CSCI565 – Compiler Design

Spring 2011

Homework 2

Due Date: February 16, 2011 in class

Problem 1 [5 points]: Predictive Top-Down Parsing
Explain why a left-recursive grammar cannot be parsed using the predictive top-down parsing algorithms.

Problem 2 [30 points]: Table-based LL(1) Predictive Top-Down Parsing
Consider the following CFG $G = (N=\{S, A, B, C, D\}, T=\{a, b, c, d\}, P, S)$ where the set of productions $P$ is given below:

- $S \rightarrow A$
- $A \rightarrow BC \mid DBC$
- $B \rightarrow Bb \mid \varepsilon$
- $C \rightarrow c \mid \varepsilon$
- $D \rightarrow a \mid d$

a) [05 points] Is this grammar suitable to be parsed using the recursive descendent parsing method? Justify and modify the grammar if needed.
b) [10 points] Compute the FIRST and FOLLOW set of non-terminal symbols of the grammar resulting from your answer in a)
c) [10 points] Construct the corresponding parsing table using the predictive parsing LL method.
d) [05 points] Show the stack contents, the input and the rules used during parsing for the input $w = "dbb"$

Problem 3 [65 points]: LR Parsing Algorithm
Given the grammar below already augmented with the basic EOF production (0) answer the following:

- (0) $S \rightarrow \text{Stmts } \$$
- (1) $\text{Stmts} \rightarrow \text{Stmt}$
- (2) $\text{Stmts} \rightarrow \text{Stmts} \ ; \ \text{Stmt}$
- (3) $\text{Stmt} \rightarrow \text{Var} = \text{E}$
- (4) $\text{Var} \rightarrow \text{id } \{ \text{E } \}$
- (5) $\text{Var} \rightarrow \text{id}$
- (6) $\text{E} \rightarrow \text{id}$
- (7) $\text{E} \rightarrow ( \text{E } )$

a) [10 points] Construct the set of LR(0) items and the DFA capable of recognizing it.
b) [10 points] Construct the LR(0) parsing table and determine if this grammar is LR(0). Justify.
c) [05 points] Is the SLR(0) DFA for this grammar the same as the LR(0) DFA? Why?
d) [10 points] Is this grammar SLR(0)? Justify by constructing its table.
e) [15 points] Construct the set of LR(1) items and the DFA capable of recognizing it.
f) [10 points] Construct the LR(1) parsing table and determine if this grammar is LR(1). Justify.
g) [05 points] How would you derive the LALR(1) parsing table this grammar? What is the difference between this table and the table found in a) above?