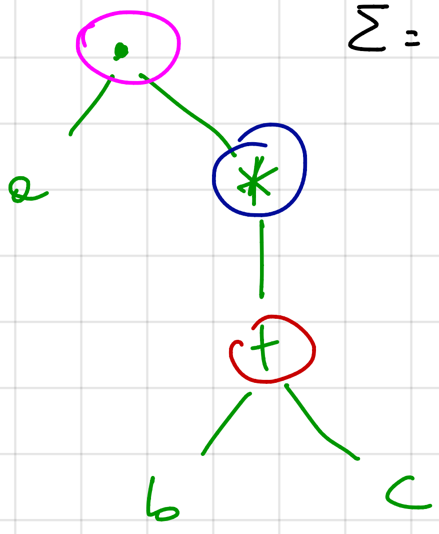
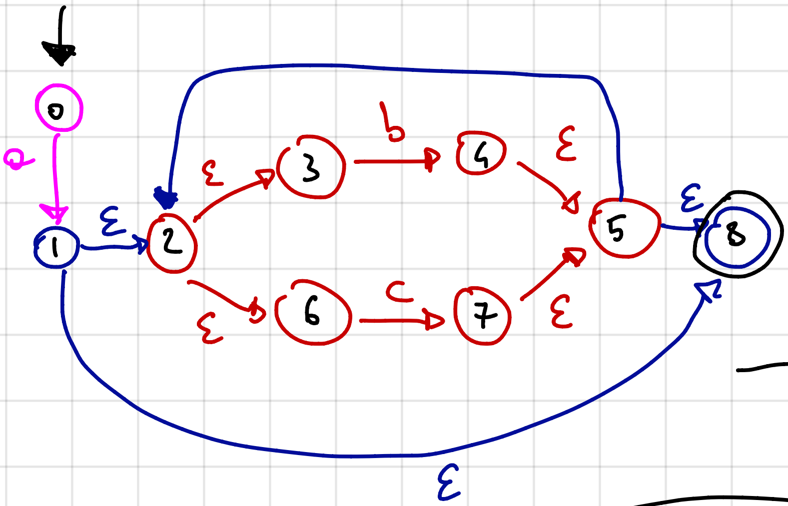
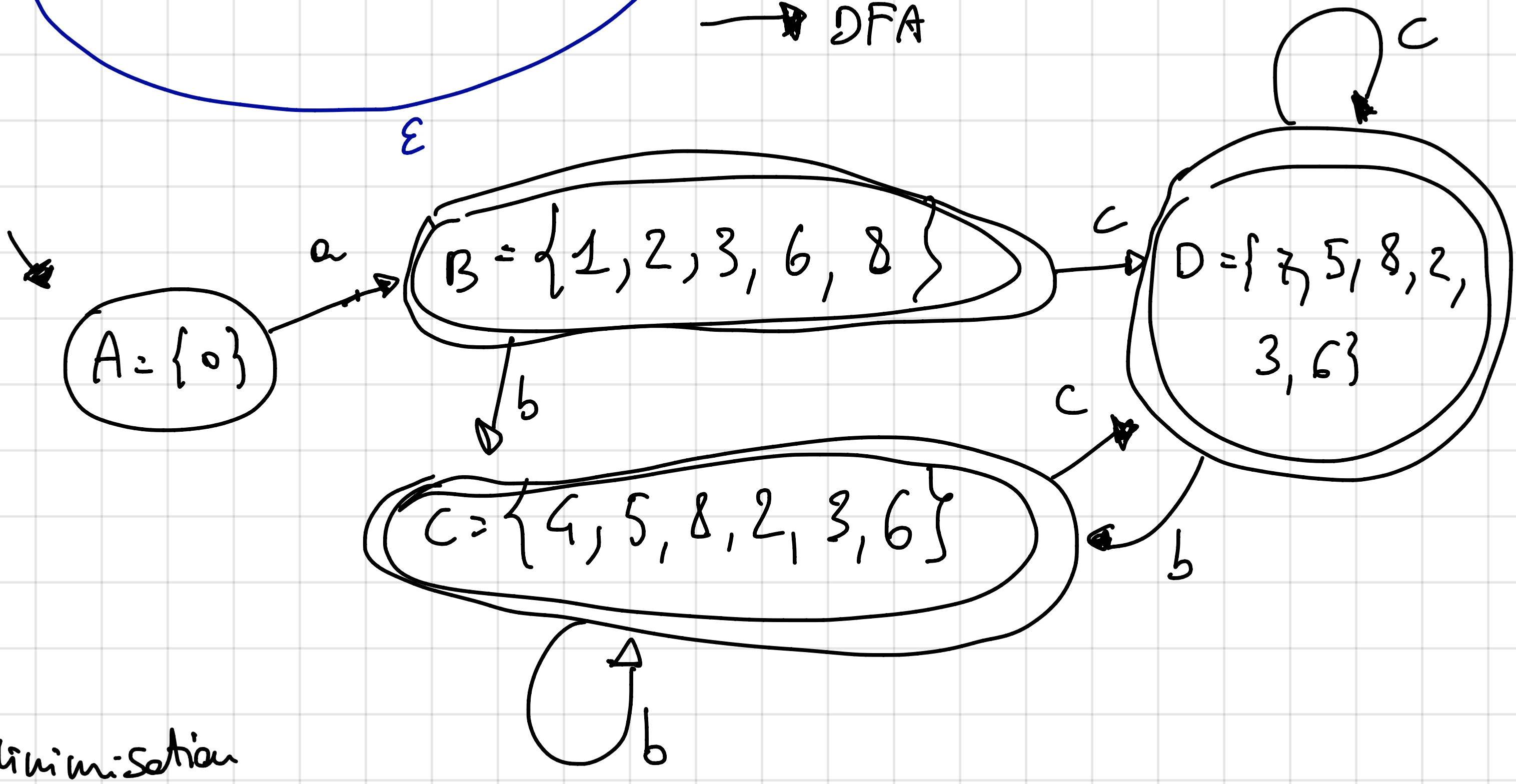
$a(b+c)^* \longrightarrow$ NFA $\qquad \Sigma = \{a, b, c\}$




