Computer science III
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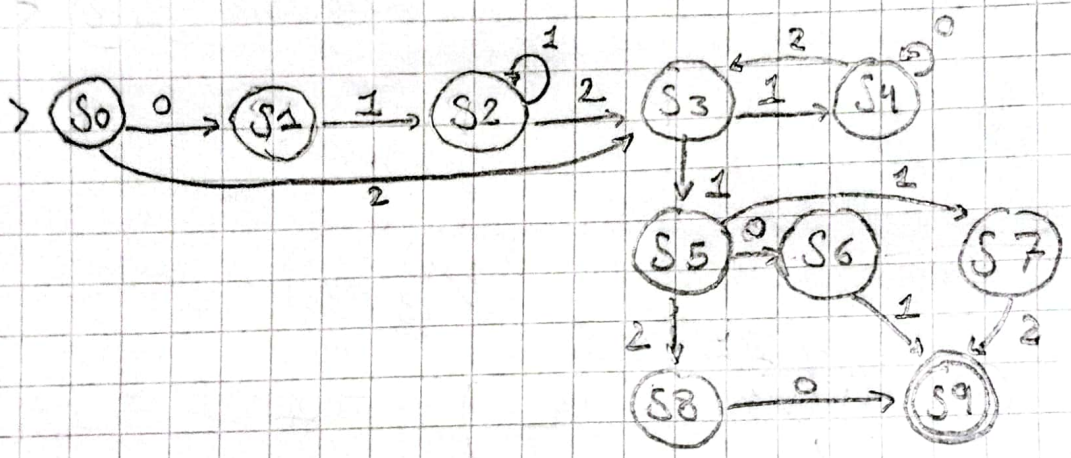
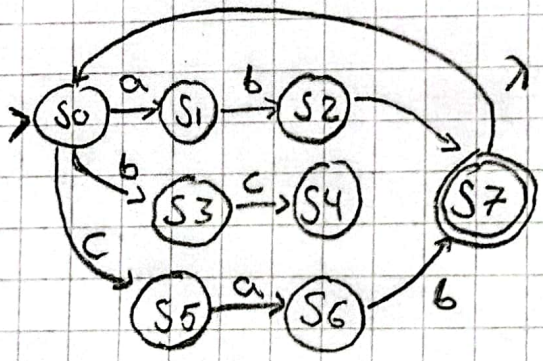
1. For each of the following languages, define the corresponding finite-state machine

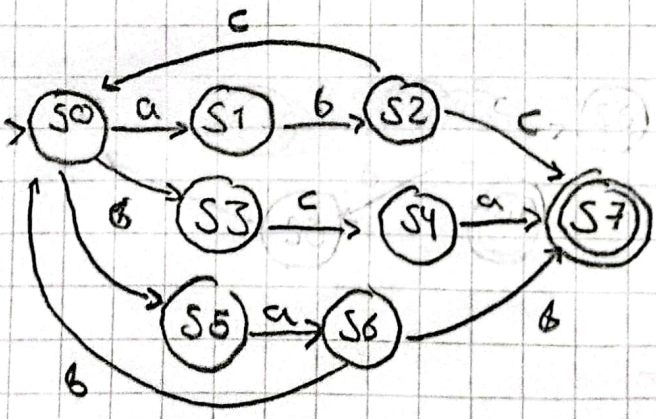
(i) $\Sigma = \{0,1,2\}$. $L = (01^*2 \cup 2|02)^* 101 (01 \cup 12 \cup 20)^*$



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



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



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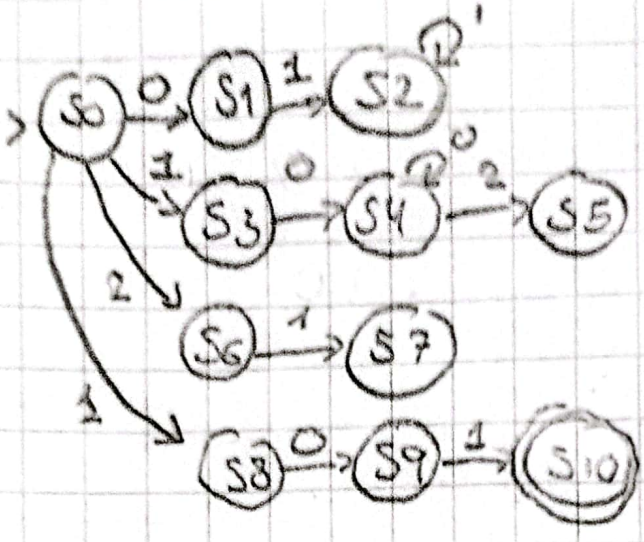
(iv) $\Sigma = \{0,1,2\}$. $L = (01^* 2 \cup 10^* 2 \cup 21^* 0)^* (01 \cup 12 \cup 20)^* 10$



