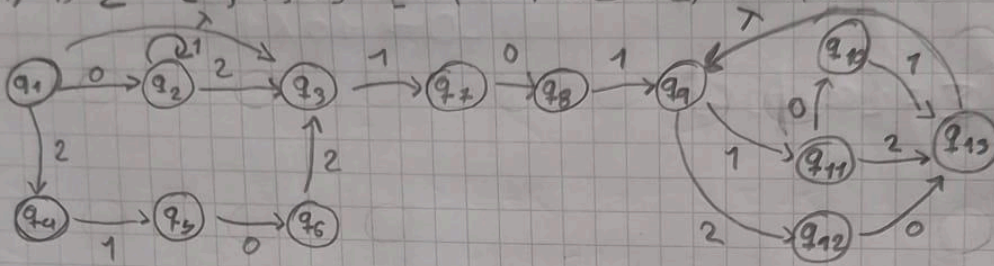


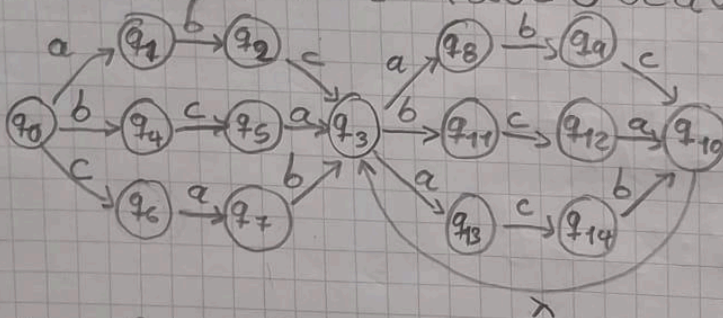
Workshop #1

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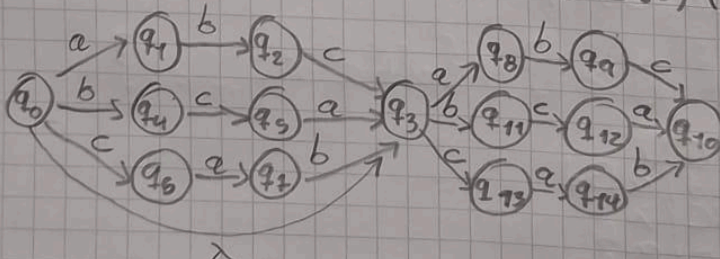
i) $\Sigma = \{0, 1, 2\}$ $L = (01^*02^*02)^*101(01 \vee 12 \vee 20)^*$



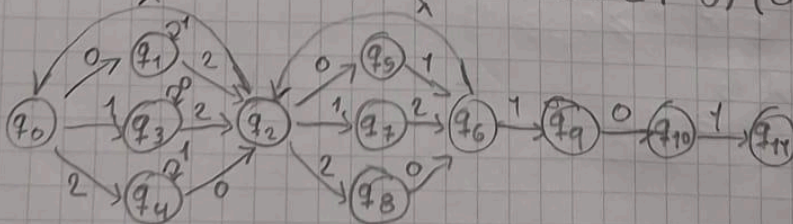
ii) $\Sigma = \{a, b, c\}$ $L = (abc \cup bca \cup cab)(abc \cup bca \cup cab)^*$



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 i) $\Sigma = \{0, 1\}$
 $L = (00^*10^*01^*1)^*$

$G = \begin{cases} S \rightarrow A S / \lambda \\ A \rightarrow 0 B \\ B \rightarrow 0 B / 1 C \\ C \rightarrow 0 C / 0 D \\ D \rightarrow 1 0 / 1 \end{cases}$

ii) $\Sigma = \{a, b, c\}$
 $L =$

③ i) $\{a^i b^j c^j d^j : i, j \geq 1\}$

$G = \begin{cases} S \rightarrow a S d / a A d \\ A \rightarrow b A c / \lambda \end{cases}$

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

$G = \begin{cases} S \rightarrow A C \\ A \rightarrow a A b / a b \\ C \rightarrow c C d / c d / \lambda \end{cases}$

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

$G = \begin{cases} S \rightarrow A / C D \\ A \rightarrow a A d / a B d \\ B \rightarrow b B C / \lambda \\ C \rightarrow a C b / a b \\ D \rightarrow c D d / c d / \lambda \end{cases}$

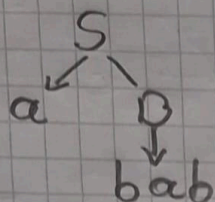
iv) $\{a^i b^j c^i d^j : i \geq 0, j \geq 1\}$

$G = \begin{cases} S \rightarrow A B \\ A \rightarrow a A B C / \lambda \\ B \rightarrow b B c / b C / \lambda \end{cases}$