$\longrightarrow$ DFA



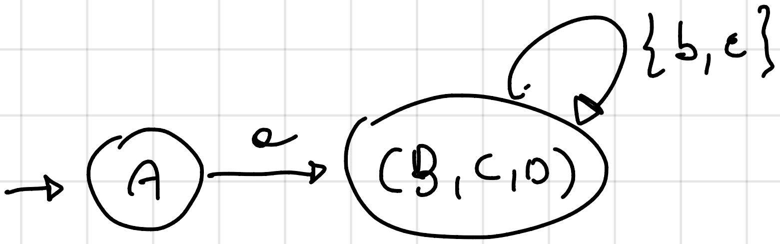

Minimisation

$\Pi_1 = \{(A), (B, C, D)\}$

| | | |
|---|---|---|
| $B \not\xrightarrow{a}$ | $B \xrightarrow{b} C$ | $B \xrightarrow{c} D$ |
| $C \not\xrightarrow{a}$ | $C \xrightarrow{b} C$ | $C \xrightarrow{c} D$ |
| $D \not\rightarrow$ | $D \xrightarrow{b} C$ | $D \xrightarrow{c} D$ |

STOP

Minimal DFA



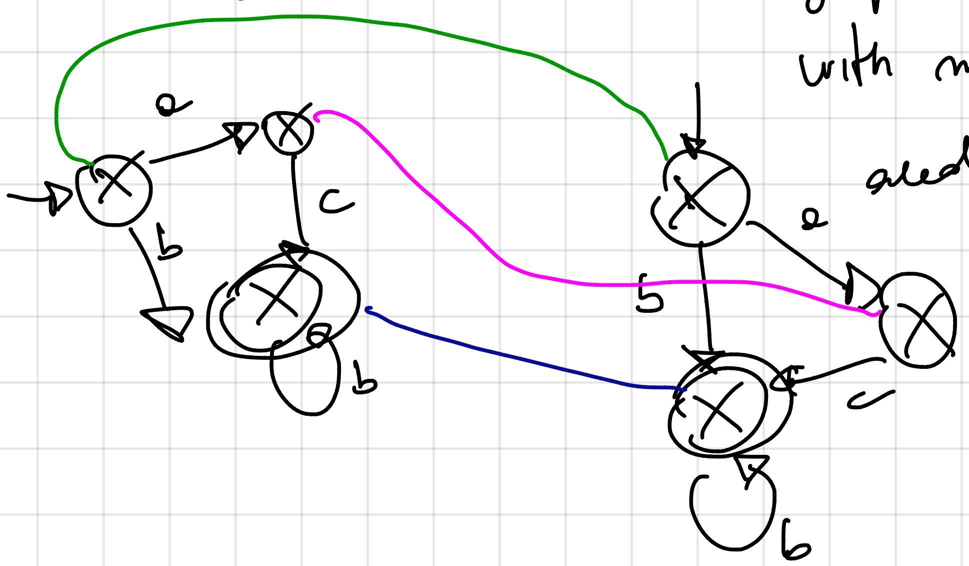
1) $r_1$, $r_2$ two regexp. Question: $r_1 \stackrel{?}{\equiv} r_2$

