \quad | bSb \langle b/S \rangle a^{0'} \\
 \quad | aa^1 | aaca^2 \\
 \langle \langle a/S \rangle a \rangle \rightarrow a^0 | aca^1 \\
 \langle \langle b/S \rangle a \rangle \rightarrow \langle Sa \rangle \langle a/S \rangle a^0 | Sb \langle b/S \rangle a^{0'}
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$[S \rightarrow a]$'s right context is now terminal $a \Rightarrow$ perform *Right-context-propagation*

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 S \rightarrow bSa \langle a/S \rangle^0 \\
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 \quad | a^1 | aac^2 \\
 \langle a/S \rangle \rightarrow \epsilon^0 | ac^1 \\
 \langle b/S \rangle \rightarrow Sa \langle a/S \rangle^0 | Sb \langle b/S \rangle^{0'} \\
 \langle Sa \rangle \rightarrow b \langle Sa \rangle \langle a/S \rangle^0 \\
 \quad | bSb \langle b/S \rangle a^{0'} \\
 \quad | aa^1 | aaca^2 \\
 \langle \langle a/S \rangle a \rangle \rightarrow a^0 | aca^1 \\
 \langle \langle b/S \rangle a \rangle \rightarrow \langle Sa \rangle \langle a/S \rangle a^0 | Sb \langle b/S \rangle a^{0'}
 \end{array}$$

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LR(2) to LR(1)

Example 2 finished:

With fresh nonterminals we get the final grammar

$$\begin{array}{l}
 S \rightarrow bSS^0 \\
 \quad | a^1 \\
 \quad | aac^2 \\
 A \rightarrow bCA^0 | bSbB^1 | a^2 | aac^3 \\
 B \rightarrow CA^0 | SbB^1 \\
 C \rightarrow bCD^0 | bSbE^1 | aa^2 | aaca^3 \\
 D \rightarrow a^0 | aca^1 \\
 E \rightarrow CD^0 | SbE^1
 \end{array}$$

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Syntactic Analysis - Part II

Chapter 2: LR(k)-Parser Design

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