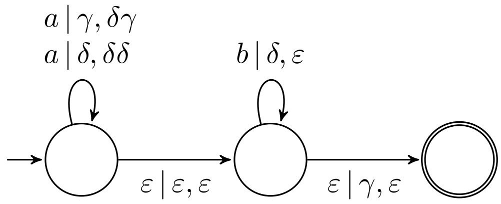
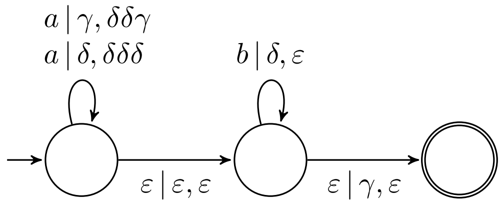
ΑΣΚΗΣΕΙΣ ΓΙΑ ΑΥΤΟΜΑΤΑ ΣΤΟΙΒΑΣ

Βρείτε τα αυτόματα στοίβας για τις παρακάτω γλώσσες:

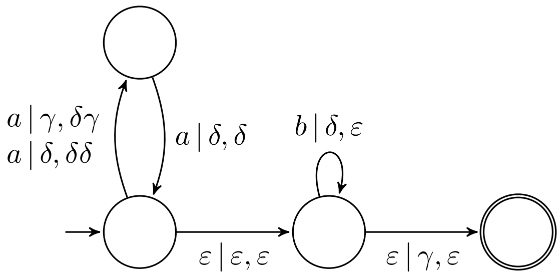
(1) $L = \{a^i b^i \colon i \geq 0\}$.



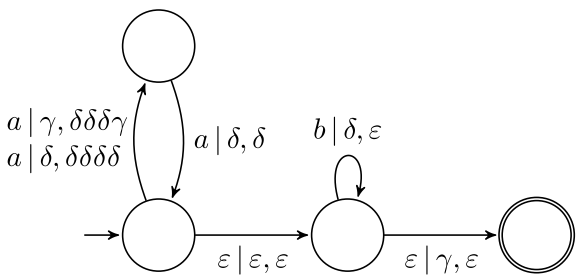
(2) $L = \{a^i b^{2i} \colon i \geq 0\}$.



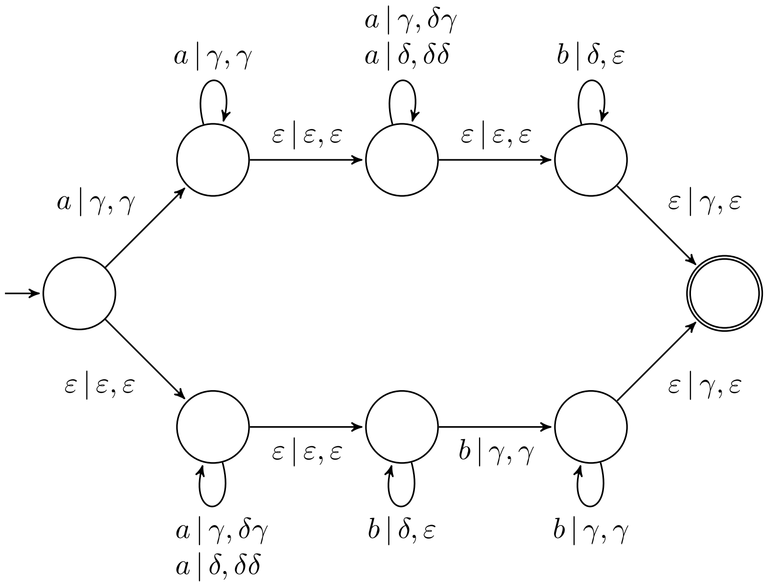
(3) $L = \{a^{2i} b^i \colon i \geq 0\}$.



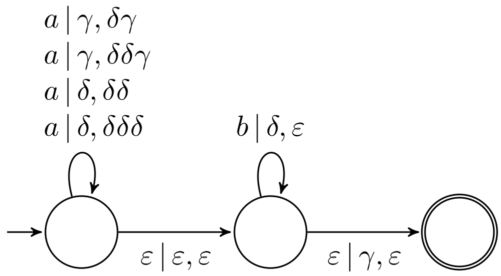
(4) $L = \{a^{2i} b^{3i} \colon i \geq 1\}$.



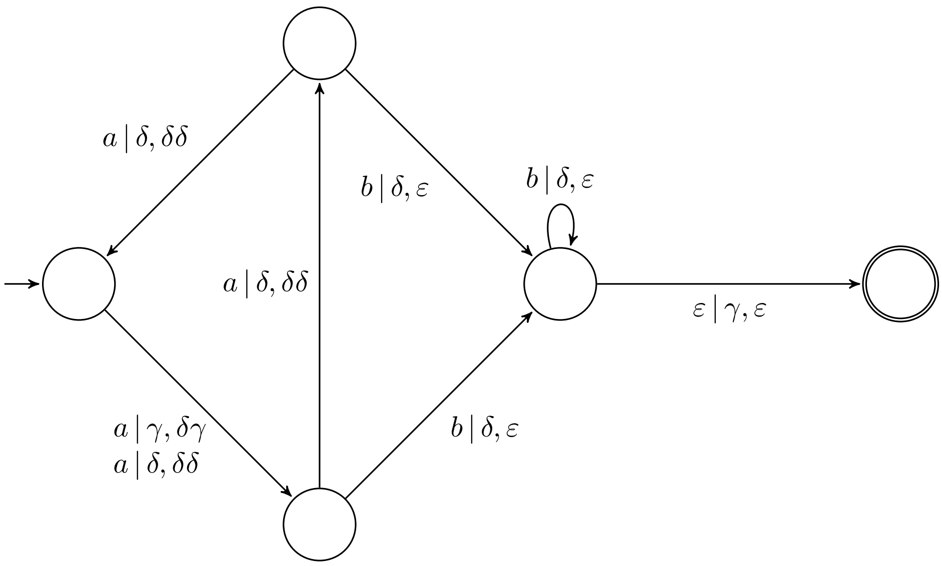
(5) $L = \{a^i b^j \colon i \neq j, i, j \geq 0\}$.