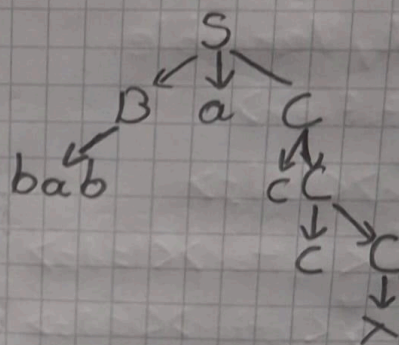
④

$$G = \begin{cases} S \rightarrow ABC \mid B a C \mid a B \\ A \rightarrow A a \mid a \\ B \rightarrow B A B \mid b a b \\ C \rightarrow c C \mid \lambda \end{cases}$$

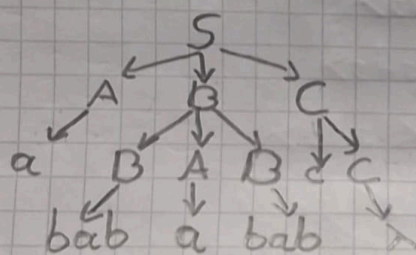
i) $w_1 = a b a b$



ii) $w_2 = b a b a c c c$



iii) $w_3 = a b a b a b a b c$



⑤ Context-free grammar to generate real numbers

$\langle \text{real} \rangle \rightarrow \langle \text{digits} \rangle \langle \text{decimal} \rangle \langle \text{exp} \rangle$

$\langle \text{digits} \rangle \rightarrow \langle \text{digit} \rangle \langle \text{digits} \rangle \mid \langle \text{digit} \rangle$

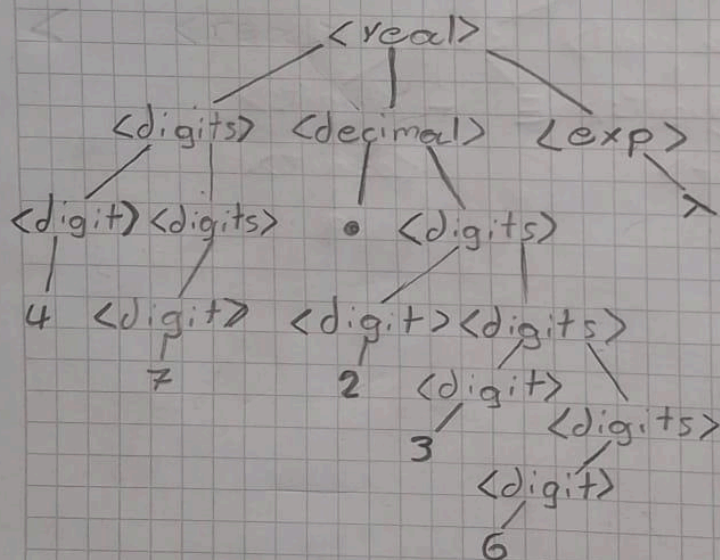
$\langle \text{decimal} \rangle \rightarrow . \langle \text{digits} \rangle \mid \lambda$

$\langle \text{exp} \rangle \rightarrow E \langle \text{digits} \rangle \mid E + \langle \text{digits} \rangle \mid E - \langle \text{digits} \rangle \mid \lambda$

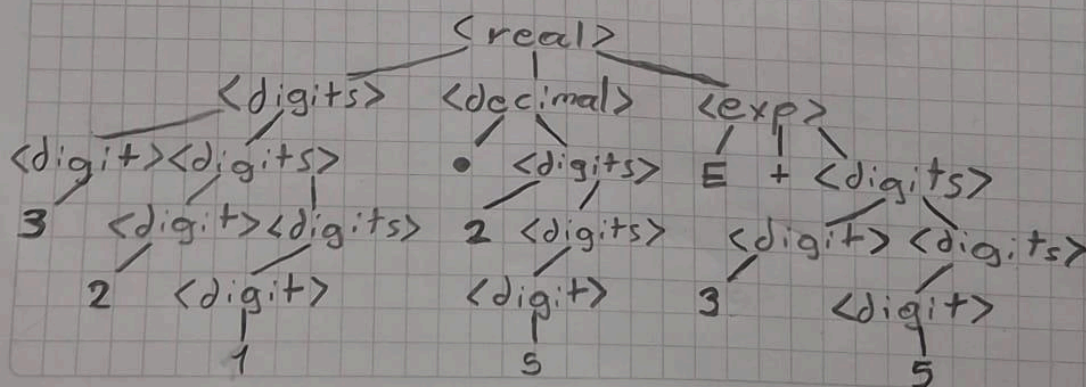
$\langle \text{digit} \rangle \rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$

