

Problème 1.

Give a context free grammar for the following language:

$$L = \{a^n b^m c^k \mid k \neq n + m\}$$

Solution

The following CFG generates the language L :

$$\begin{aligned} S &\rightarrow S_1 \mid S_2 \mid S_3 \\ S_1 &\rightarrow aS_1c \mid aS_1 \mid A \\ S_2 &\rightarrow bS_2c \mid bS_2 \mid B \\ S_3 &\rightarrow aS_3b \mid cS_3 \mid C \\ A &\rightarrow aAc \mid aA \mid a \mid \varepsilon \\ B &\rightarrow bBc \mid bB \mid b \mid \varepsilon \\ C &\rightarrow aCb \mid cC \mid c \mid \varepsilon \end{aligned}$$

Problème 2.

Let

$$L_1 = \{a^n b^m c^k \mid n, m, k \geq 0\}$$

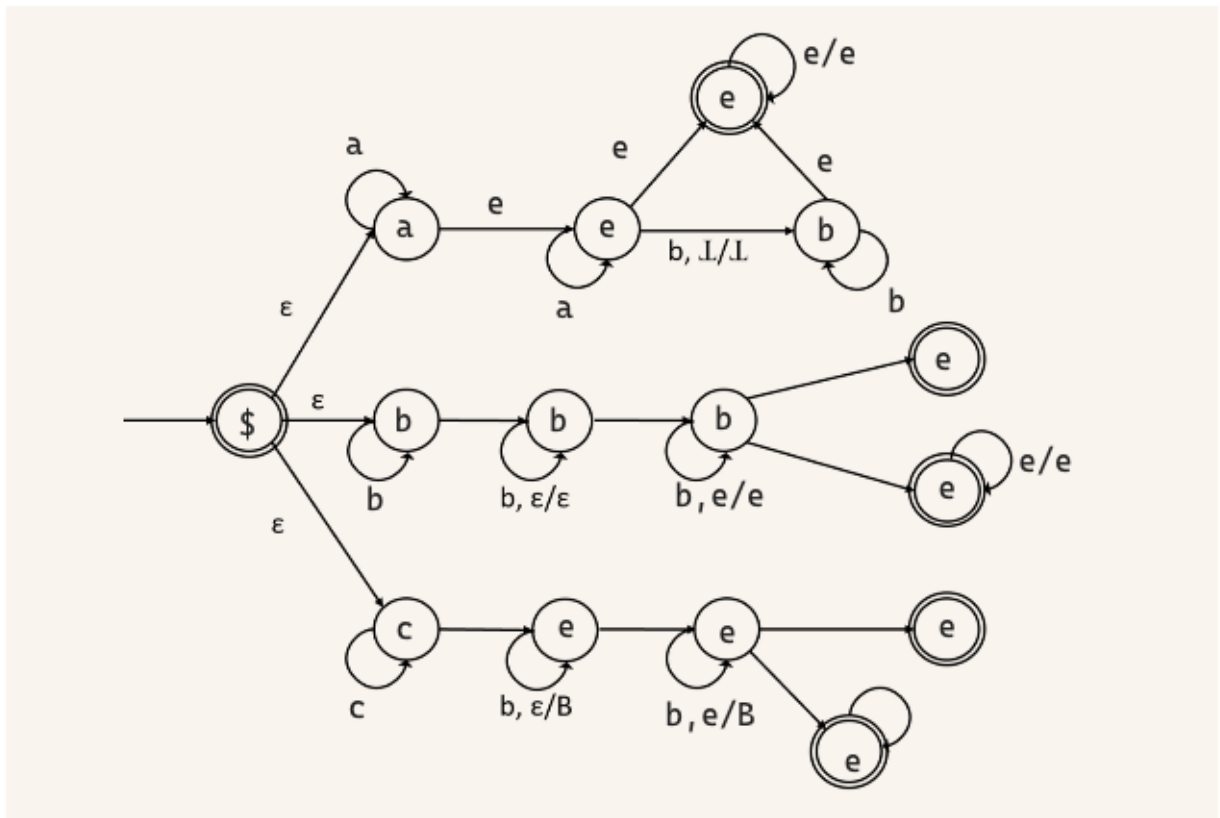
and let

$$L_2 = \{a^n b^n c^n \mid n \geq 1\}$$

Complete the pushdown automata M such that $L(M) = L_1 - L_2$, where $\Sigma = \{a, b, c\}$.