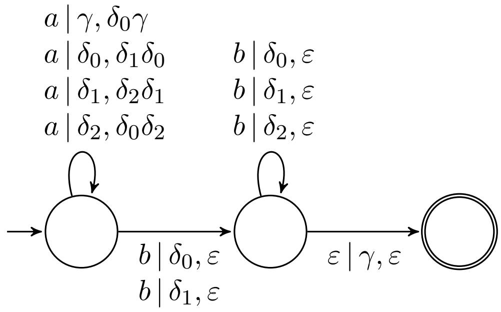
(6) $L = \{a^i b^j \colon 0 \leq i \leq j \leq 2i\}$.



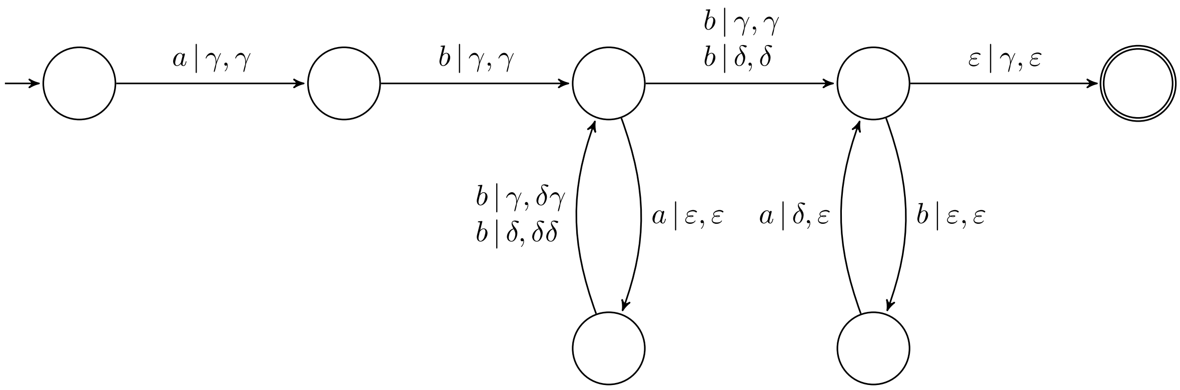
(7) $L = \{a^i b^i \colon i \neq 0 \mod 3\}$.



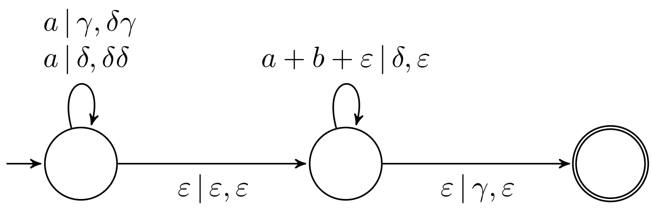
Εναλλακτική λύση:



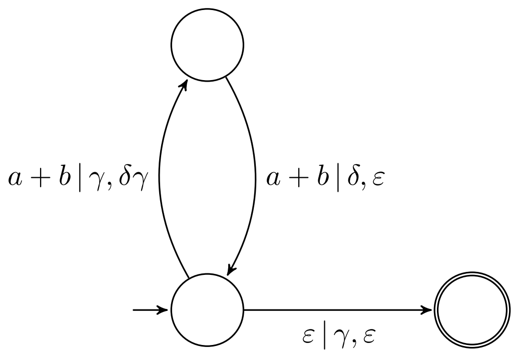
(8) $L = \{ab(ab)^i b(ba)^i \colon i \geq 0\}$.



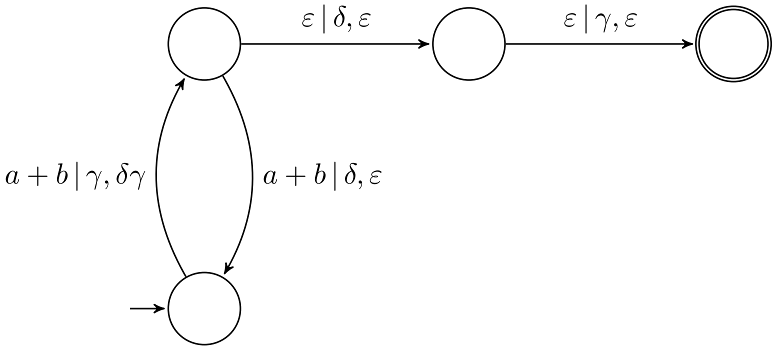
(9) $L = \{a^n w \colon n \geq 0, w \in (a+b)^* \text{ και } |w| \leq n\}$.



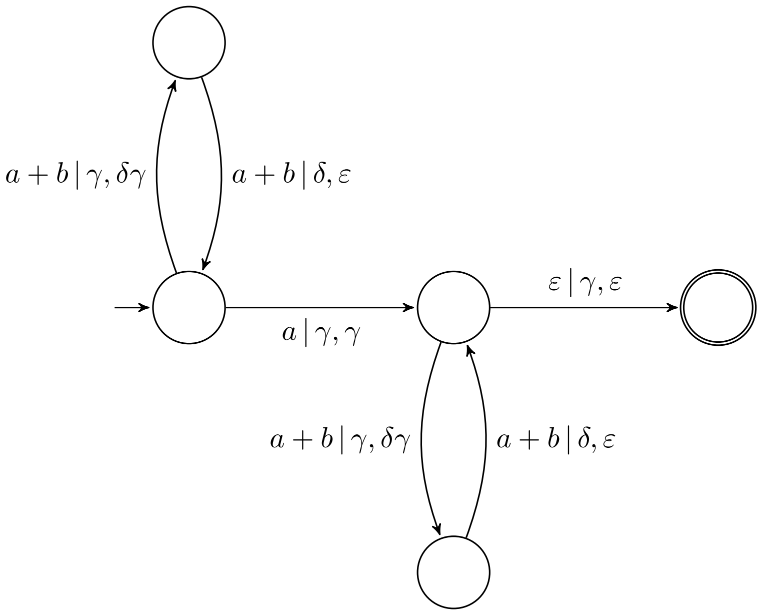
(10) $L = \{w \in (a+b)^* \colon |w| \text{ άρτιο}\}$.



