CSCI 447 – Summer 2002
LL Parsing

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1. For each of the following grammars, find the predict sets and state whether the grammar is LL(1) or not.

   a. $S \rightarrow A\ B\ \mathbf{c}$
   $A \rightarrow \mathbf{a} \mid \varepsilon$
   $B \rightarrow \mathbf{b} \mid \varepsilon$

   b. $S \rightarrow A\ \mathbf{b}$
   $A \rightarrow \mathbf{a} \mid B \mid \varepsilon$
   $B \rightarrow \mathbf{b} \mid \varepsilon$

   c. $S \rightarrow A\ B\ B\ A$
   $A \rightarrow \mathbf{a} \mid \varepsilon$
   $B \rightarrow \mathbf{b} \mid \varepsilon$

   d. $S \rightarrow \mathbf{a}\ S\ \mathbf{e} \mid B$
   $B \rightarrow \mathbf{b}\ B\ \mathbf{e} \mid C$
   $C \rightarrow \mathbf{c}\ C\ \mathbf{e} \mid \mathbf{d}$

2. Given the following grammar

   $lexp \qquad \rightarrow \qquad (\ lexpseq \ ) \mid \mathbf{id} \mid \mathbf{num}$
   $lexpseq \quad \rightarrow \qquad lexp \ \ lexptail$
   $lexptail \quad \rightarrow \qquad \mathbf{,} \ lexp \ \ lexptail \mid \varepsilon$

   a. Find the First and Follow sets of all nonterminals

   b. Find the predict sets of all productions

   c. Construct the LL(1) parse table

   d. Show the parsing of **((id , num) , id) $** and **(id , (id $**

3. **a)** Show that an LL(1) grammar cannot be ambiguous.
   b) Show that a left-recursive grammar cannot be LL(1).

4. Transform the following grammar into LL(1)

   $DeclList \qquad \rightarrow \qquad DeclList \ \mathbf{;} \ Decl \mid Decl$
   $Decl \qquad \rightarrow \qquad IdList \ \mathbf{:} \ Type$
   $IdList \qquad \rightarrow \qquad IdList \ \mathbf{,} \ \mathbf{ID} \mid \mathbf{ID}$
   $Type \qquad \rightarrow \qquad ScalarType \mid \mathbf{array} \ (\ ScalarTypeList \ ) \ \mathbf{of} \ Type$
   $ScalarTypeList \rightarrow \qquad ScalarTypeList \ \mathbf{,} \ ScalarType \mid ScalarType$
   $ScalarType \qquad \rightarrow \qquad \mathbf{ID} \mid Bound \ \mathbf{..} \ Bound$
   $Bound \qquad \rightarrow \qquad Sign \ \mathbf{INTLIT} \mid \mathbf{ID}$
   $Sign \qquad \rightarrow \qquad \mathbf{+} \mid \mathbf{-} \mid \varepsilon$