2) $r_1 \to NFA_1 \to DFA_1 \to MinDFA_1 = A_1$

$r_2 \to NFA_2 \to DFA_2 \to MinDFA_2 = A_2$

$$A_1 \stackrel{?}{=} A_2$$

graph isomorphism with mapping of initial and final states

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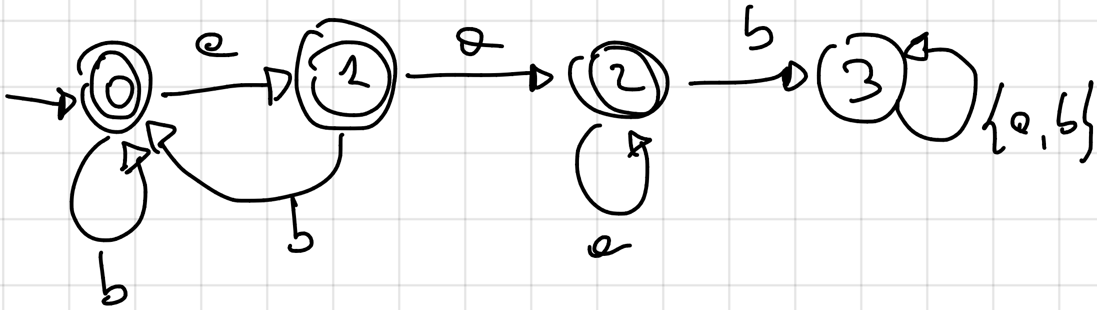
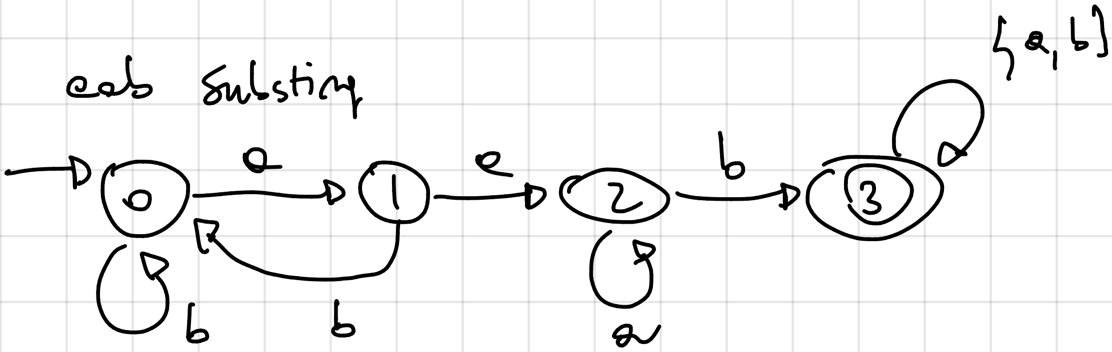
not aab substring $\Sigma = \{a, b\}$




b

$\varepsilon$

aab substring



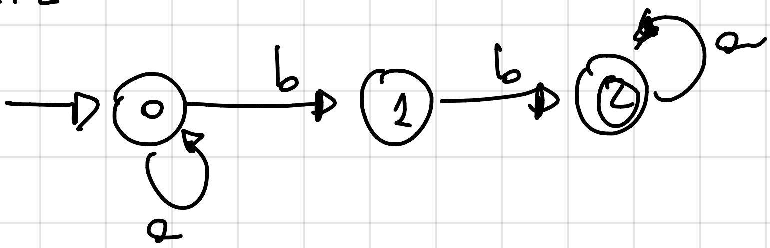
**Theorem** Let $A = (S, \Sigma, \delta, s_0, F)$ be a DFA non-blocking. Then $A^c = (S, \Sigma, \delta, s_0, S \setminus F)$ accepts the complement language of $\mathcal{L}(A)$.