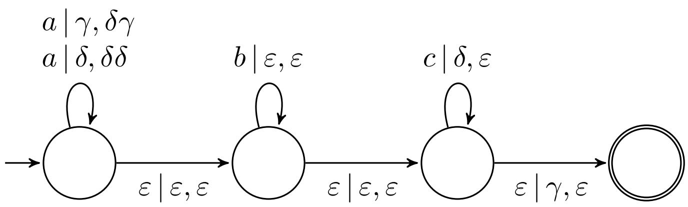
(11) $L = \{w \in (a+b)^*\colon |w| \text{ περιττό}\}$.



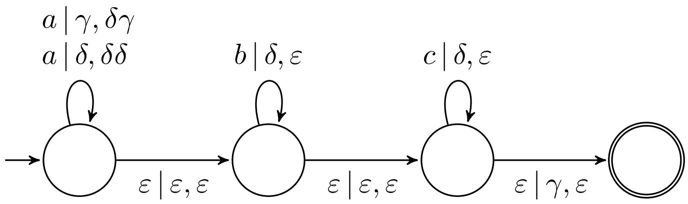
(12) $L = \{w_1 a w_2 \in (a+b)^*\colon |w_1| \text{ και } |w_2| \text{ άρτια}\}$.



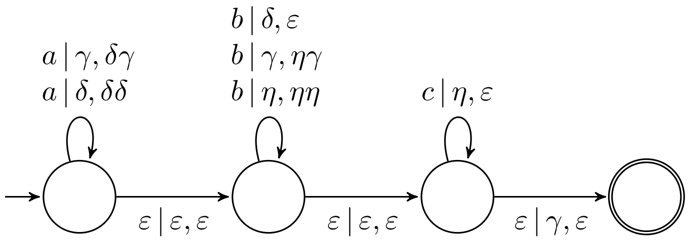
(13) $L = \{a^i b^j c^i\colon i, j \geq 0\}$.



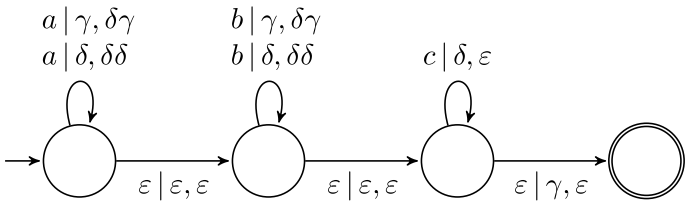
(14) $L = \{a^i b^j c^k\colon i = j + k\}$.



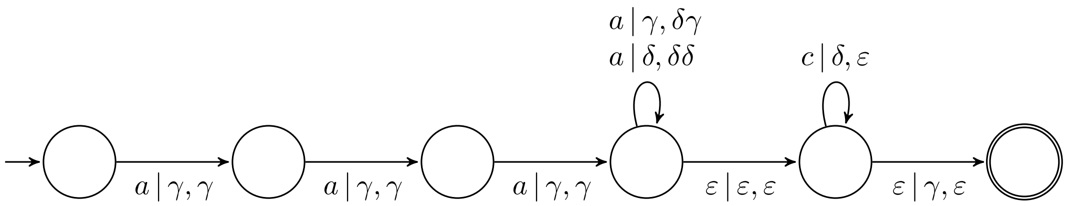
(15) $L = \{a^i b^j c^k \colon j = i + k\}$.



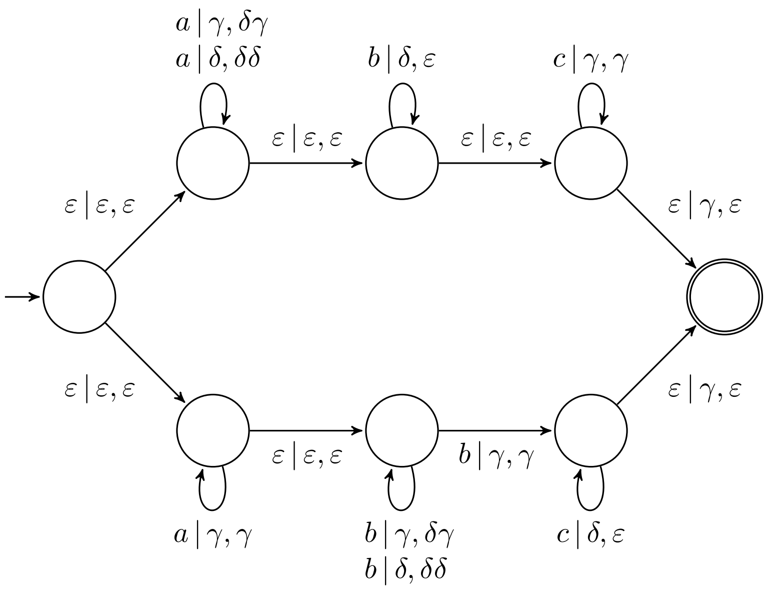
(16) $L = \{a^i b^j c^k \colon k = i + j\}$.