define the derivation tree

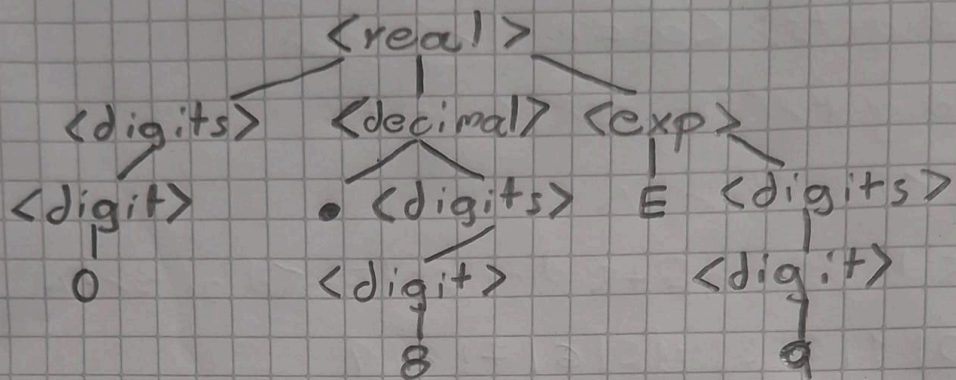
i) $w_1 = 47.236$



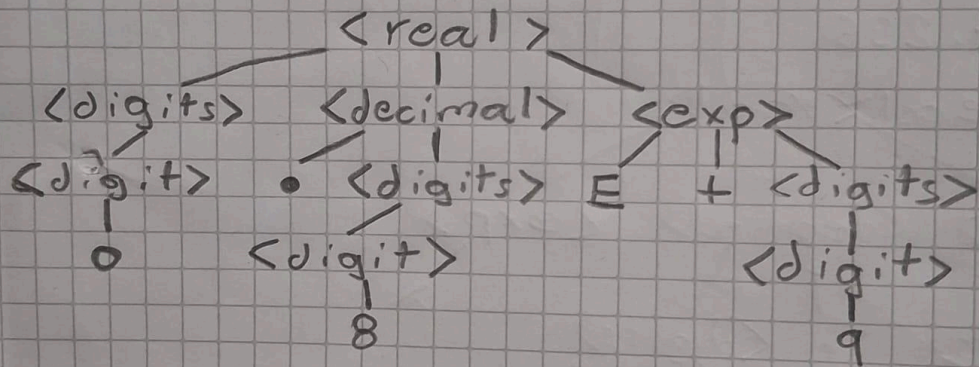
ii) $w_2 = 321.25E + 35$



iii) $0.8E9$



iv) $w_4 = 0.8E+9$



⑥ $\langle \text{identifier} \rangle \rightarrow \langle \text{letter} \rangle \langle \text{lds} \rangle$
 $\langle \text{lds} \rangle \rightarrow \langle \text{letter} \rangle \langle \text{lds} \rangle \mid \langle \text{digit} \rangle \langle \text{lds} \rangle \mid \epsilon$
 $\langle \text{letter} \rangle \rightarrow a|b|c|\dots|y|z|A|B|C|\dots|Y|Z|$
 $\langle \text{digit} \rangle \rightarrow 0|1|2|3|4|5|6|7|8|9$

i) $W_1 = \text{My Variable}$

$\langle \text{identifier} \rangle$
 \downarrow
 $\langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $M \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $y \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $V \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $a \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $r \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $i \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $a \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $b \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $\downarrow \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 $e \langle \text{letter} \rangle \langle \text{lds} \rangle$
 \downarrow
 ϵ

ii) temp 2

$\langle \text{identifier} \rangle$
 $\langle \text{letter} \rangle \langle \text{lds} \rangle$
 $t \langle \text{letter} \rangle \langle \text{lds} \rangle$
 $e \langle \text{letter} \rangle \langle \text{lds} \rangle$
 $m \langle \text{letter} \rangle \langle \text{lds} \rangle$
 $p \langle \text{digit} \rangle \langle \text{lds} \rangle$
 $2 \langle \text{lds} \rangle$
 \downarrow
 ϵ

iii) $w_3 = \text{string 2 int}$

$\langle \text{identifier} \rangle$

$\langle \text{letter} \rangle \langle \text{lds} \rangle$

$s \langle \text{letter} \rangle \langle \text{lds} \rangle$

$t \langle \text{letter} \rangle \langle \text{lds} \rangle$

$r \langle \text{letter} \rangle \langle \text{lds} \rangle$

$i \langle \text{letter} \rangle \langle \text{lds} \rangle$

$n \langle \text{letter} \rangle \langle \text{lds} \rangle$

$g \langle \text{digit} \rangle \langle \text{lds} \rangle$

$2 \langle \text{letter} \rangle \langle \text{lds} \rangle$

$i \langle \text{letter} \rangle \langle \text{lds} \rangle$

$n \langle \text{letter} \rangle \langle \text{lds} \rangle$

$t \langle \text{lds} \rangle$

λ

iv) $w_4 = 2 \text{ Not A Variable}$

$\langle \text{identifier} \rangle$

$\langle \text{letter} \rangle \langle \text{lds} \rangle$

It can't be solved

⊕

i) Identifier: $r'[a-zA-Z][a-zA-Z 0-9]^*$

ii) Integer Literal: $r'[+ -]? \backslash d +$

iii) Floating point Literal

$r'[+ -]? (\backslash d + \backslash . \backslash d^* | \backslash . \backslash d^+) ([eE][+ -]? \backslash d +)?$

iv) Single-line Comment

$r'//, *'$

vii) White space

$r' \backslash s +$