**Def.** Let $A = (S, \Sigma, \delta, s_0, F)$ be a DFA.
$A$ is non-blocking if and only if
$\forall s \in S \ \forall c \in \Sigma \ \ \delta(s, c)$ is defined

IF a DFA is blocking there is a way to find an equivalent DFA that is non-blocking

EXAMPLE

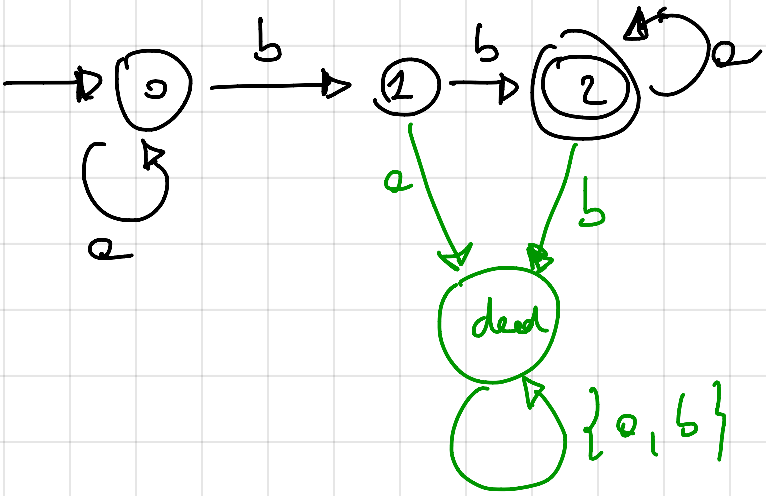
A



$$\mathcal{L}(A) = \mathcal{L}(a^* bb a^*) = \{ a^n bb a^m \mid n, m \geq 0 \}$$

aaba $\quad 0 \xrightarrow{a} 0 \xrightarrow{a} 0 \xrightarrow{b} 1 \cancel{\xrightarrow{a}}$

the automaton is blocking




this automaton is non-blocking and equivalent to the original one

bba accept

aba not accept

---

$\mathcal{L}_1 = \mathcal{L}(a^*b \quad + \quad b^+)$

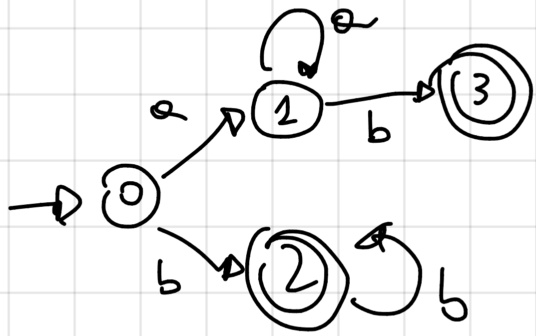
$\mathcal{L}_2 = \mathcal{L}(b^+c^*)$

$\mathcal{L}_1 \cap \mathcal{L}_2 = \mathcal{L}(b^+)$

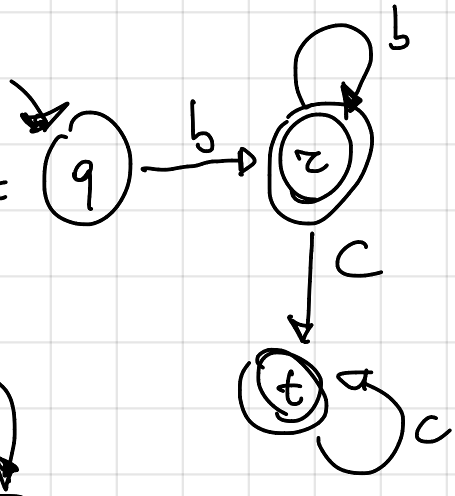
$A_1$ DFA for $\mathcal{L}_1$ $(S_1, \Sigma_1, \delta_1, s_0^1, F_1)$