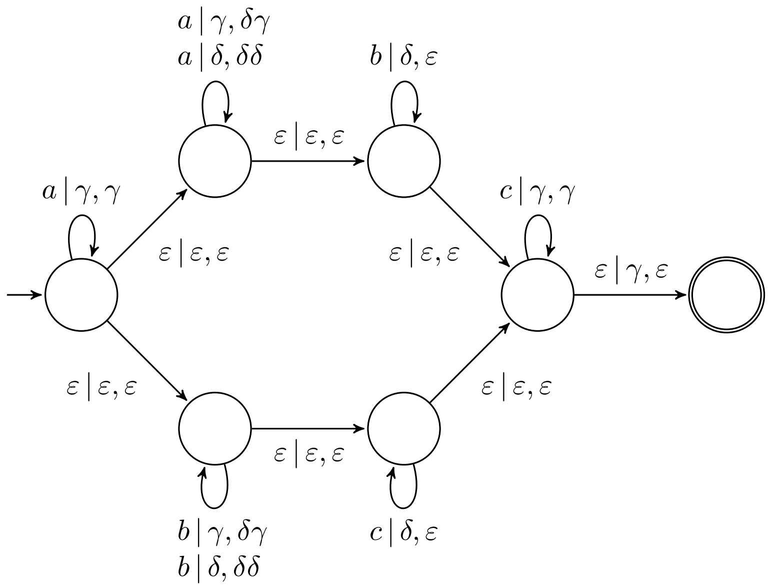
(17) $L = \{a^3 b^i c^i \colon i \geq 0\}$.



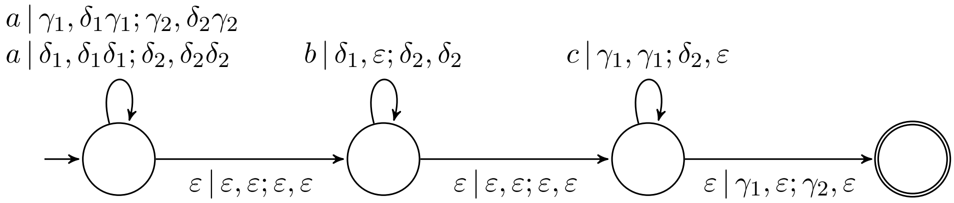
(18) $L = \{a^i b^j c^k \colon i = j \text{ ή } j = k\}$.



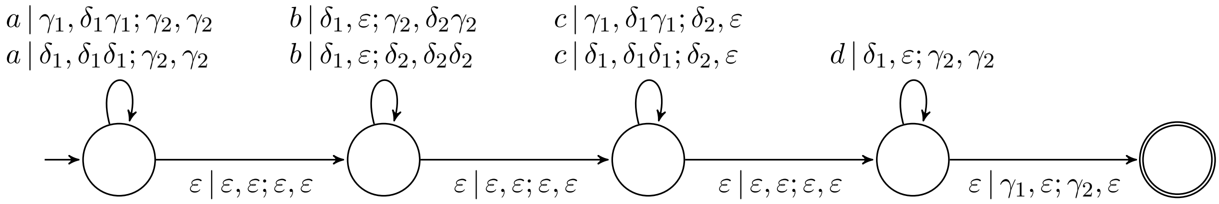
(19) $L = \{a^i b^j c^k \colon j < i$ ή $j < k\}$.



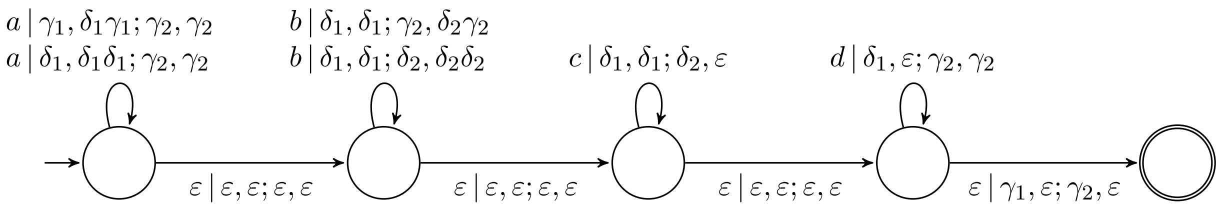
(20) $L = \{a^i b^i c^i \colon i \geq 0\}$.



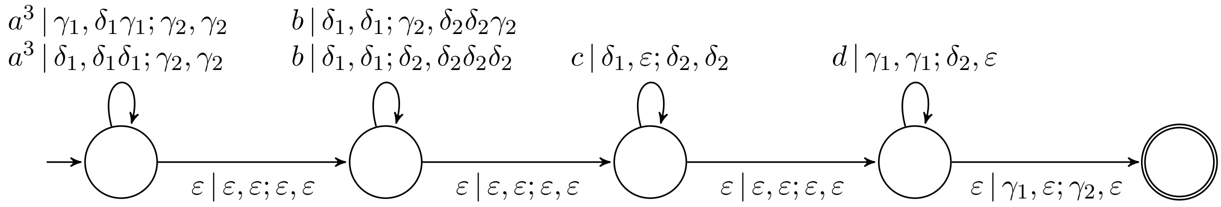
(21) $L = \{a^i b^i c^i d^i \colon i \geq 0\}$.



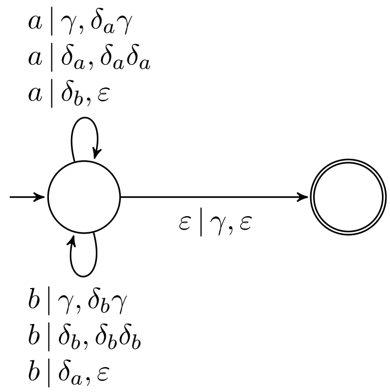
(22) $L = \{a^i b^j c^j d^i \colon i, j \geq 0\}$.



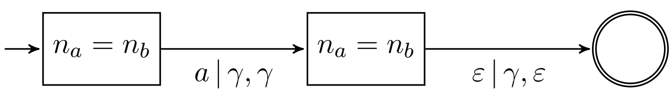
(23) $L = \{a^{3i}b^jc^id^{2j} \colon i, j \geq 0\}$.