2) for each one of the following finite-state machines, define the corresponding regular expression and generative grammar

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

$(0^+ 10^+ 1^*)^*$

generative grammar G

$$\begin{cases} S \to 0A \mid \lambda \\ A \to 0A \mid 1B \\ B \to 0B \mid 0C \\ C \to 1C \mid 1S \mid \lambda \end{cases}$$

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

$((a \cup b)\, c\, (\lambda \cup$

3) for each of the following regular expressions, define the corresponding generative grammar (all over the alphabet $\Sigma = \{a, b, c, d\}$):

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

$$G: \begin{cases} S \to aAd \\ A \to aAd \mid bBC \\ B \to bBC \mid \lambda \end{cases}$$

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

$$G: \begin{cases} S \to AB \\ A \to aAb \mid ab \\ B \to cBd \mid cd \end{cases}$$

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

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

$$G: \begin{cases} S \to AB \\ A \to aAc \\ B \to bBc \mid bc \end{cases}$$

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

$$G: \begin{cases} S \to ABC \mid BaC \mid aB \\ A \to aa \mid a \\ B \to BAB \mid bob \\ C \to oC \mid \lambda \end{cases}$$

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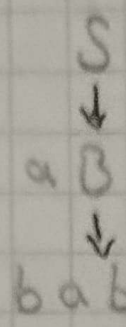
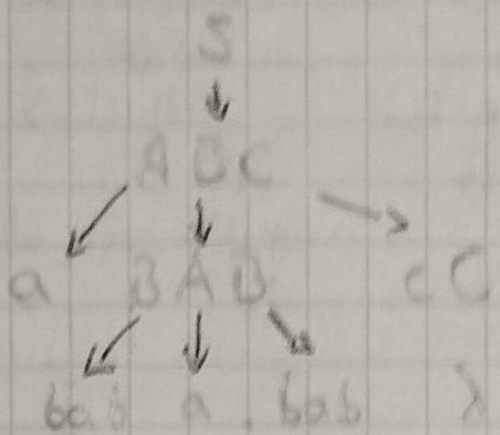
Found derivation trees for the following strings

