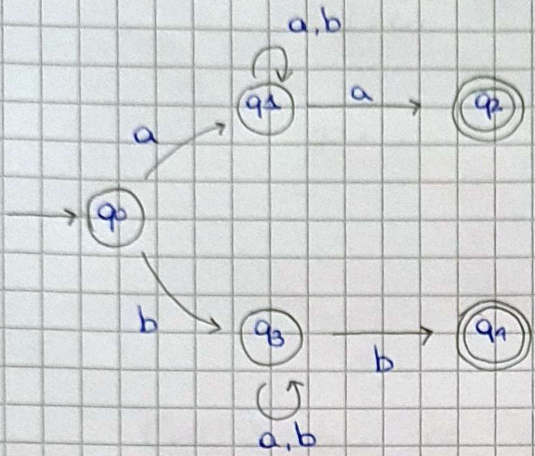
ESERCIZIO 1

a) Determinare la 5-tupla che descrive l'automa finito non deterministico in figura.



$N = (Q, \Sigma, \delta, q_0, F)$

$Q = \{q_0, q_1, q_2, q_3, q_4\}$

$\Sigma = \{a, b\}$

$F = \{q_2, q_4\}$

δ:

	a	b	ε
$\rightarrow q_0$	$\{q_1\}$	$\{q_3\}$	$\emptyset$
q_1	$\{q_1, q_2\}$	$\{q_1\}$	$\emptyset$
$* q_2$	$\emptyset$	$\emptyset$	$\emptyset$
q_3	$\{q_3\}$	$\{q_3, q_4\}$	$\emptyset$
$* q_4$	$\emptyset$	$\emptyset$	$\emptyset$

b. $\omega = bb \in L(N)$?

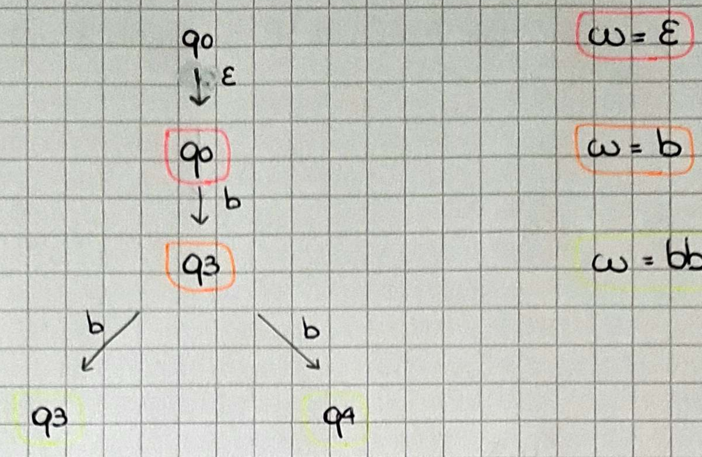
$$\delta^*(q_0, bb) = E\left(\bigcup_{p \in \delta^*(q_0, b)} \delta(p, b)\right) = E(\delta(q_3, b)) = E(\{q_3, q_4\}) = \{q_3, q_4\}$$

$$\delta^*(q_0, b) = E\left(\bigcup_{p \in \delta^*(q_0, \varepsilon)} \delta(p, b)\right) = E(\delta(q_0, b)) = E(\{q_3\}) = \{q_3\}$$

$$\delta^*(q_0, \varepsilon) = E(\{q_0\}) = \{q_0\}$$

$$\delta^*(q_0, bb) \cap F = \{q_3, q_4\} \cap \{q_2, q_4\} = \{q_4\} \neq \emptyset \Rightarrow \omega = bb \in L(N)$$

Soluzione tramite albero delle computazioni.



$$\delta^*(q_0, bb) \cap F = \{q_3, q_4\} \cap \{q_2, q_4\} \neq \emptyset \implies \omega = bb \in L(N)$$

c. $\omega = abaa \in L(N)$?

$$\delta^*(q_0, abaa) = E\Big(\bigcup_{p \in \delta^*(q_0, aba)} \delta(p, a)\Big) = E\Big(\bigcup_{p \in \{q_1, q_2\}} \delta(p, a)\Big) = E(\delta(q_1, a) \cup \delta(q_2, a))$$
$$= E(\{q_1, q_2\}) = \{q_1, q_2\}$$

$$\delta^*(q_0, aba) = E\Big(\bigcup_{p \in \delta^*(q_0, ab)} \delta(p, a)\Big) = E(\delta(q_1, a)) = E(\{q_1, q_2\}) = \{q_1, q_2\}$$