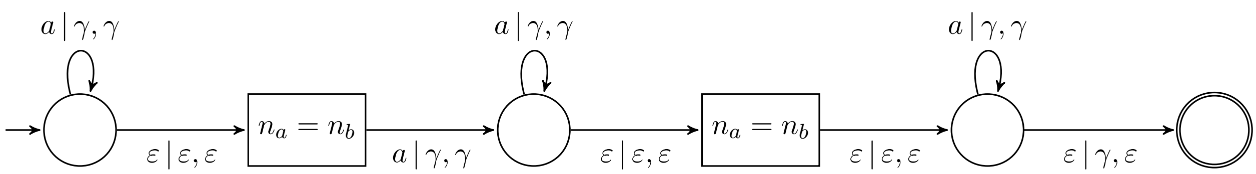
(24) $L = \{w \in (a + b)^\star \colon n_a(w) = n_b(w)\}$.



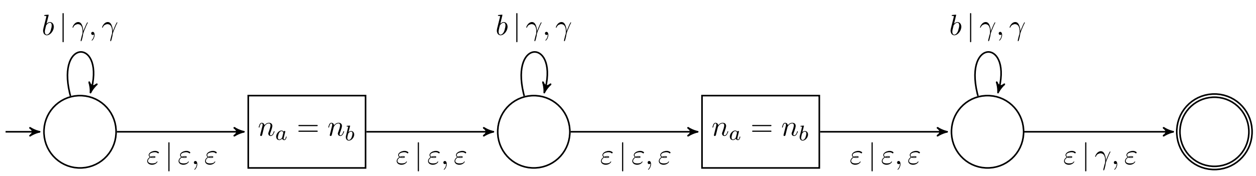
(25) $L = \{w \in (a + b)^\star \colon n_a(w) = n_b(w) + 1\}$.



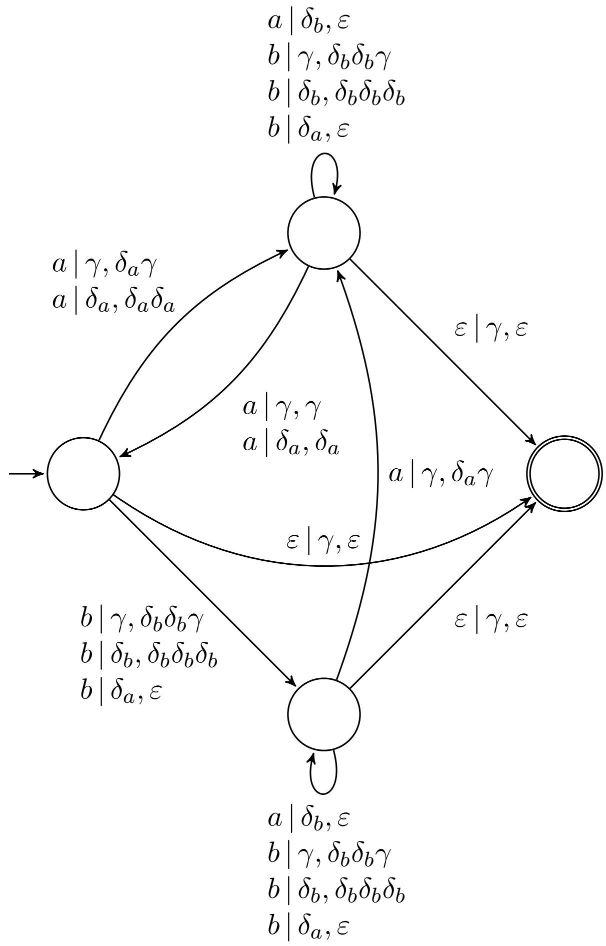
(26) $L = \{w \in (a + b)^\star \colon n_a(w) \geq n_b(w) + 1\}$.



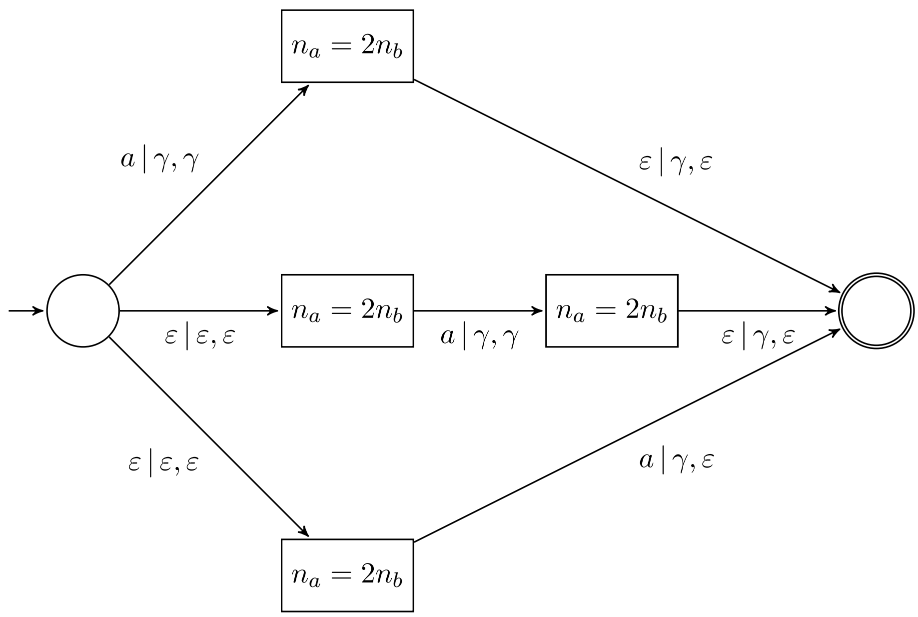
(27) $L = \{w \in (a + b)^\star \colon n_a(w) < n_b(w)\}$.



