PROPERTIES OF REGULAR EXPRESSION

ITEU133

AUTOMATA AND THEORY OF COMPUTATION



PROPERTIES OF REGULAR SETS (LANGUAGES)

 A regular set (language) is a set accepted by a finite automaton.

Closure

 A set is closed under an operation if, whenever the operation is applied to members of the set, the result is also a member of the set.



PROPERTIES OF REGULAR SETS (LANGUAGES)

There are several operations defined on languages:

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L_1 \cup L_2: strings in either L_1 or L_2.
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$$L_1 \cap L_2$$
: strings in both L_1 and L_2 .

 L_1L_2 : strings composed of one string from L, followed by one

string from L_2 .

 $-L_2$: All strings (over the same alphabet) not in L_1 .

 L_1^* : Zero or more strings from L_1 concatenated together

 $L_1 - L_2$: strings in L_1 that are not in L_2 .

 L_1^R : strings in L_1 , reversed.



Union, Con cat e na tion, Nega tion, Kleene Star, Reverse

The general approach is as follows:

- (i) Build automata (DFA or NFA) for each of the languages involved.
- (ii) Show how to combine the automata in order to form a new automaton which recognizes the desired language.
- (iii) Since the language is represented by NFA/DFA, shall conclude that the language is regular.

Union, Concatena tion, Negation, Kleene Star, Reverse

Union of L1 and L2

- (a) Create a new start state
- (b) Make a ε-transition from the new start state to each of the original start states.

Union, Concatenation, Negation, Kleene Star, Reverse

Con cat e na tion of L1 and L2

- (a) Put a ε -transition from each final state of L1 to the initial state of L2.
- (b) Make the original final states of L1 nonfinal.

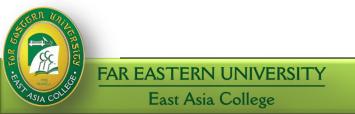
Union, Concatenation, Negation, Kleene Star, Reverse

Negation of L₁

- (a) Start with a complete DFA, not with an NFA
- (b) Make every final state nonfinal and every nonfinal state final.

Kleene star of L1

- (a) Make a new start state; connect it to the original start state with a λ-transition.
- (b) Make a new final state; connect the original final state (which becomes nonfinal) to it with λ-transitions.
- (c) Connect the new start state and new final state with a pair of λ-transitions.



Union, Concatenation, Negation, Kleene Star, Reverse

Reverse of L₁

- (a) Start with an automaton with just one final state.
- (b) Make the initial state final and final state initial.
- (c) Reverse the direction of every arc.

The same construction is used for both intersection and set difference. The distinction is in how the final states are selected.

Intersection

Make a state (A, B) as final if both

- A is a final state in L₁ and
- (ii) B is a final state in L₂

