Francisco José de Caldas District University

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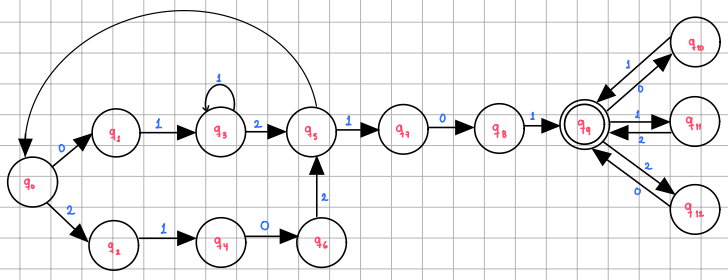
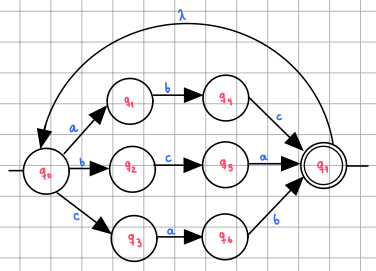
Computer Science III: Workshop I.

1. Define the corresponding finite-state machine for:

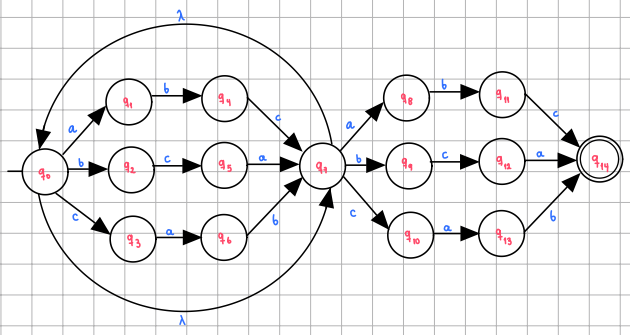
(i) $\Sigma = \{0, 1, 2\}$. $L = (01^*2 \cup 2102)^*101(01 \cup 12 \cup 20)^*$.



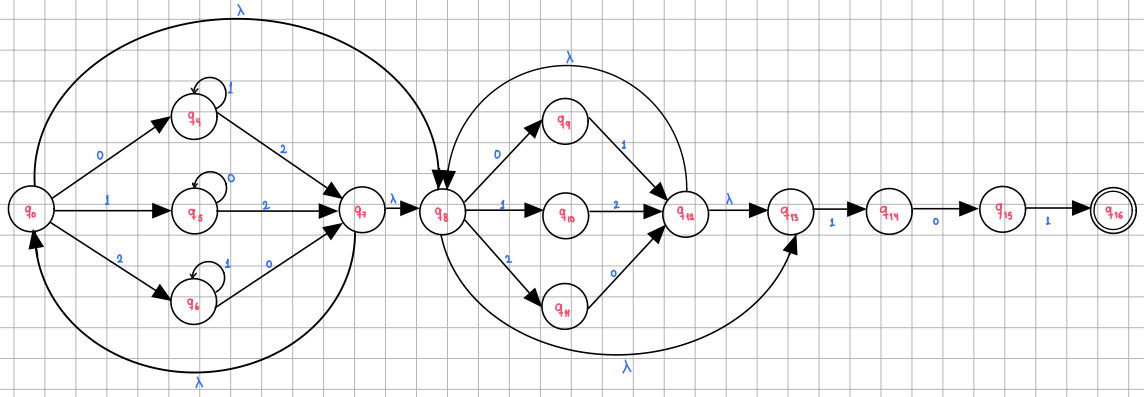
(ii) $\Sigma = \{a, b, c\}$. $L = (abc \cup bca \cup cab)(abc \cup bca \cup cab)^*$.



(iii) $\Sigma = \{a, b, c\}$. $L = (abc \cup bca \cup cab)^*(abc \cup bca \cup cab)$.

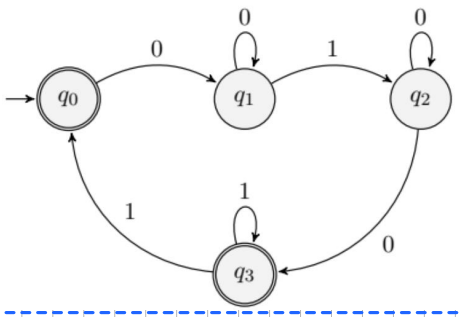


(iv) $\Sigma = \{0, 1, 2\}$. $L = (01^*2 \cup 10^*2 \cup 21^*0)^*(01 \cup 12 \cup 20)^*101$



2. Define the corresponding regular expression and generative grammar for:

(i) $\Sigma = \{0, 1\}$.

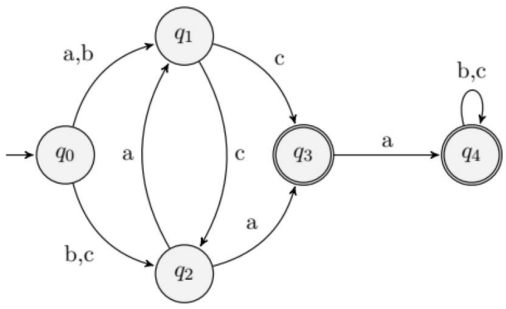


Regular Expression:

$L = [(00^*10^*)(01^*\cup 01^*1)]^*$

Generative Grammar:

S = 0A | λ
A = 0A | B
B = 1C
C = 0C | 0D
D = 1D | 1S | 1



Regular Expression:

$L = \{(a \cup b)[(ca)^*c \cup (ca)^*ca \cup c \cup ca](b \cup c)^*\}$
$\cup \{(b \cup c)[(ac)^*a \cup (ac)^*aa \cup a \cup aa](b \cup c)^*\}$

S = aA | bA | bB | cB
A = cB | cC | c
B = aA | aC | a
C = aD | a
D = bD | cD | b | c

3. Define the corresponding generative grammar for:

(i) $\{a^i b^j c^j d^i : i, j \geq 1\}$.