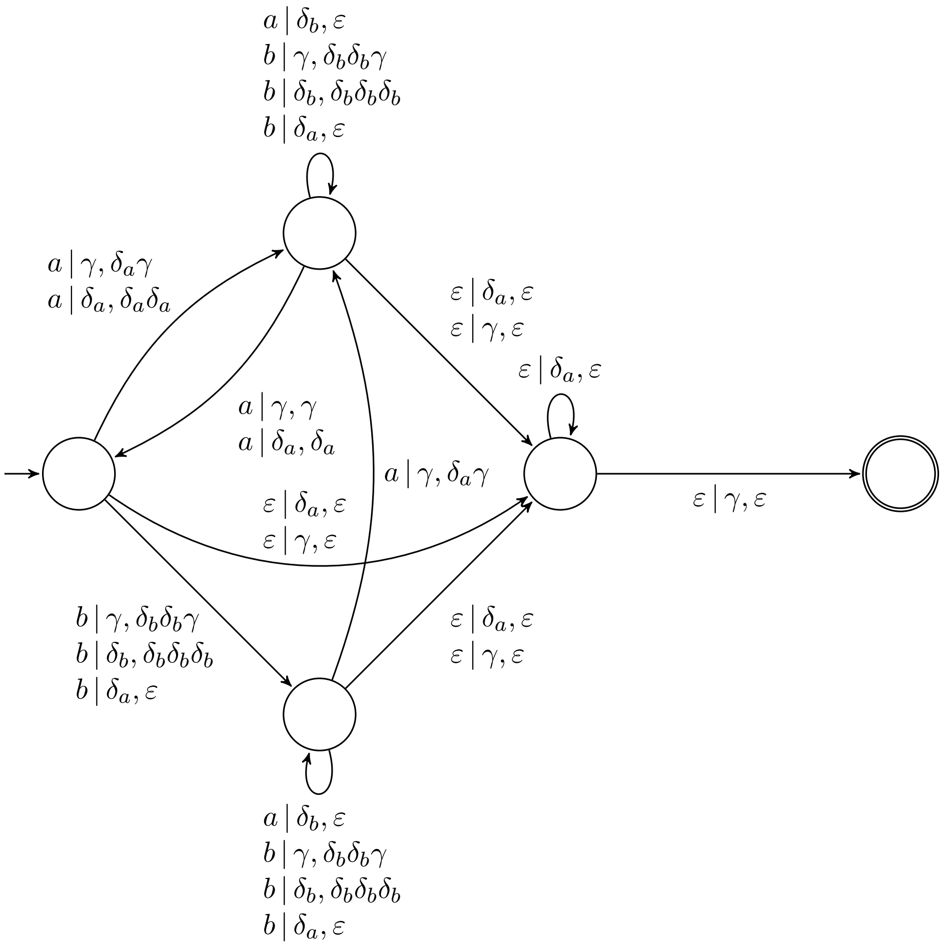
(28) $L = \{w \in (a+b)^\star\colon n_a(w) = 2n_b(w)\}$.



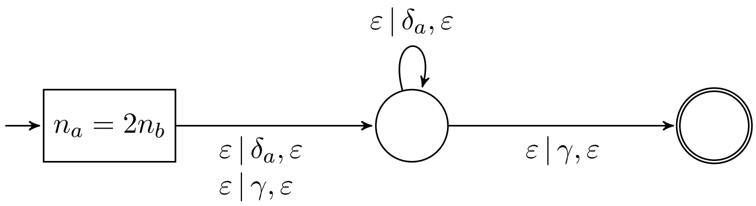
(29) $L = \{w \in (a+b)^\star\colon n_a(w) = 2n_b(w) + 1\}$.



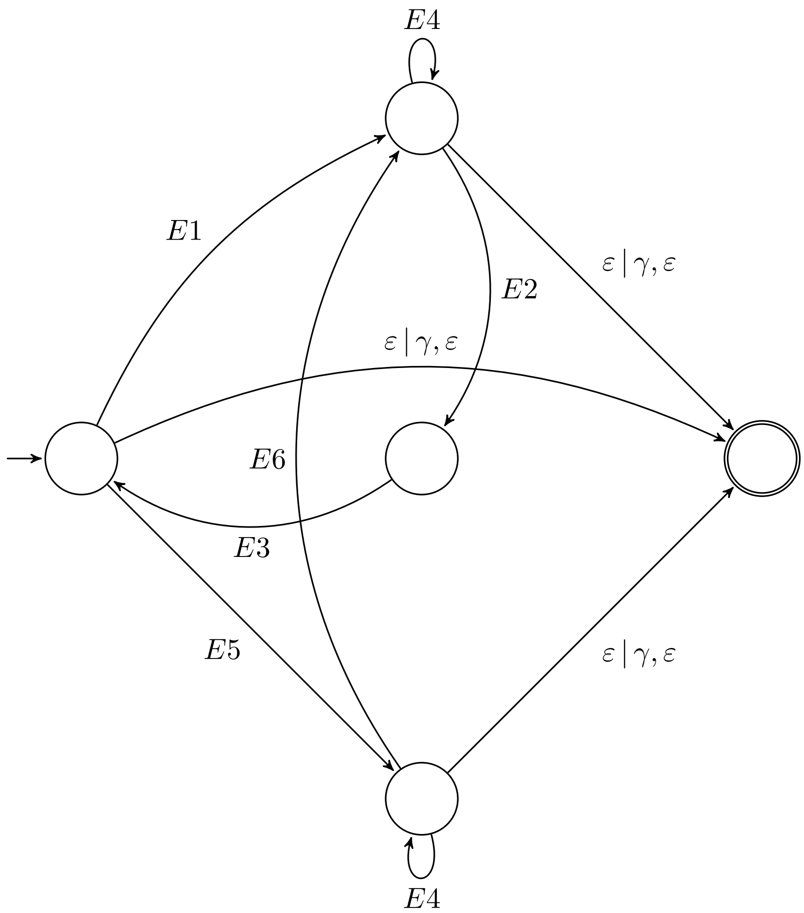
(30) $L = \{w \in (a+b)^\star \colon n_a(w) > 2n_b(w)\}$.



