Problem

Convert the CFG G4 given in Exercise 2.1 to an equivalent PDA, using the procedure given in Theorem 2.20.

THEOREM **2.20**

A language is context free if and only if some pushdown automaton recognizes it.

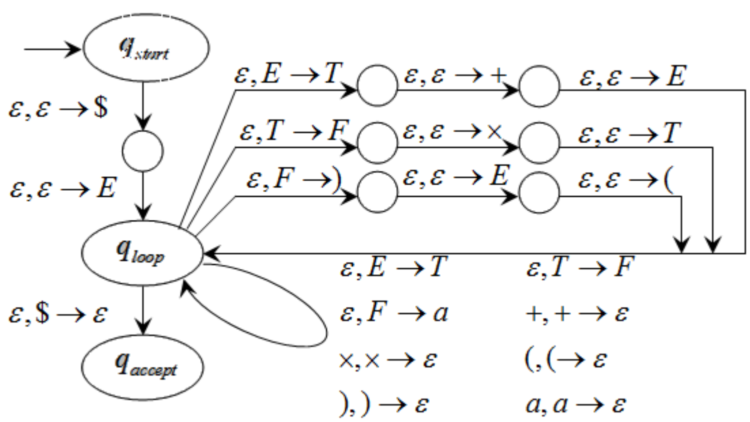
Step-by-step solution

Step 1 of 2

Given CFG (Context-free grammar) G_4 is

$E \to E+T \mid T$
$T \to T\times F \mid F$
$F \to (E) \mid a$

Equivalent PDA for the CFG G_4 is as follows:



Comments (5)

Step 2 of 2

Explanation:

1. A shorthand notation is used for pushing multiple symbols onto the stack.

2. Initially, at the start variable on the stack a marker symbol '\$' is inserted. The start state is q_{start}. The transition function is $\delta(q_{start},\in,\in)=\{(q_{loop},S\$)\}$

3. If the stack top is a non-terminal variable E. Select one of the rules of E and substitutes its value on the right hand side of the rule. Repeat this process until the end of the string.

The transition function is $\delta(q_{loop},\in,E)=\{(q_{loop},w) \mid E\to w \text{ is a rule in CFG}\}$

Example:

• Consider the rule $E\to E+T$.

• Another rule for *E* is $E\to T$. Substitute the value of *E* in the above rule.

• Then, the equation becomes $E\to T+T$.

4. If the stack top is a terminal variable such as (,),a,+ and x the next symbol is read from the input rule. Repeat step-3 if again a non-terminal variable is encountered.

The transition function is $\delta(q_{loop},a,a)=\{(q_{loop},\in)\}$.

5. If the stack top is a '\$' symbol, the accept state is entered because, the input is read completely.

The transition function is $\delta(q_{loop},\in,\$)=\{(q_{accept},\in)\}$.

Comment