Solution

Given that the $L(M)$ will accept all string where the number of a's, b's, and c's are not all the same or there are zero of one or more types of characters, the following is the pushdown automata M



Problème 3.

The first table:

	1	0	x	#	c	□
q_s	$(q_{1,1}, x, R)$	$(q_{1,3}, x, R)$	(q_s, x, R)	-	-	-
$q_{1,1}$	$(q_{1,1}, 1, R)$	$(q_{1,1}, 0, R)$	-	$(q_{1,2}, \#, R)$	-	-
$q_{1,2}$	$(q_{1,5}, x, R)$	$(q_{1,2}, x, R)$	-	-	-	-
$q_{1,3}$	$(q_{1,3}, 1, R)$	$(q_{1,3}, 0, R)$	-	$(q_{1,4}, \#, R)$	-	-
$q_{1,4}$	$(q_{1,3}, c, L)$	$(q_{1,7}, x, R)$	$(q_{1,4}, x, R)$	-	-	-
$q_{1,5}$	$(q_{1,5}, 1, R)$	$(q_{1,5}, 0, R)$	-	$(q_{1,8}, \#, R)$	-	-
$q_{1,6}$	$(q_{1,6}, 1, R)$	$(q_{1,6}, 0, R)$	-	$(q_{1,9}, \#, R)$	-	-
$q_{1,7}$	$(q_{1,7}, 1, R)$	$(q_{1,7}, 0, R)$	-	$(q_{1,10}, \#, R)$	-	-
$q_{1,8}$	$(q_{1,8}, 1, R)$	$(q_{1,8}, 1, R)$	-	-	$(q_{1,8}, c, R)$	$(q_{1,end1}, \square, L)$
$q_{1,9}$	$(q_{1,9}, 1, R)$	$(q_{1,9}, 0, R)$	-	-	$(q_{1,9}, 1, R)$	$(q_{1,end2}, \square, L)$
$q_{1,10}$	$(q_{1,10}, c, R)$	$(q_{1,10}, 1, R)$	-	-	$(q_{1,10}, c, R)$	$(q_{1,end3}, \square, L)$
$q_{1,end1}$	$(q_{1,end1}, 1, L)$	$(q_{1,end1}, 0, L)$	-	$(q_{1,end2}, \#, L)$	$(q_{1,end1}, c, L)$	-
$q_{1,end2}$	$(q_{1,end3}, 1, L)$	$(q_{1,end3}, 0, L)$	$(q_{1,end2}, x, L)$	$(q_{1,end2}, \#, L)$	-	-
$q_{1,end3}$	$(q_{1,end3}, 1, L)$	$(q_{1,end3}, 0, L)$	$(q_{1,end3}, x, L)$	$(q_{1,end3}, \#, L)$	-	(q_2, s, \square, R)

The second table:

	1	0	x	#	c	\square
$q_{2,s}$	-	-	$(q_{2,s}, \square, R)$	$(q_{2,1}, \square, R)$	-	-
$q_{2,1}$	-	-	$(q_{2,1}, \square, R)$	$(q_{2,1}, \square, R)$	-	-
$q_{2,2}$	$(q_{2,1}, \square, L)$	$(q_{2,1}, \square, L)$	-	-	$(q_{2,1}, \square, L)$	$(q_{3,s}, \square, L)$

The final transition table:

	1	0	c	\square
$q_{3,s}$	$(q_{3,s}, 1, R)$	$(q_{3,s}, 0, R)$	$(q_{3,s}, c, R)$	$(q_{3,1}, \square, R)$
$q_{3,1}$	$(q_{3,2}, 0, L)$	$(q_{3,2}, 1, L)$	$(q_{3,1}, 1, L)$	$(q_{3,2}, \square, R)$
$q_{3,2}$	$(q_{3,1}, \square, L)$	$(q_{3,1}, \square, L)$	$(q_{3,1}, \square, L)$	$(q_{3,end}, \square, L)$