

Assignment 2: Lexing, Parsing, and Control Flow

15-411: Compiler Design

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Due: Tuesday, September 25, 2007 (1:30 pm)

Problem 1

[20 points] Appel 2.3(a), 2.5(a), 2.8

Problem 2

[30 points] Consider the following grammar \mathcal{G} for a dialect of English (apparently spoken in Buffalo, NY):

$$\begin{aligned} S &\rightarrow NP VP \\ S &\rightarrow Imp \\ NP &\rightarrow N \\ NP &\rightarrow N Rel \\ VP &\rightarrow V \\ VP &\rightarrow V NP \\ Imp &\rightarrow VP \\ Rel &\rightarrow NP V \\ N &\rightarrow buffalo \\ V &\rightarrow buffalo \end{aligned}$$

It might help you to know the conventions S = “sentence”, NP = “noun phrase”, VP = “verb phrase”, Imp = “imperative”, Rel = “relative clause”, N = “noun”, V = “verb”. You may also examine this excerpt from the *The American Heritage[®] Dictionary of the English Language, Fourth Edition*:

<p>buf·fa·lo n. <i>pl.</i> buffalo or buf·fa·loes or buf·fa·los</p> <ol style="list-style-type: none">(a) Any of several oxlike Old World mammals of the family Bovidae, such as the water buffalo and African buffalo. (b) The North American bison, <i>Bison bison</i>.The buffalo fish. <p>tr.v. buf·fa·loed, buf·fa·lo·ing, buf·fa·loes</p> <ol style="list-style-type: none">To intimidate, as by a display of confidence or authority: “The board couldn’t buffalo the federal courts as it had the Comptroller” (American Banker).To deceive; hoodwink: “Too often... job seekers have buffaloeed lenders as to their competency and training” (H. Jane Lehman).To confuse; bewilder.
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- (a) Derive “buffalo buffalo buffalo buffalo buffalo” from the start symbol S .
- (b) Show that \mathcal{G} is not SLR by finding a shift/reduce or reduce/reduce conflict.
- (c) Can you find a different grammar that is SLR and that accepts the same language (i.e., the same set of strings) as \mathcal{G} ?
- (d) Conversely, suppose we define a new grammar \mathcal{G}' , almost identical to \mathcal{G} except that the rules for N and V are replaced by the following:

$$\begin{aligned} N &\rightarrow \text{bison} \\ V &\rightarrow \text{bewilder} \end{aligned}$$

(Note that \mathcal{G}' accepts a *different* language from \mathcal{G} , but their parse trees are isomorphic.) Show that \mathcal{G}' is SLR by building a conflict-free parsing table. (Hint: you can ask `ml-yacc` for advice, but don't follow it blindly. In particular, `ml-yacc` generates LALR parsers, a larger class than SLR.)

Problem 3

[10 points] Appel 10.1