Theory of Machines and Languages

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1403-1404

Regular Expressions

- **Example**

For $\Sigma = \{0, 1\}$, give a regular expression r such that

$$L(r) = \{w \in \Sigma^* : w \text{ has at least one pair of consecutive zeros}\}$$

$$r = (0+1)^* 00 (0+1)^*$$

Find a regular expression for the language

$$L = \{w \in \{0,1\}^* : w \text{ has no pair of consecutive zeros}\}$$

$$r = (1+01)^* (0+\lambda)$$

Give a regular expression for $L = \{a^n b^m : n \geq 2, m \geq 1, nm \geq 3\}$

Give regular expressions for the following languages on $\Sigma = \{a, b, c\}$:

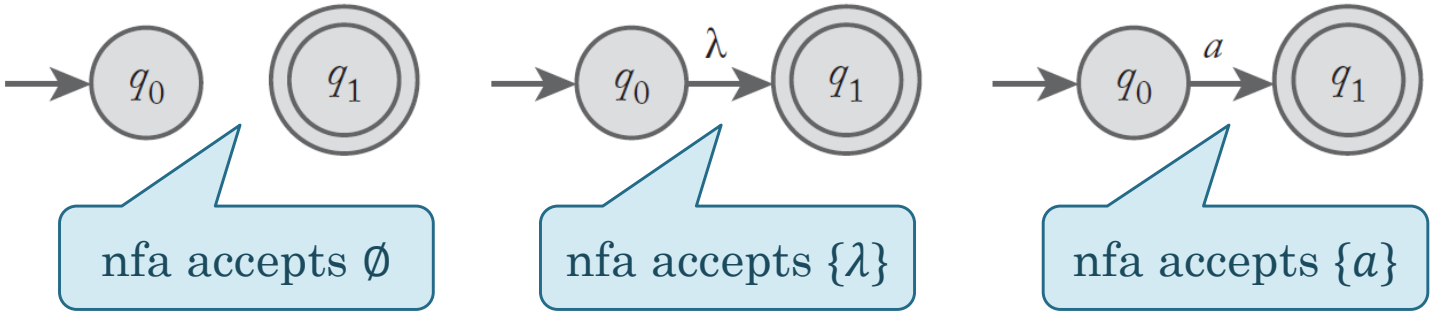
(a) All strings containing exactly two a's.

(b) All strings containing no more than three a's.

(c) All strings that contain at least one occurrence of each symbol in Σ.

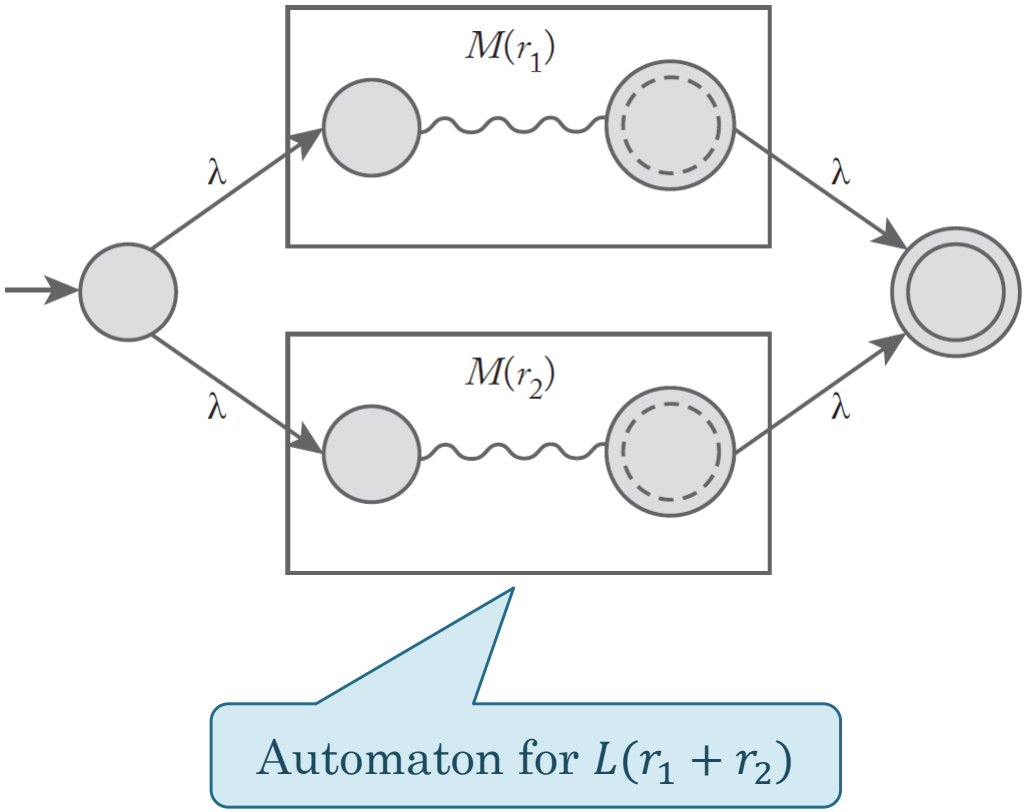
Connection Between Regular Expressions and Regular Languages