Ή (συμβολικά):



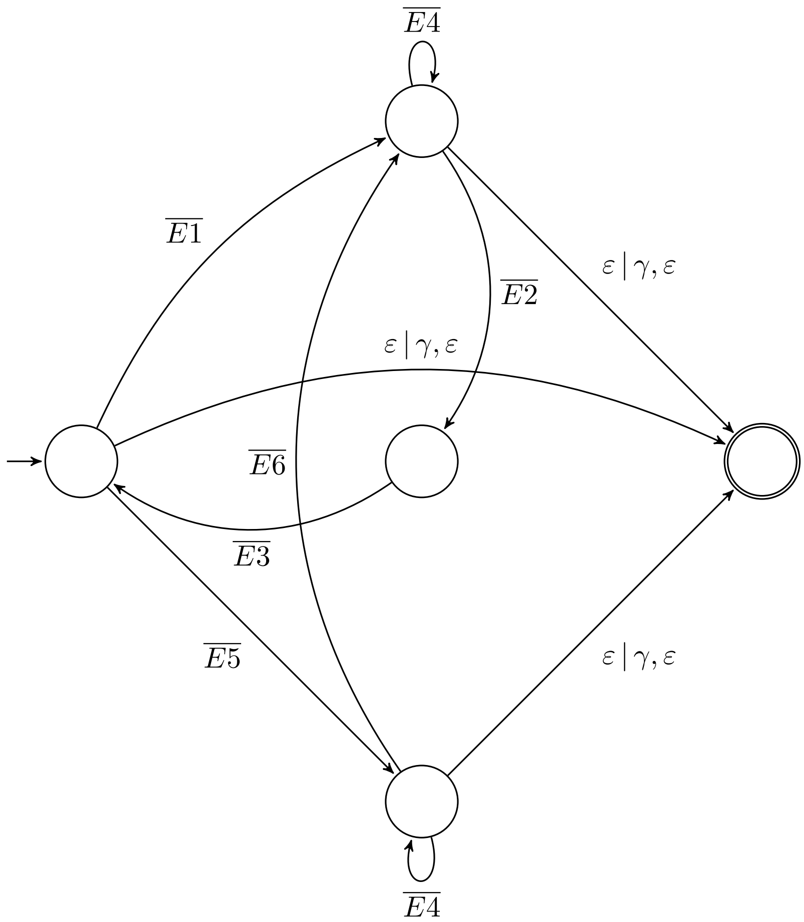
(31) $L = \{w \in (a+b)^\star \colon n_a(w) = 3n_b(w)\}$.



όπου

$$
\begin{array}{rl@{\qquad}rl}
E1: & a \,|\, \gamma, \delta_a\gamma & E4: & b \,|\, \gamma, \delta_b\delta_b\delta_b\gamma \\
 & a \,|\, \delta_a, \delta_a\delta_a & & b \,|\, \delta_b, \delta_b\delta_b\delta_b\delta_b \\
E2: & a \,|\, \gamma, \gamma & & b \,|\, \delta_a, \varepsilon \\
 & a \,|\, \delta_a, \delta_a & & a \,|\, \delta_b, \varepsilon \\
E3: & a \,|\, \gamma, \gamma & E5: & b \,|\, \gamma, \delta_b\delta_b\delta_b\gamma \\
 & a \,|\, \delta_a, \delta_a & & b \,|\, \delta_b, \delta_b\delta_b\delta_b\delta_b \\
 & \varepsilon \,|\, \varepsilon, \varepsilon & & b \,|\, \delta_a, \varepsilon \\
 & & E6: & a \,|\, \gamma, \delta_a\gamma
\end{array}
$$

(32) $L = \{w \in (a+b)^{\star} \colon 2n_a(w) \le n_b(w) \le 3n_a(w)\}$.