$A_2$ DFA for $\mathcal{L}_2$ $(S_2, \Sigma_2, \delta_2, s_0^2, F_2)$

$A_1 :$

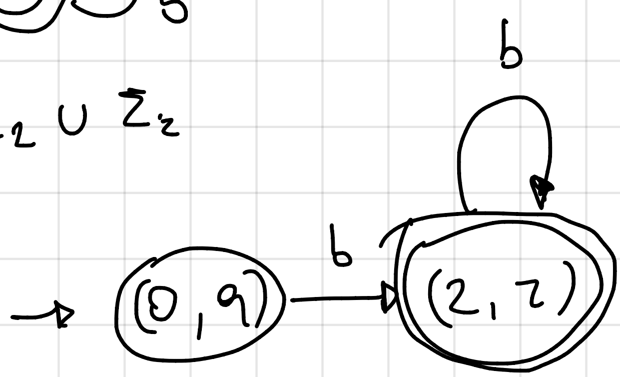



$A_2 :$



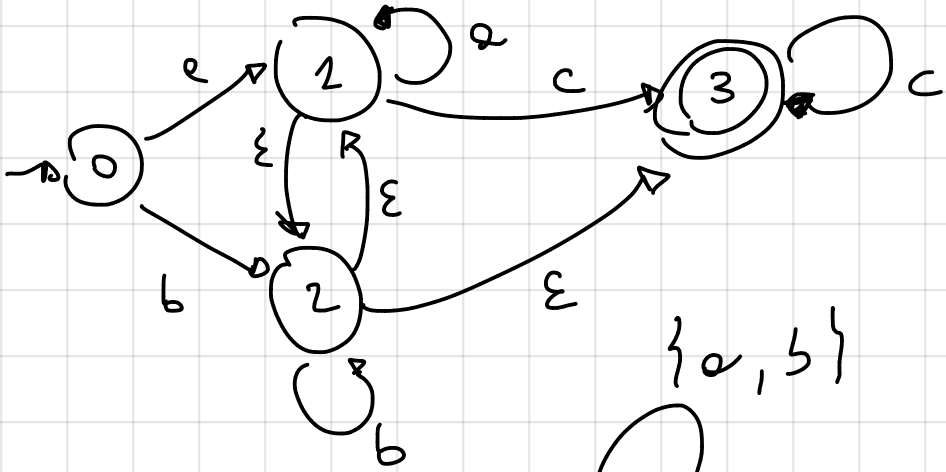

$\Sigma = \{a, b, c\} = \Sigma_1 \cup \Sigma_2$

$A_1 \otimes A_2 =$

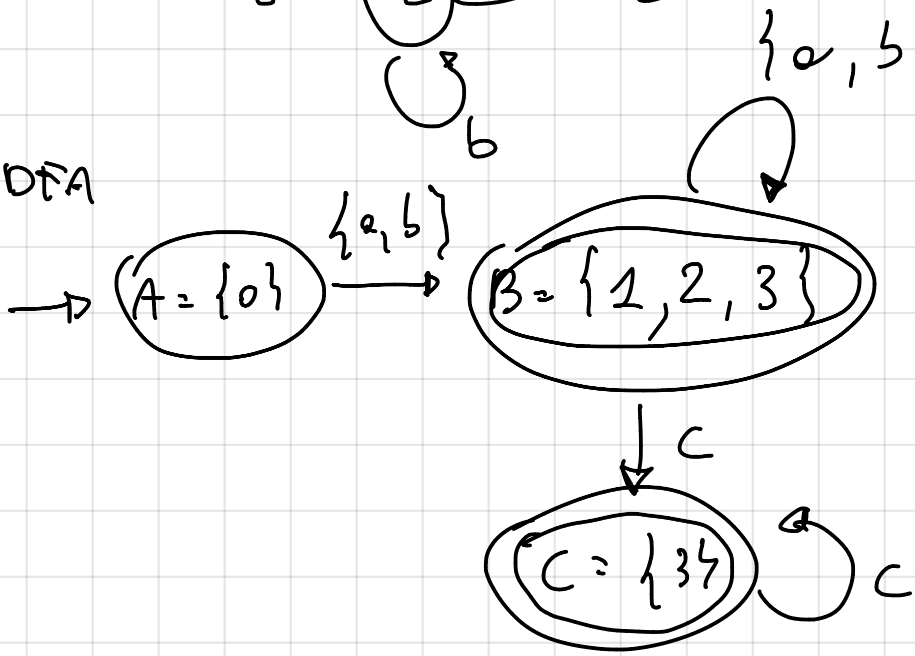



$\mathcal{L}(A_1 \otimes A_2)$

$= \mathcal{L}(b^+) = \mathcal{L}_1 \cap \mathcal{L}_2$




DFA




$$(a+b)(a+b)^* +$$

$$(a+b)(a+b)^* c c^*$$

$$\equiv$$

$$(a+b)^+ + (a+b)^+ c^+$$

$$\equiv$$

$$(a+b)^+ c^*$$