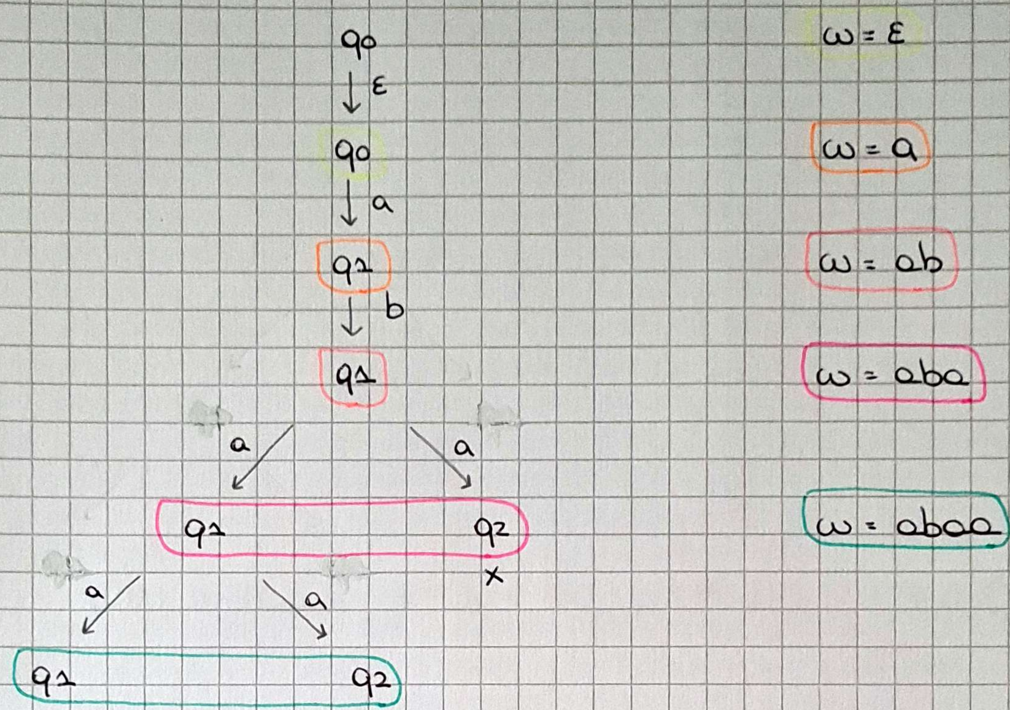
$$\delta^*(q_0, ab) = E\Big(\bigcup_{p \in \delta^*(q_0, a)} \delta(p, b)\Big) = E(\delta(q_1, b)) = E(\{q_1\}) = \{q_1\}$$

$$\delta^*(q_0, a) = E\Big(\bigcup_{p \in \delta^*(q_0, \varepsilon)} \delta(p, a)\Big) = E(\delta(q_0, a)) = E(\{q_1\}) = \{q_1\}$$

$$\delta^*(q_0, \varepsilon) = E(\{q_0\}) = \{q_0\}$$

$$\delta^*(q_0, abaa) \cap F = \{q_1, q_2\} \cap \{q_2, q_4\} = \{q_2\} \neq \emptyset \implies \omega = abaa \in L(N)$$

Soluzione tramite albero delle computazioni



$\delta^*(q_0, abaa) \cap F = \{q_1, q_2\} \cap \{q_2, q_4\} \neq \emptyset \Rightarrow \omega = abaa \in L(N)$

d. $\omega = abb \in L(N)$?

$$\delta^*(q_0, abb) = E\left(\bigcup_{p \in \delta^*(q_0, ab)} \delta(p, b)\right) = E\left(\bigcup_{p \in \{q_1\}} \delta(p, b)\right)$$

$$= E(\delta(q_1, b)) = E(\{q_1\}) = \{q_1\}$$

$$\delta^*(q_0, ab) = E\left(\bigcup_{p \in \delta^*(q_0, a)} \delta(p, b)\right) = E\left(\bigcup_{p \in \{q_1\}} \delta(p, b)\right) = E(\delta(q_1, b))$$

$$= E(\{q_1\}) = \{q_1\}$$

$$\delta^*(q_0, a) = E\left(\bigcup_{p \in \delta^*(q_0, \varepsilon)} \delta(p, a)\right) = E\left(\bigcup_{p \in \{q_0\}} \delta(p, a)\right) = E(\delta(q_0, a))$$

$$= E(\{q_1\}) = \{q_1\}$$

$$\delta^*(q_0, \varepsilon) = E(\{q_0\}) = \{q_0\}$$

$\delta^*(q_0, abb) \cap F = \{q_1\} \cap \{q_2, q_4\} = \emptyset \Rightarrow \omega \notin L(N)$

Soluzione tramite albero delle computazioni.

$$
\begin{array}{ccc}
q_0 & \qquad & w = \varepsilon \\
\downarrow \varepsilon & & \\
q & & \boxed{w = a} \\
\downarrow a & & \\
\boxed{q_1} & & \boxed{w = ab} \\
\downarrow b & & \\
\boxed{q_1} & & \boxed{w = abb} \\
\downarrow b & & \\
\boxed{q_1} & &
\end{array}
$$

$\delta^*(q_0, abb) \cap F = \{q_1\} \cap \{q_2, q_4\} = \emptyset \Rightarrow w = abb \notin L(N)$