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:

$L_1 \cup L_2$	:	strings in either L_1 or L_2.
$L_1 \cap L_2$	:	strings in both L_1 and L_2.
$L_1 L_2$	:	strings composed of one string from L_1 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 L_1

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

Kleene star of L_1

(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 L_1

(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

(i) A is a final state in L_1 and
(ii) B is a final state in L_2