

Computer Science Comprehensive Exam—Spring 2009
Compiler Construction (with some answers)

Instructions: Do *not* put your name on the exam, please answer all the questions directly on the exam itself. You may need scratch paper. Answer **all** the questions. Explain answers as fully as possible, give examples or define terms, if appropriate.

1. Suppose you are writing a LALR(1) parser generator (not a parser). The parser generator will produce code in an object-oriented language like C++ or Java. You want the parser generator to not just simply detect syntax errors, but to automatically generate the parse tree as well. Please describe in words and at a high-level how you would design the parser generator.

Answer:

2. What is the relationship between the set of languages recognized by LR(1) parsers and the set of languages recognized by LL(1) parsers?

Answer:

3. Compute nullable, FIRST, and FOLLOW for all non-terminals in the following grammar. (S' , S , X , B , and E are nonterminals.) Construct the LL(1) parsing table for the following grammar. And, comment on the results. Is the grammar LL(1)?

```
0  S' → S$
1  S  →
2  S  → X S
3  X  → B S E
4  X  → { S }
5  X  → word
6  X  → begin
7  X  → end
8  X  → / word
9  B  → / begin{ word }
10 E  → / end{ word }
```

4. Construct the LR(1) parsing table for the following grammar. And, comment on the results. Is the grammar LALR(1)?

```
0  S' → S$
1  S  → ( X
2  S  → E ]
3  S  → F )
4  X  → E )
5  X  → F ]
6  E  → A
7  F  → A
8  A  →
```