- If r is a regular expression, then $L(r)$ is a regular language
- A language is regular if it is accepted by some dfa or nfa
- Proof



Connection Between Regular Expressions and Regular Languages

- **Proof (Cont.)**



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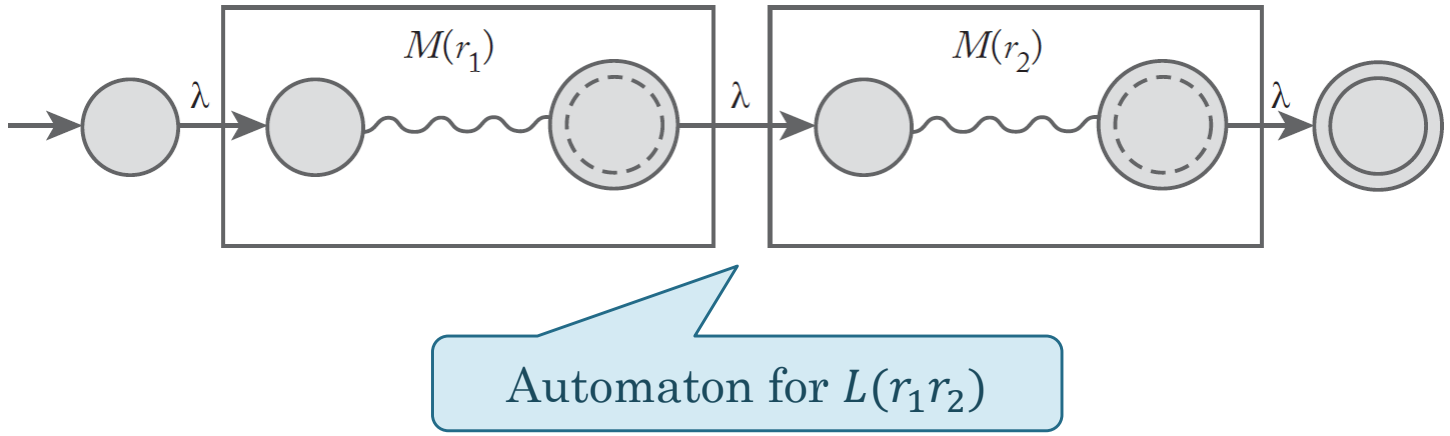
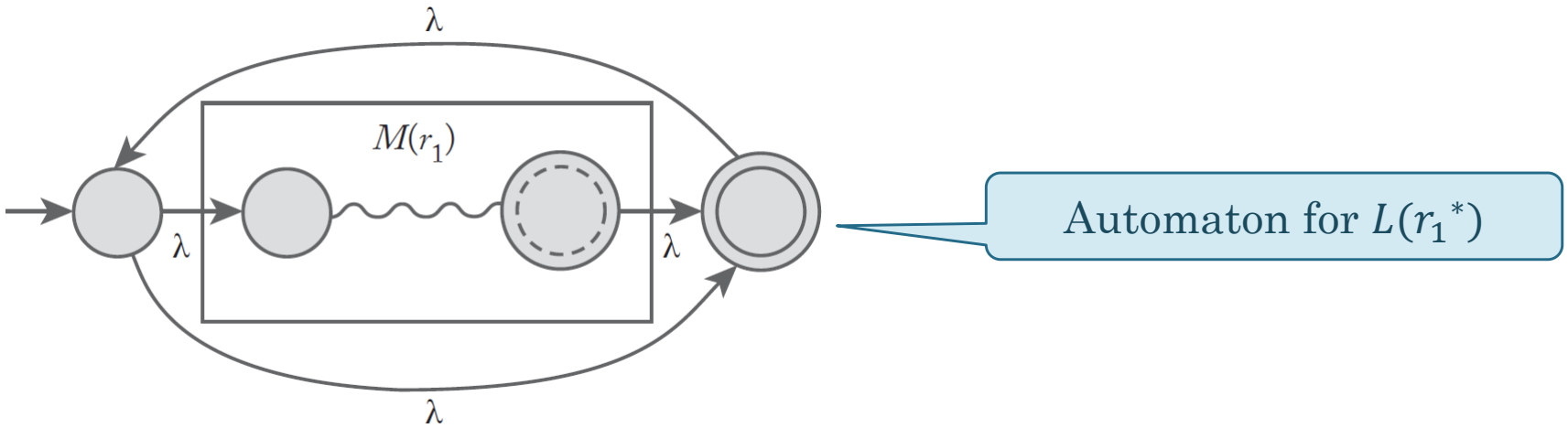
- **Proof (Cont.)**