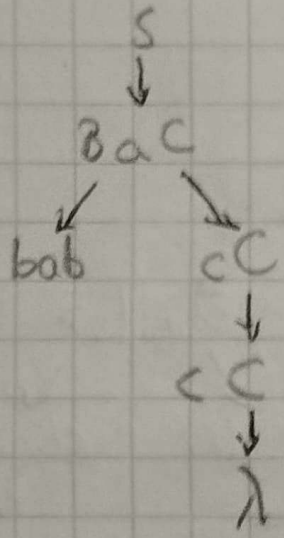
i) $w_1 = abab$



iii) $w_3 = abababbabc$



ii) $w_2 = babacc$



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

i) $w_1 = 43,236$

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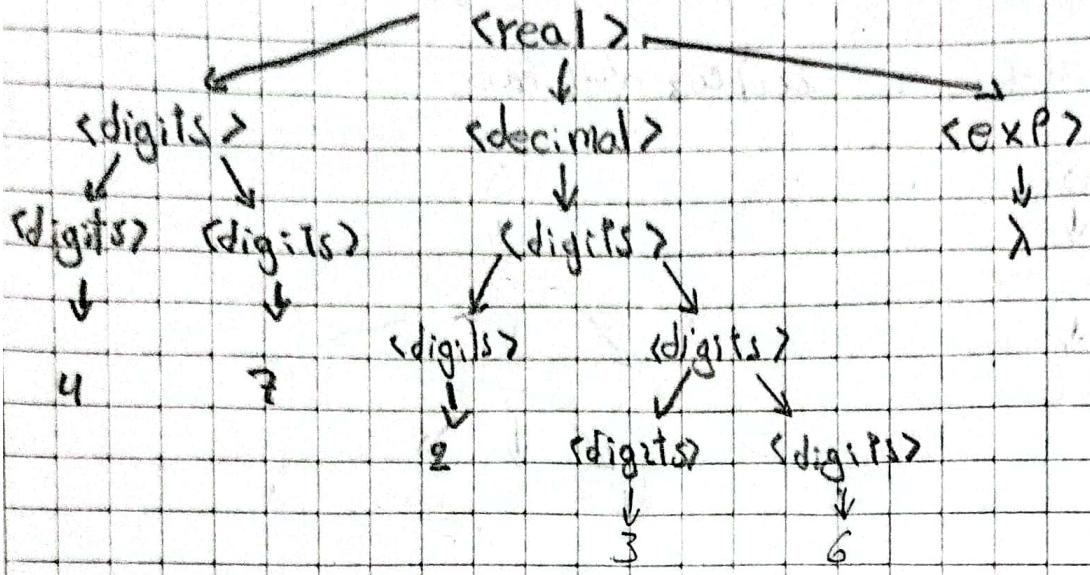
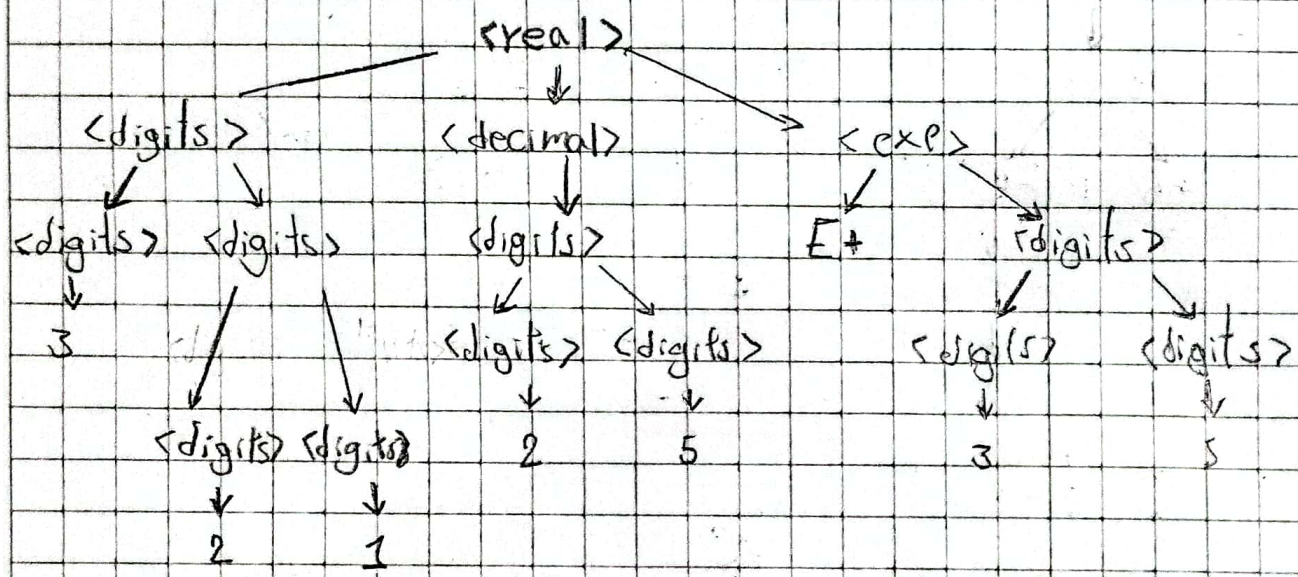
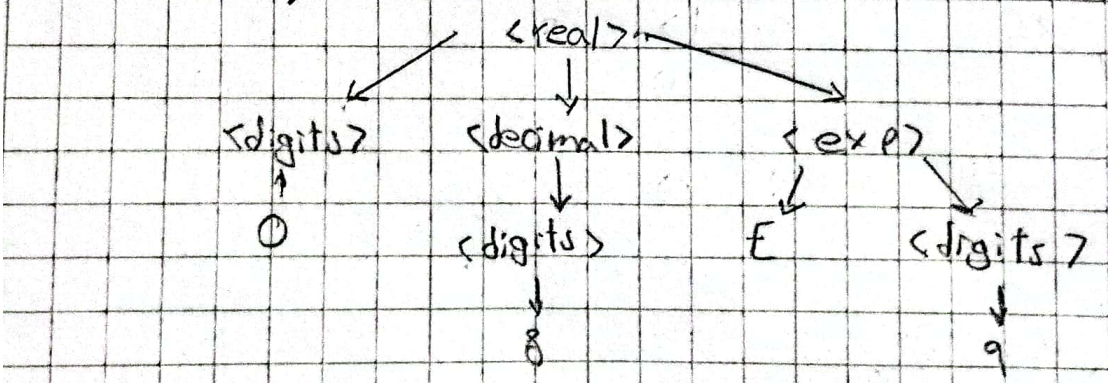


