Theory of Automata & Formal Languages

(Theory of Computation)

Compiled By

Prof. M. S. Bhatt

Languages

Examples

- Find a language over {a, b} which is neighter {λ} nor {a, b}* and satisfies L=L*

Examples

- Find a language over {a, b} which is neighter {λ} nor {a, b}* and satisfies L=L*

- L= {λ , a ,aa ,aaa, aaaa,........, } = $\{a^n \mid n >= 0\}$

- L={x belongs to{a, b}*| length of x is even}

Examples

- Find an infinite language over {a, b} which is neigher {λ} nor {a, b}* and satisfies L ≠ L*

Examples

- Find an infinite language over {a, b} which is neigher {λ} nor {a, b}* and satisfies L ≠ L*

- L= {a ,aaa, aaaaa,…….., } = $\{a^n \mid n \text{ is odd}\}$

- L={x belongs to{a, b}*| length of x is odd}

Examples

- Find languages L1 and L2 satisfying L1L2= L2L1 and neither language is subset of the other and neither language is {λ}

Examples

- Find languages L1 and L2 satisfying L1L2= L2L1 and neither language is subset of the other and neigher language is {λ}

- L1 = {a ,aaa, aaaaa,........, } = $\{a^n \mid n \text{ is odd}\}$

- L2= {λ ,aa , aaaa,........, } = $\{a^n \mid n \text{ is even}\}$

- L1L2= a.aa = aaa = aa.a = L2L1
- L1L2= a. λ= a = λ.a=L2L1

Examples

- Find languages L1 and L2 satisfying L1L2= L2L1 and L1 is a proper non-empty subset of L2 and L1 ≠{λ}

Examples

- Find languages L1 and L2 satisfying L1L2= L2L1 and L1 is a proper non-empty subset of L2 and L1 $\neq\{\lambda\}$
- L1 = {a ,aaa, aaaaa,........, } = $\{a^n \mid n \text{ is odd}\}$
- L2= {λ ,a, aa ,aaa, aaaa,........, } = $\{a^n \mid n >= 0\}$
- L1L2= a.aa = aaa = aa.a = L2L1
- L1L2= a. λ= a = λ.a=L2L1

Examples

- Let languages L1 and L2 be subset of {a,b}* and consider two languages L1*U L2* and (L1 U L2)*. Which of the two is always a subset of the other ?

Examples

- Let languages L1 and L2 be subset of {a,b}* and consider two languages L1*U L2* and (L1 U L2)*. Which of the two is always a subset of the other ?

- L1={a} , L1*= {λ ,a, aa, aaa, aaaa,…….}
- L2={b}, L2*={λ ,b, bb, bbb, bbbb,…..}
- L1* U L2* = {λ, a, b, aa, bb, aaa, bbb,………}
- (L1 U L2) = {a, b}, (L1 U L2)* = {λ , a, b, ab, ba, aba, ……….}

Examples

- For a finite language L, |L| denotes number of elements in L, for finite languages A and B,is |A.B|= |A|*|B| always true ?

Examples

- For a finite language L, |L| denotes number of elements in L, for finite languages A and B,is |A.B|= |A|*|B| always true ?

- A={ab, a}, |A| = 2
- B={ba ,a}, |B|= 2
- AB = {abba, aba, aba, aa} = {abba, aba, aa}
- |AB|= 3
- |A|*|B|=2*2=4
- Statement is not always true

Examples

- Let L1, L2 and L3 be languages over some alphabet Σ. Is $L1(L2 \cap L3) = L1.L2 \cap L1.L3$ always true ?

Examples

- Let L1, L2 and L3 be languages over some alphabet Σ. Is $L1(L2 \cap L3) = L1.L2 \cap L1.L3$ always true ?

- L1={ab, a}
- L2={a}
- L3={ba}
- $L1(L2 \cap L3) = \{ab, a\} . \Phi = \Phi$
- $L1.L2 \cap L1.L3 = \{aba, aa\} \cap \{abba, aba\} = \{aba\}$

Let L_1, L_2 be languages, then the concatenation $L_1 \circ L_2 = \{w \mid w = xy, x \in L_1, y \in L_2\}$. If $L_2 = \emptyset$, then there is no string $y \in L_2$ and so there is no possible w such that $w = xy$. Thus for any L_1, we'll have $L_1 \circ \emptyset = \emptyset$.

Are $(L1 \cap L2)^*$ and $L1^* \cap L2^*$ always Equal ?

$L1 = \{a, ba\}$
$L2 = \{ab, a\}$

$L1^* = \{ \wedge, a, ba, aa, aba, baa, baba ,.....\}$
$L2^* = \{ , ab, a, abab, aba, aab, aa, ...\}$

$L1^* \cap L2^* = \{\wedge, a, aba, aa, ...\}$

$L1 \cap L2 = \{a\}$

$(L1 \cap L2)^* = \{\wedge, a, aa, aaa, ...\}$

They are not always equal