Lecture Four

Finite Automata (FA)

Deterministic Finite Automaton(DFA)

In DFA, for each input symbol, one can determine the state to which the machine will move. Hence, it is called **Deterministic Automaton**. As it has a finite number of states, the machine is called **Deterministic Finite Machine** or **Deterministic Finite Automaton**.

Definition of a DFA

A DFA can be represented by:
1. A finite set of states.
2. A finite set of symbols called the alphabet (Σ).
3. The transition function.
4. The initial state from where any input is processed.
5. A final state/states.

Properties of DFA: There are two condition must be achieving **together**:

1. It has no transition on input ∧.
2. For each state (S) and input symbol (a) there almost one edge label (a) leave (S).

✍ كل (FA) هو (DFA) لأن في كلاهما لايوجد (∧) ولايوجد اكثر من سهم اوحافة تخرج من نفس العقدة وتحمل نفس الحرف.

Nondeterministic Finite Automaton (NFA)

If the basic finite automata model is modified in such a way that from a state on an input symbol zero, one or more transitions are permitted, then the corresponding finite automata is called a "Nondeterministic finite automata" (NFA). Therefore, an NFA is finite automata in which there may exist more than one paths corresponding to x in $\sum^*$ (because zero, one, or more transitions are permitted from a state on an input symbol). Whereas in a DFA, there exists exactly one path corresponding to x in $\sum^*$.

A Nondeterministic finite automaton (NFA) is a collection of three things:

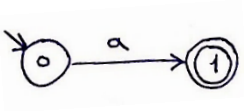
1. A finite set of states with one start state and some final states.
2. An alphabet ∑ of possible input letters.
3. A finite set of transitions that describe how to proceed from each state to other states along edges labeled with letters of the alphabet, where we allow the possibility of more than one edge with the same label from any state and some states for which certain input letters have no edge.

Properties of NFA: One or both of these conditions must be achieve:

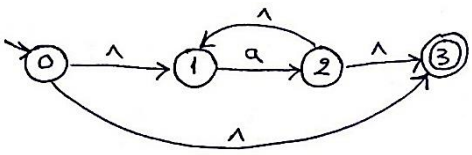
1- It has transition on input ∧.
2- For each state (S) and input symbol (a) there almost more than one edge label (a) leave (S).

Example: Draw Nondeterministic finite automaton (NFA) transition diagram for the following Regular Expressions (RE).

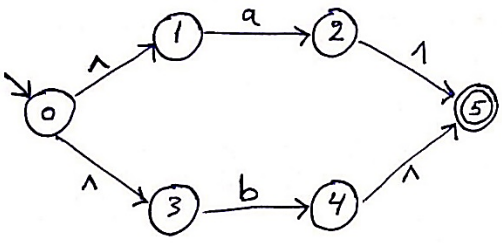
1- a



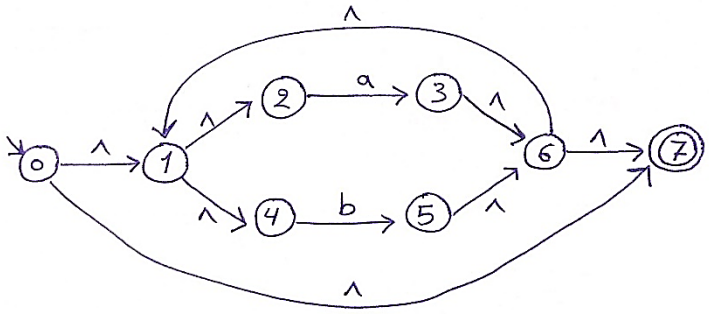
2- a*



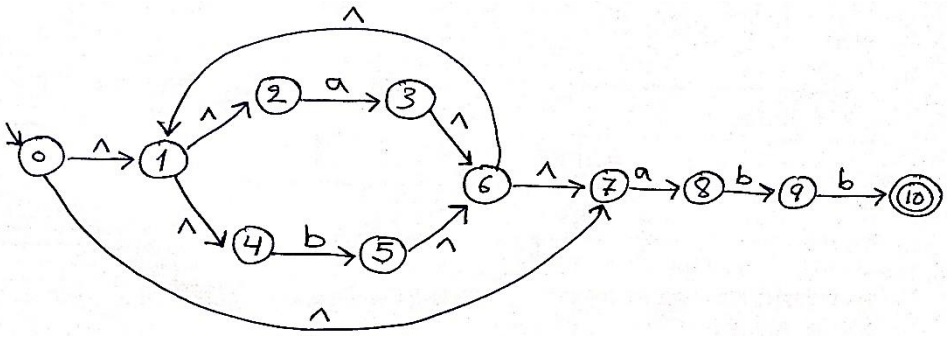
3- (a + b)



4- (a + b)*



5- (a + b)*abb



Homework: Draw Nondeterministic finite automaton (NFA) transition diagram for the following Regular Expressions (RE).

1- a(a +b)*a(a + b)
2- (a + b)(a + b)$^+$
3- (a +b)*ba