S = A
A = aAd | aBd
B = bBc | bc

(ii) $\{a^i b^j c^j d^j : i, j \geq 1\}$.

S = AB
A = aAb | ab
B = cBd | cd

(iii) $\{a^i b^j c^j d^i : i, j \geq 1\} \cup \{a^i b^j c^j d^j : i, j \geq 1\}$.

S = A | C
A = aAd | aBd
B = bBc | bc
C = aAb | aDb
D = cDd | cd

(iv) $\{a^i b^j c^{i+j} : i \geq 0, j \geq 1\}$.

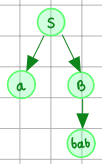
S = A
A = aAc | B
B = bBc | bc

4. Be G a context-free grammar with the following productions:

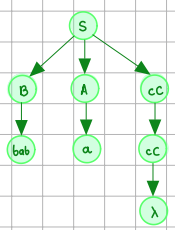
$$G = \begin{cases} S \to ABC \mid BaC \mid aB \\ A \to Aa \mid a \\ B \to BAB \mid bab \\ C \to cC \mid \lambda \end{cases}$$

Found derivation trees for:

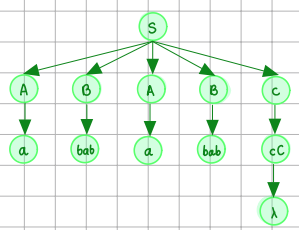
(i) $w_1 = abab$.



(ii) $w_2 = babacc$.



(iii) $w_3 = abababbc$.



5. As follows there is a **context-free grammar** to generate **real numbers** without sign, the alphabet is $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., +, -, E\}$:

$$
\begin{array}{lcl}
< real > & \rightarrow & < digits >< decimal >< exp > \\
< digits > & \rightarrow & < digits >< digits > | \, 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9 \\
< decimal > & \rightarrow & < digits > | \, \lambda \\
< exp > & \rightarrow & E < digits > | \, E+ < digits > | \, E- < digits > | \, \lambda
\end{array}
$$

Define the derivation tree for:

(i) $w_1 = 47.236$

<Real> → <Digits><Decimal><Exp>
→ <Digits><Digits><Decimal><Exp>
→ 4 <Digits><Decimal><Exp>
→ 47. <Digits><Exp>
→ 47. <Digits><Digits><Exp>
→ 47. 2 <Digits><Digits><Exp>
→ 47.236 <Exp>
→ 47. 236 λ
→ 47. 236

(ii) $w_2 = 321.25E + 35$

<Real> → <Digits><Decimal><Exp>
→ <Digits><Digits><Decimal><Exp>
→ <Digits><Digits><Digits><Decimal><Exp>
→ 321. <Digits><Exp>
→ 321. <Digits><Digits><Exp>
→ 321. 25 <Exp>
→ 321. 25 E + <Digits>
→ 321. 25 E + <Digits><Digits>
→ 321. 25 E + 35

(iii) $w_3 = 0.8E9$

<Real> → <Digits><Decimal><Exp>
→ 0 <Decimal><Exp>
→ 0. <Digits><Exp>
→ 0. 8 <Exp>
→ 0.8 E <Digits>
→ 0.8 E 9

(iv) $w_4 = 0.8E + 9$

<Real> → <Digits><Decimal><Exp>
→ 0 <Decimal><Exp>
→ 0. <Digits><Exp>
→ 0. 8 E+ <Digits>
→ 0.8E+9

6. As follows there is a **context-free grammar** to generate **identifiers**, identifiers are strings of letters and digits, starting with a letter:

$$
\begin{array}{lcl}
< identifier > & \rightarrow & < letter >< lsds > \\
< lsds > & \rightarrow & < letter >< lsds > | < digit >< lsds > | \, \lambda \\
< letter > & \rightarrow & a \mid b \mid c \mid \ldots \mid x \mid y \mid z \mid A \mid B \mid C \mid \ldots \mid X \mid Y \mid Z \\
< digit > & \rightarrow & 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9
\end{array}
$$

Define the derivation tree for the following names:

Define the derivation tree for the following names:

(i) $w_1 = MyVariable$

<Identifier> → <Letter><lsds>
→ <Letter><Letter><lsds>
→ <Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Letter><lsds>
→ My Var <Letter><lsds>
→ My Var <Letter><Letter><lsds>
→ My Varia <lsds>
→ My Varia <Letter><lsds>
→ My Variab <lsds>
→ My Variab <Letter><lsds>
→ My Variabl <lsds>
→ My Variabl <Letter><lsds>
→ My Variable <lsds>
→ My Variable λ
→ My Variable

(ii) $w_2 = temp2$

<Identifier> → <Letter><lsds>
→ <Letter><Letter><lsds>
→ <Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Digit><lsds>
→ temp 2 λ
→ temp 2

(iii) $w_3 = string2int$

<Identifier> → <Letter><lsds>
→ <Letter><Letter><lsds>
→ <Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Letter><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Letter><Letter><Digit><lsds>
→ <Letter><Letter><Letter><Letter><Letter><Letter><Digit><Letter><lsds>
→ <Letter><Letter><Letter><Letter><Letter><Letter><Digit><Letter><Letter><lsds>
→ String2int

(iv) $w_4 = 2NotAVariable$

It does not conform to the rules defined in the grammar