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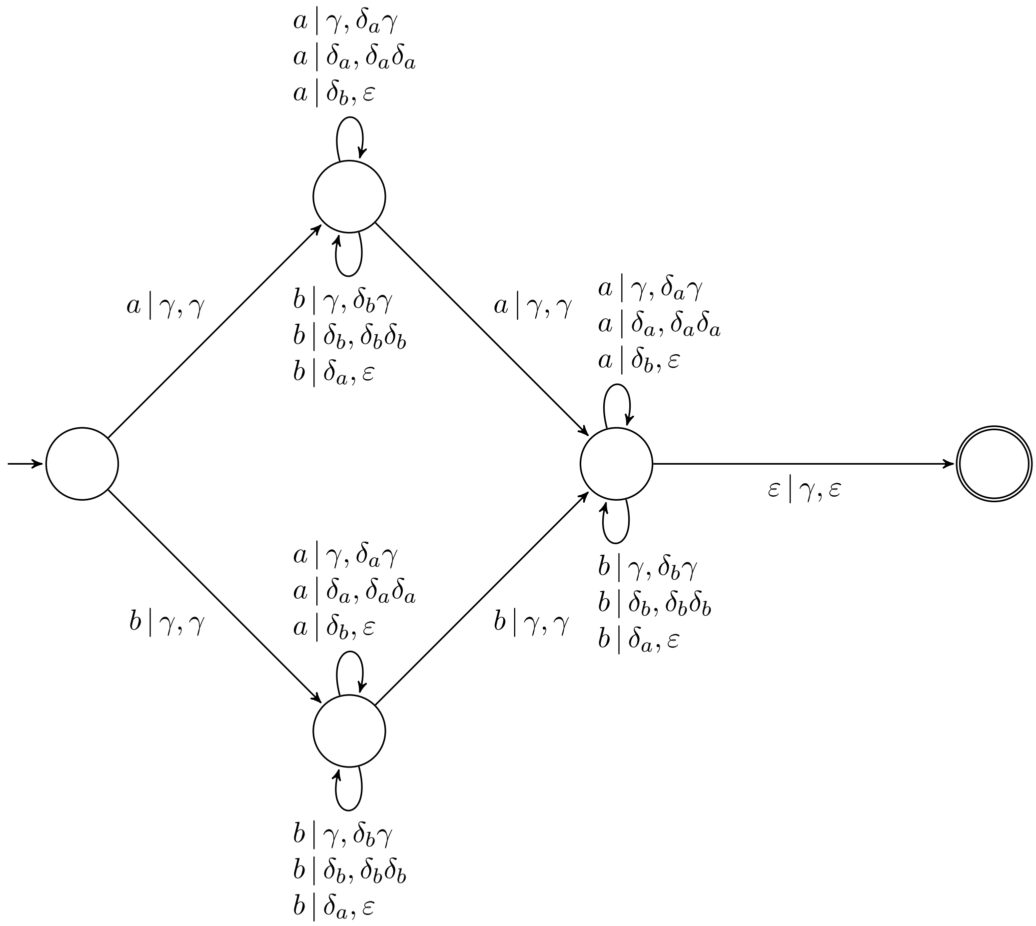
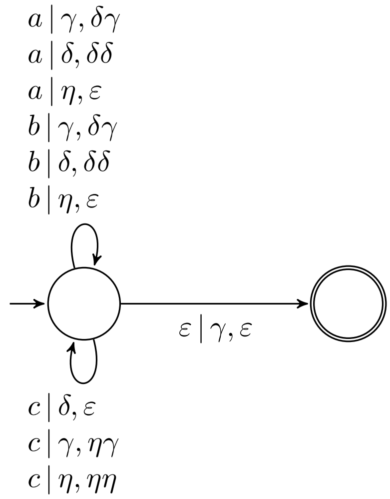
$$\begin{aligned}
\overline{E1} &: b \,|\, \gamma, \delta_b\gamma \\
&\ b \,|\, \delta_b, \delta_b\delta_b \\
\overline{E2} &: b \,|\, \gamma, \gamma \\
&\ b \,|\, \delta_b, \delta_b \\
\overline{E3} &: b \,|\, \gamma, \gamma \\
&\ b \,|\, \delta_b, \delta_b \\
&\ \varepsilon \,|\, \varepsilon, \varepsilon \\
\overline{E6} &: b \,|\, \gamma, \delta_b\gamma
\end{aligned}
\qquad
\begin{aligned}
\overline{E4} &: b \,|\, \gamma, \delta_b\delta_b\delta_b\gamma \\
&\ a \,|\, \gamma, \delta_a\delta_a\delta_a\delta_a\gamma \\
&\ b \,|\, \delta_b, \delta_b\delta_b\delta_b\delta_b \\
&\ a \,|\, \delta_a, \delta_a\delta_a\delta_a\delta_a\delta_a \\
&\ a \,|\, \delta_b, \varepsilon \\
&\ b \,|\, \delta_a, \varepsilon \\
\overline{E5} &: a \,|\, \gamma, \delta_a\delta_a\delta_a\gamma \\
&\ a \,|\, \gamma, \delta_a\delta_a\delta_a\delta_a\gamma \\
&\ a \,|\, \delta_a, \delta_a\delta_a\delta_a\delta_a \\
&\ a \,|\, \delta_a, \delta_a\delta_a\delta_a\delta_a\delta_a
\end{aligned}$$

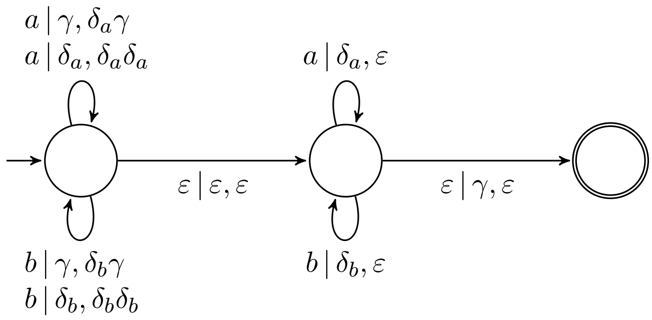
(33) $L = \{w \in (a+b)^* \colon |n_a(w) - n_b(w)| = 2\}$.



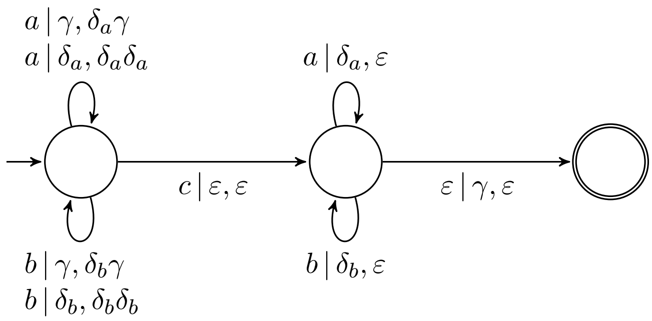
(34) $L = \{w \in (a+b+c)^\star \colon n_a(w) + n_b(w) = n_c(w)\}$.



(35) $L = \{ww^R \colon w \in (a+b)^\star\}$.



(36) $L = \{wcw^R \colon w \in (a+b)^\star\}$.



(37) $L = \{w \in (a+b)^\star \colon w = w^R\}$.

Απ.: Προφανώς, ισχύει ότι $w = w^R$ αν και μόνον αν είτε $w = zz^R$ ή $w = z\sigma z^R$, για κάποια λέξη $z \in (a+b)^*$ και κάποιο σύμβολο $\sigma = a$ ή b. Επομένως: