10

ภาษาสม่ำเสมอ

REGULAR LANGUAGES

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วัตถุประสงค์

Language defined by regular expression is called a

regular languages.

All languages are regular ? (YES/NO)

Discuss some properties of all regular languages.

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ทฤษฎีบท

Let L_1 and L_2 be regular languages. Then L_1+L_2, L_1L_2 and L_1^* are also regular languages.

What's about finite automata?

Proof:
By definition of regular expression, regular expression is closed under union, concatenate and Kleene star.

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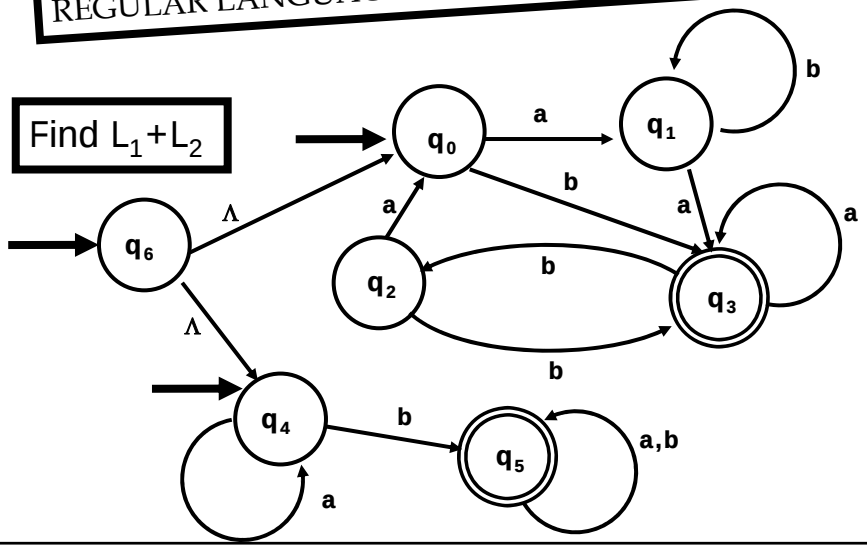
Find L_1+L_2



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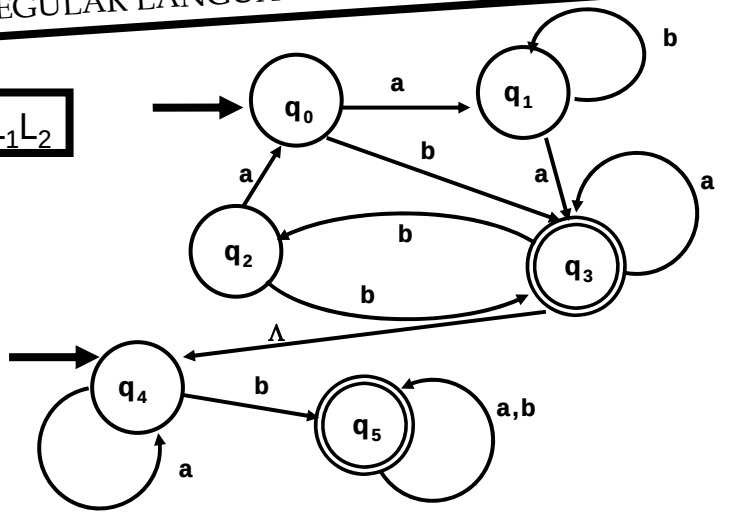
Find L_1L_2



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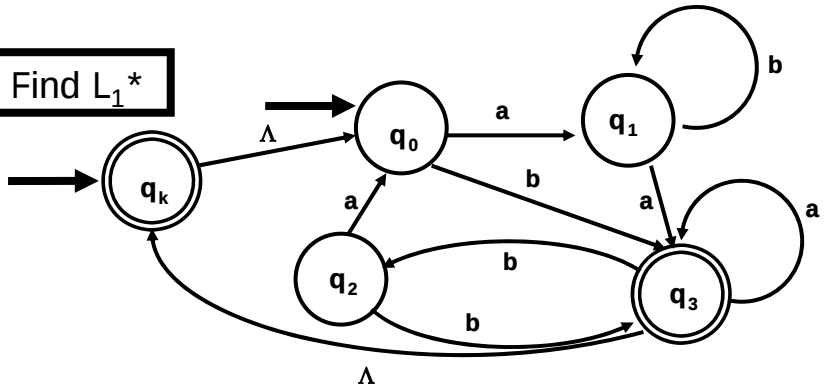
Find L_1^*



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COMPLEMENT

นิยาม

If L is a language over the alphabet Σ.
The complement of L denoted by L' is
the language of all strings of characters
from Σ that are not words in L.

The complement of L = Σ^* - L.
Notice that the complement of L' is L. ((L')'=L.)

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Let L be a regular language.
Then L' is also a regular language.
(closed under complementation)

Proof:

By Kleene's theorem, there is some FA that accepts the language L. By reversing all final states in that FA into non-final states, and all non-final states into final states, the new machine is a FA that accepts L'.
By Kleene's theorem, L' is a regular language.

QED.

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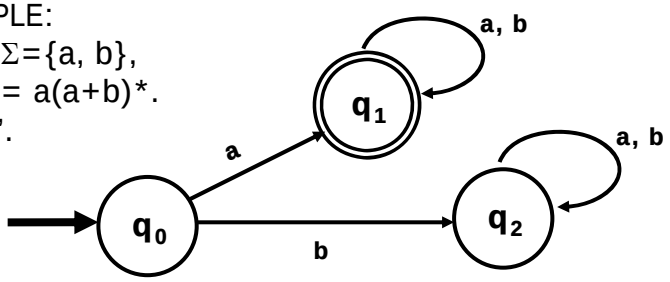
EXAMPLE:
Given Σ={a, b},
and L = a(a+b)*.
Find L'.



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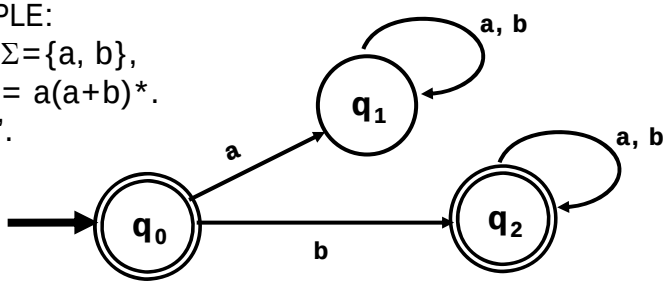

This FA accepts all words started with b, and also Λ.
L' = Λ+b(a+b)*

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ทฤษฎีบท

INTERSECTION

How to construct a finite automaton associated with the language?

Let L_1 and L_2 be regular languages.
Then $L_1 \cap L_2$ is also a regular language.

Proof:
By DeMorgan's law for sets,

$$L_1 \cap L_2 = (L_1' + L_2')'.$$

So, $L_1 \cap L_2$ is a regular language.

QED.

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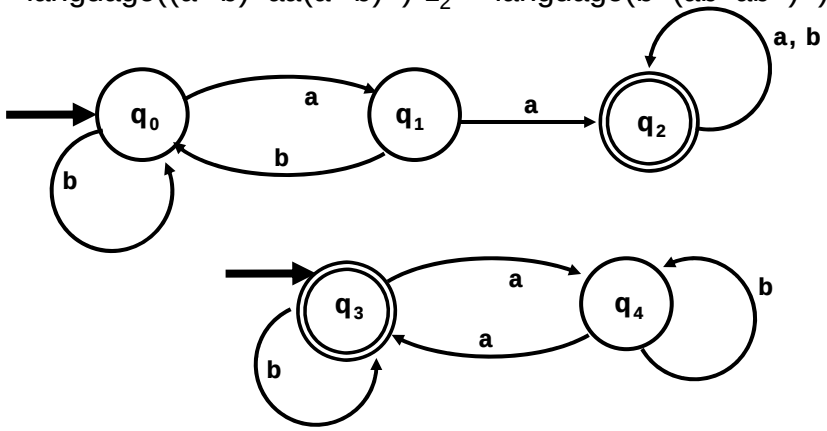
L_1 = language((a+b)*aa(a+b)*) L_2 = language(b*(ab*ab*)*)



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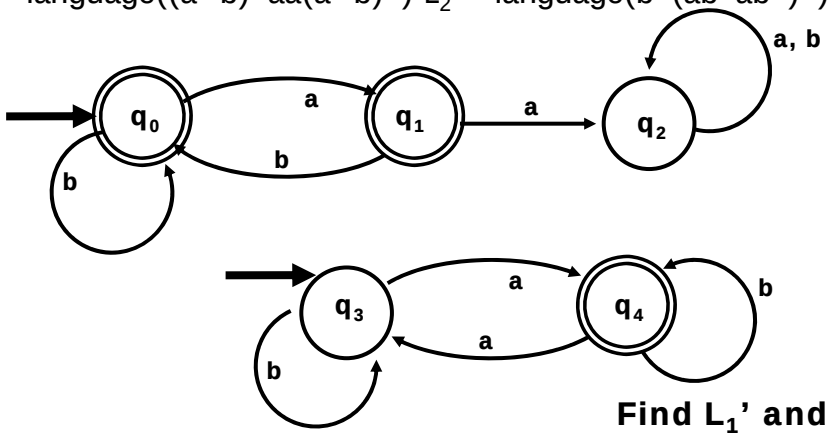

Find L_1' and L_2'

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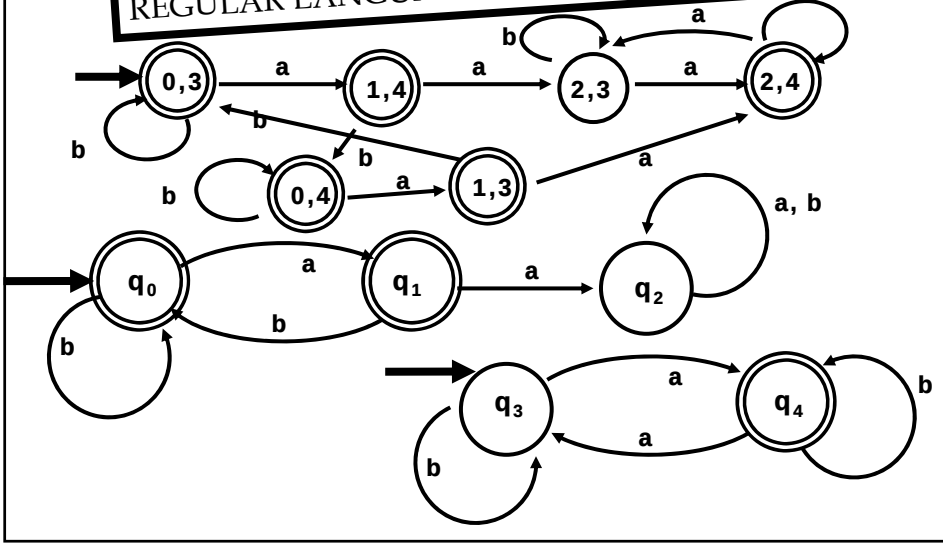

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SUMMARY

ทฤษฎีบท

Let L_1 L_2 be regular languages associated with machines $M_1=(Q_1,\Sigma,q_1,A,\delta_1)$ and $M_2=(Q_2,\Sigma,q_2,A,\delta_2)$. Let $M=(Q_1\times Q_2,\Sigma,(q_1,q_2),A,\delta)$ and transition function is defined by the formula

$$\delta((p,q),a) = (\delta_1(p,a),\delta_2(q,a)).$$

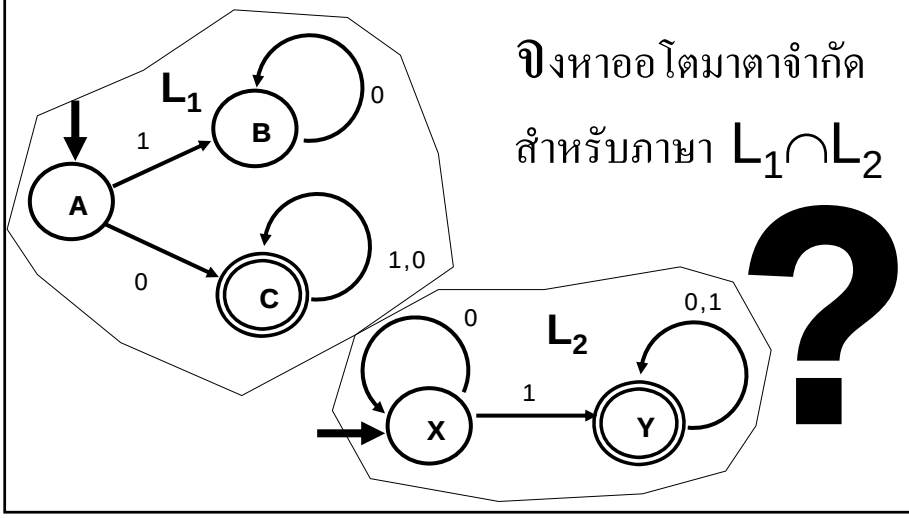
Then

if $A=\{(p,q)|p\in A_1$ or $q\in A_2\}$, M accepts the $L_1\cup L_2$.

if $A=\{(p,q)|p\in A_1$ and $q\in A_2\}$, M accepts the $L_1\cap L_2$.

if $A=\{(p,q)|p\in A_1$ and $q\notin A_2\}$, M accepts the L_1-L_2.

โจทย์น่าคิด



จงหาออโตมาตาจำกัด

สำหรับภาษา $L_1\cap L_2$