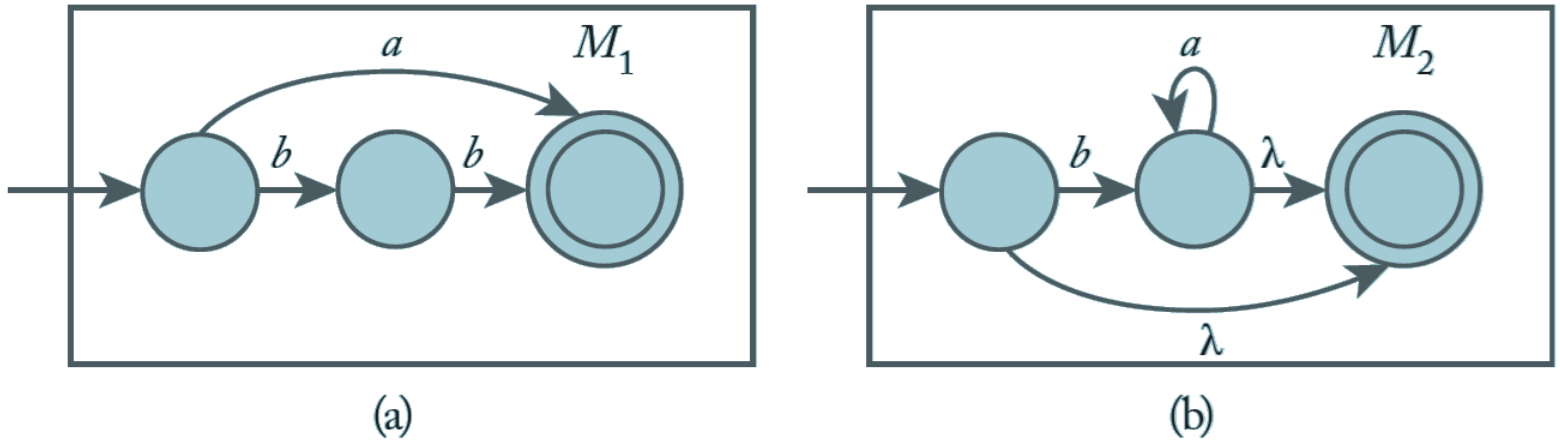


Connection Between Regular Expressions and Regular Languages

- **Example**

Find an nfa that accepts $L(r)$, where

$$r = (a + bb)^* (ba^* + \lambda)$$



(a) M_1 accepts $L(a + bb)$. (b) M_2 accepts $L(ba^* + \lambda)$.

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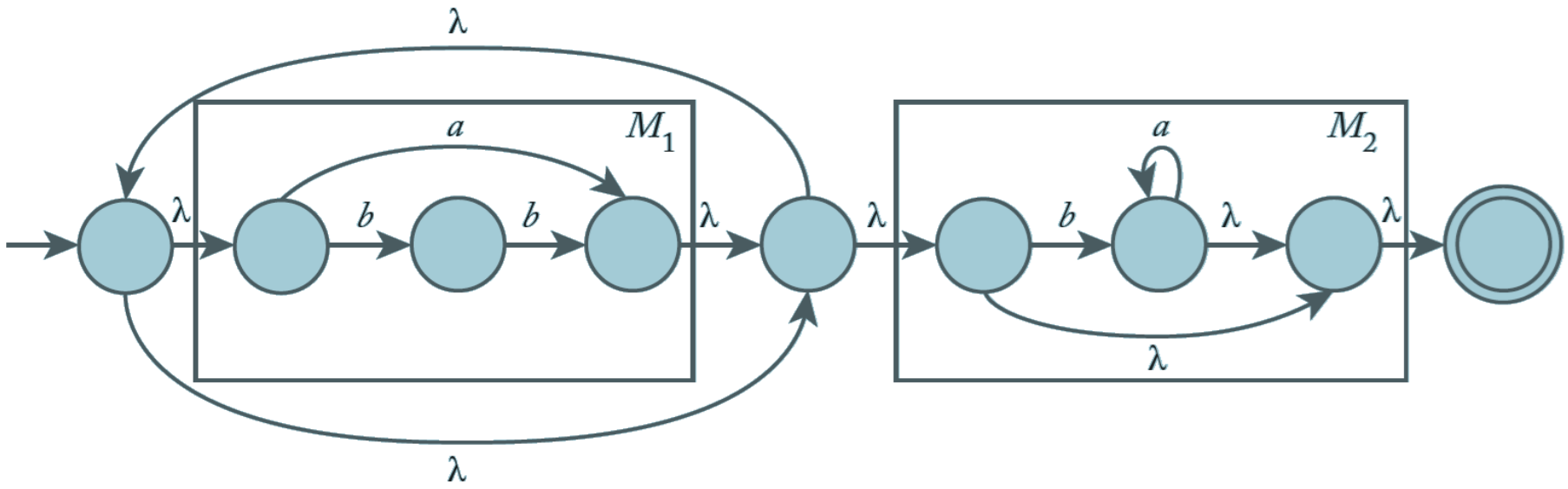

Automaton accepts $L((a + bb)^* (ba^* + \lambda))$.