German University in Cairo
Department of Computer Science
Assoc. Prof. Haythem O. Ismail

CSEN 1003 Compiler, Spring Term 2019
Practice Assignment 6

Discussion: 17.03.19 - 20.03.19

Exercise 6-1

Answer the following questions:

a) Left recursion is a problem in LL top-down parsing, is this the case in LR parsing?

Solution:

No it is not. Because we do the reverse of a right-most derivation.

b) What grammar property could be a problem in a bottom-up parser?

Solution:

Right recursion can be a problem in a bottom up parser.

Exercise 6-2

Handles

Given the following grammar:

$S \rightarrow SS\texttt{+} \mid SS\texttt{*} \mid \texttt{a}$

indicate the handle in each of the following right sentential forms:

a) $SSS\texttt{+a*+}$

Solution:

$S\ \underline{SS\texttt{+}}\ \texttt{a*+}$

b) $SS\texttt{+a*a+}$

Solution:

$\underline{SS\texttt{+}}\ \texttt{a*a+}$

c) $\texttt{aaa*a++}$

Solution:

$\underline{\texttt{a}}\ \texttt{aa*a++}$

[0]Exercises are due to Dr. Carmen Gervet

Exercise 6-3

Given the following grammar:

$S \quad \rightarrow \quad \texttt{0}S\texttt{1} \mid \texttt{01}$

indicate the handle in each of the following right sentential forms:

a) `000111`

Solution:

`00` $\underline{\texttt{01}}$ `11`

b) `00`S`11`

Solution:

`0` $\underline{\texttt{0}S\texttt{1}}$ `1`

Exercise 6-4

Shift-Reduce Parsing

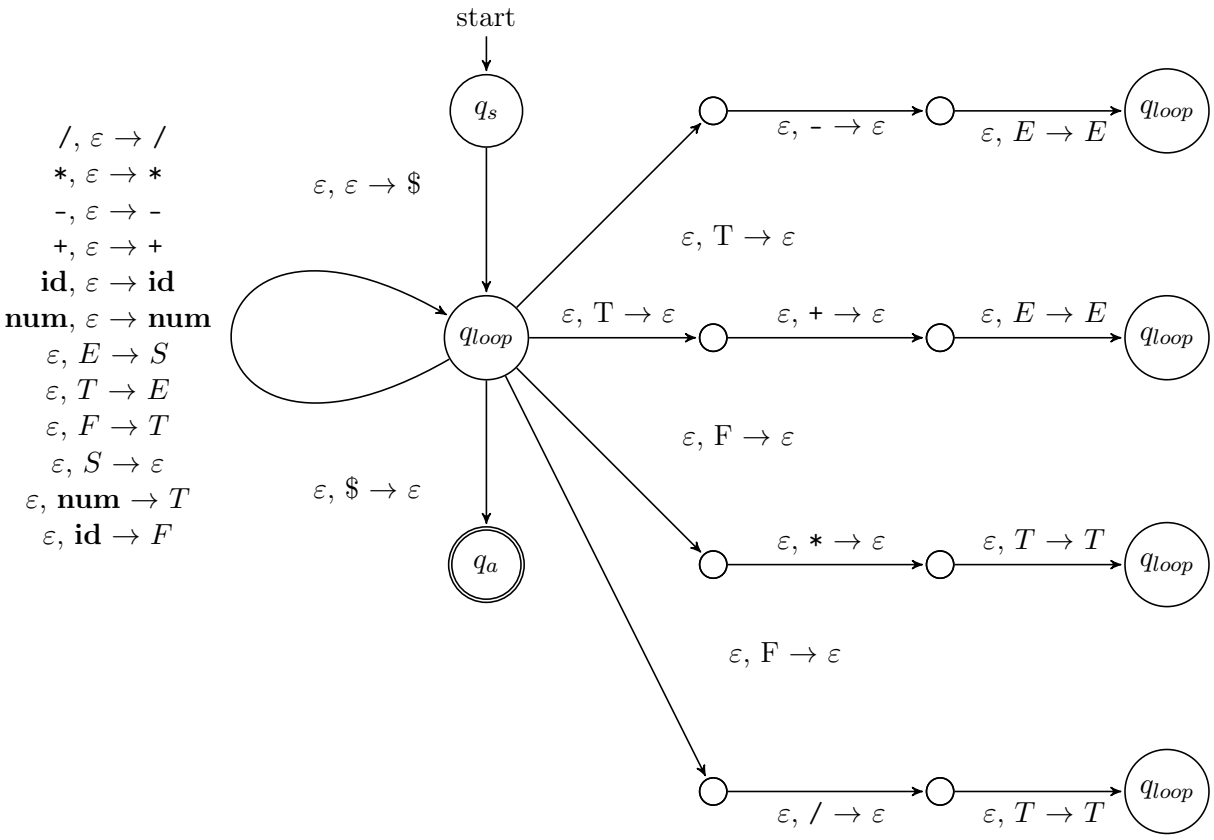
Consider the following grammar:

$$
\begin{array}{rcl}
S & \rightarrow & Expr \\
Expr & \rightarrow & Expr \texttt{ + } Term \mid Expr \texttt{ - } Term \mid Term \\
Term & \rightarrow & Term \texttt{ * } Factor \mid Term \texttt{ / } Factor \mid Factor \\
Factor & \rightarrow & \textbf{num} \mid \textbf{id}
\end{array}
$$

and the string: **id - num * id**

a) Construct the corresponding Shift-Reduce PDA.

Solution:



b) Give the shift-reduce parser action in terms of:

Stack	Input	Action

Solution:

Stack	Input	Action
\$	**id** - **num** $*$ **id** \$	Shift
\$**id**	- **num** $*$ **id** \$	Reduce $Factor \rightarrow$ **id**
\$$Factor$	- **num** $*$ **id** \$	Reduce $Term \rightarrow Factor$
\$$Term$	- **num** $*$ **id** \$	Reduce $Expr \rightarrow Term$
\$$Expr$	- **num** $*$ **id** \$	Shift
\$$Expr$-	**num** $*$ **id** \$	Shift
\$$Expr$-**num**	$*$ **id** \$	Reduce $Factor \rightarrow$ **num**
\$$Expr$-$Factor$	$*$ **id** \$	Reduce $Term \rightarrow Factor$
\$$Expr$-$Term$	$*$ **id** \$	Shift
\$$Expr$-$Term*$	**id** \$	Shift
\$$Expr$-$Term*$**id**	\$	Reduce $Factor \rightarrow$ **id**
\$$Expr$-$Term*Factor$	\$	Reduce $Term \rightarrow Term*Factor$
\$$Expr$-$Term$	\$	Reduce $Expr \rightarrow Expr$-$Term$
\$$Expr$	\$	Reduce $S \rightarrow Expr$
\$$S$	\$	Accept