Compiler Construction : Exercises on Lexing and Parsing

Timothy G. Griffin

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1 Lexing

For each of these regular expressions

$$b(a+b)^*a$$
$$((\epsilon + a)b^*)^*$$

1.1 construct an NFA accepting the regular language.

1.2 construct a corresponding DFA.

1.3 Given any regular expression, can you produce a CFG that generates the same language? Can you do this for the above regular expressions?

2 Context-Free Grammars

Consider the grammar

$$\begin{array}{rcl} T & \rightarrow & R \\ & | & aTc \\ R & \rightarrow & \epsilon \\ & | & RbR \end{array}$$

2.1 Give a leftmost derivation of *aabbbcc*.

2.2 Give a rightmost derivation of *aabbbcc*.

2.3 Is the grammar ambiguous? Justify your answer.

3 LL(1) Parsing

Consider this grammar for boolean expressions (grammar and question corrected on 26 Feb):

$$\begin{array}{lcl} E & \rightarrow & T \\ & | & E \text{ or } T \\ T & \rightarrow & F \\ & | & T \text{ and } F \\ F & \rightarrow & id \\ & | & \textit{not } F \\ & | & (E) \end{array}$$

3.0 Eliminate left recursion from this grammar.

3.1 Write pseudocode for a recursive descent parser for the resulting grammar.

3.2 Compute FIRST and FOLLOW for the resulting grammar.

3.3 Construct the predictive parsing table using FIRST and FOLLOW.

3.4 Trace a parsing of (not y or z) and x.

4 SLR(1) Parsing

Consider the grammar (grammar and question 4.6 corrected on 26 Feb):

$$S \rightarrow (S)|()$$

4.1 Construct the LR(0) items for this grammar.

4.2 Construct the NFA with LR(0) items as states.

4.3 Construct the corresponding DFA.

4.4 Compute FIRST and FOLLOW for this grammar.

4.5 Construct the SLR(1) versions of ACTION and GOTO.

4.6 Trace the parsing of ((())).

Consider the grammar

$$E \rightarrow E + E|E * E|id$$

4.7 Construct the LR(0) items for this grammar.

4.8 Construct the NFA with LR(0) items as states.

4.9 Construct the corresponding DFA.

4.10 Compute FIRST and FOLLOW for this grammar.

4.11 Attempt to construct the SLR(1) versions of ACTION and GOTO. Describe the problems that you encounter.