CSE105 Closed Book Quiz, Thursday, Nov. 11, 1999

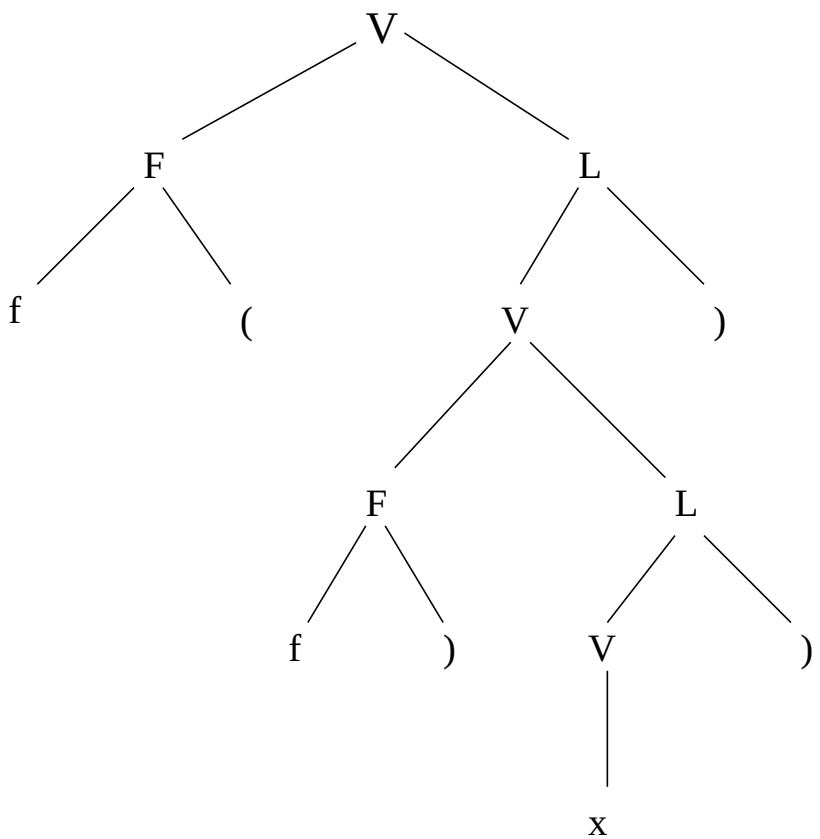
1. Construct a CFG for the language

   $\{0^n 1^m \mid 1 \leq n \leq m\}$

   S → 0S1 | S1 | 01

2. Draw a parse tree for the string **f(f(x))** using the CFG below. (Here, the nonterminals of the grammar are { **( ) x f** }, and the start variable is V)

   $V \to x \mid f \mid FL$
   $F \to f($
   $L \to V)$

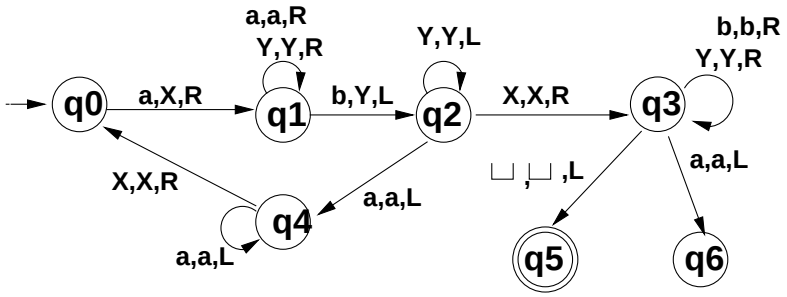


3. Given the Turing machine below for $\{a^n b^m \mid 1 \leq n \leq m\}$, show the configurations of the Turing machine on input *aabbb*, beginning with the start configuration.

Q = {q0, q1, q2, q3, q4, q5, q6}

Σ = {a,b} **Γ = {a,b, X, Y, $\sqcup$}**

q0 start **q5 accept** **q6 reject**



$q_0 aabbb \sqcup$
$Xq_1 abbb \sqcup$
$Xaq_1 bbb \sqcup$
$Xq_2 aYbb \sqcup$
$q_4 XaYbb \sqcup$
$Xq_0 aYbb \sqcup$
$XXq_1 Ybb \sqcup$
$XXYq_1 bb \sqcup$
$XXq_2 YYb \sqcup$
$Xq_2 XYYb \sqcup$
$XXq_3 YYb \sqcup$
$XXYq_3 Yb \sqcup$
$XXYYq_3 b \sqcup$
$XXYYbq_3 \sqcup$
$XXYYq_5 b \sqcup$

ACCEPT

4. Fill in the blanks: A derivation in a CFG is leftmost if ....
at every step, the leftmost remaining variable is the one replaced.