Homework 2
COSE312, Fall 2015

Hakjoo Oh

Due: 10/15, 17:00 (in class)

Problem 1 (20 pts) Consider the following simple programming language:

$$
\begin{array}{lcl}
S & \rightarrow & \texttt{if}\ E\ \texttt{then}\ S\ \texttt{else}\ S \\
S & \rightarrow & \texttt{begin}\ S\ L \\
S & \rightarrow & \texttt{print}\ E \\
L & \rightarrow & \texttt{end} \\
L & \rightarrow & \texttt{;}\ S\ L \\
E & \rightarrow & \texttt{num} \\
E & \rightarrow & \texttt{id}
\end{array}
$$

1. Find FIRST and FOLLOW sets for this grammar.
2. Construct the LL(1) parsing table.
3. Show the top-down parsing sequence for the program:

```
if num then
  begin
    print id;
    print num
  end
else
  print num
```

Problem 2 (20 pts) Consider the following grammar:

$$
\begin{array}{lcl}
Z & \rightarrow & d \\
Z & \rightarrow & X\ Y\ Z \\
Y & \rightarrow & \epsilon \\
Y & \rightarrow & c \\
X & \rightarrow & Y \\
X & \rightarrow & a
\end{array}
$$

1. Find FIRST and FOLLOW sets for this grammar.
2. Construct the LL(1) parsing table. Is the grammar in LL(1)?

Problem 3 (20pts) Consider the following grammar:

$$
\begin{array}{lcl}
S' & \rightarrow & S \\
S & \rightarrow & \texttt{(}\ L\ \texttt{)} \\
S & \rightarrow & x \\
L & \rightarrow & S \\
L & \rightarrow & L\ \texttt{,}\ S
\end{array}
$$

1. Construct the LR(0) automaton for the grammar.
2. Construct the LR(0) parsing table for the grammar.
3. Show the LR(0) parsing process for the input string:

   `( x, ( x, x ) )`

Problem 4 (20pts) Consider the following grammar:

$$\begin{array}{lcl} S & \rightarrow & E \\ E & \rightarrow & T + E \\ E & \rightarrow & T \\ T & \rightarrow & x \end{array}$$

1. Construct the LR(0) automaton for the grammar.
2. Construct the LR(0) parsing table for the grammar. Is the grammar in LR(0)?
3. Construct the SLR parsing table for the grammar. Is the grammar in SLR?