ii) $w_2 = 321{,}25E+35$



iii) $w_3 = 0{,}8E9$



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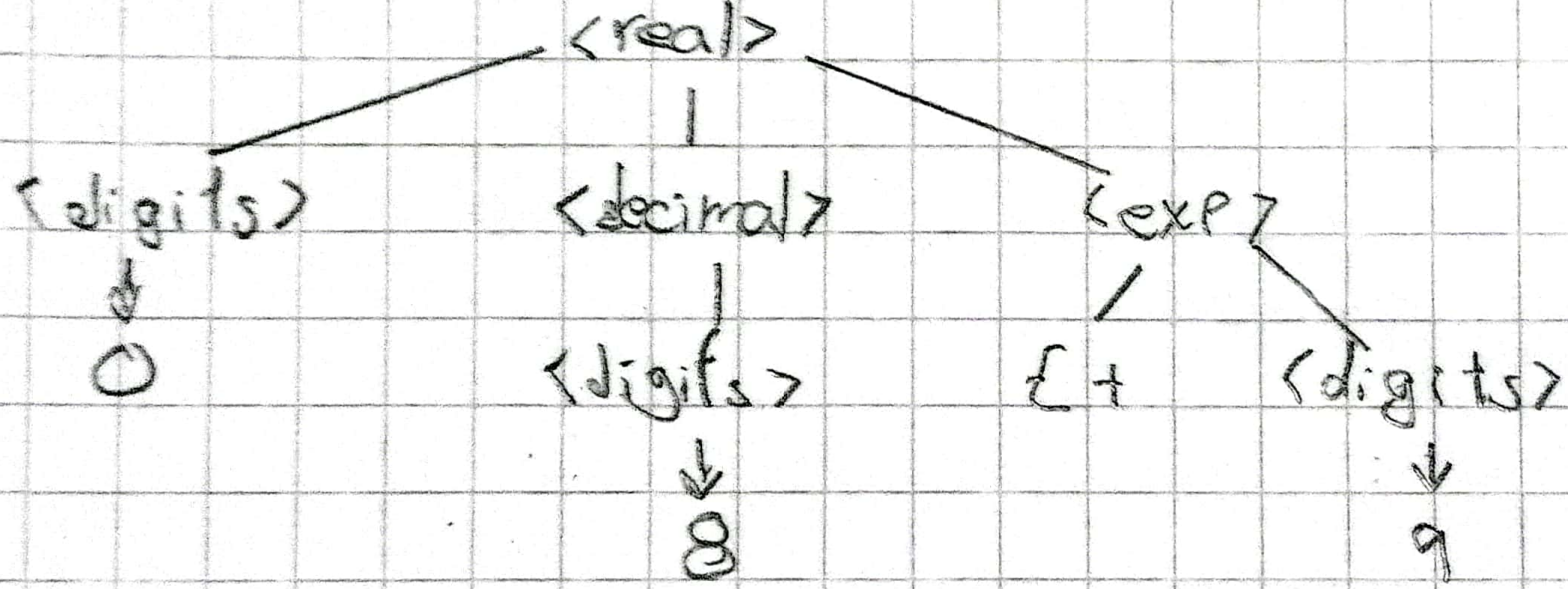
iv) w4 = 0.8E+9



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