Lesson 7 - DFA and NFA Equivalence

Differences between DFA and NFA

Before we proceed with DFA and NFA Equivalence, let us review of the differences between the DFA and NFA.

DFA	NFA
Each transition leads to exactly one state	A transition could lead to a number of states
Transition on all possible input symbols should be defined in every state	Not all input symbols need to be defined explicitly in every state
Accepts the input string if the last transition ends in the final/ accept state	Accepts the input string if one of the active states for the last input symbol is the final/ accept state
Sometimes difficult to construct because of the number of states	Generally easier to design than a DFA to construct and may have fewer states

Converting NFA to DFA

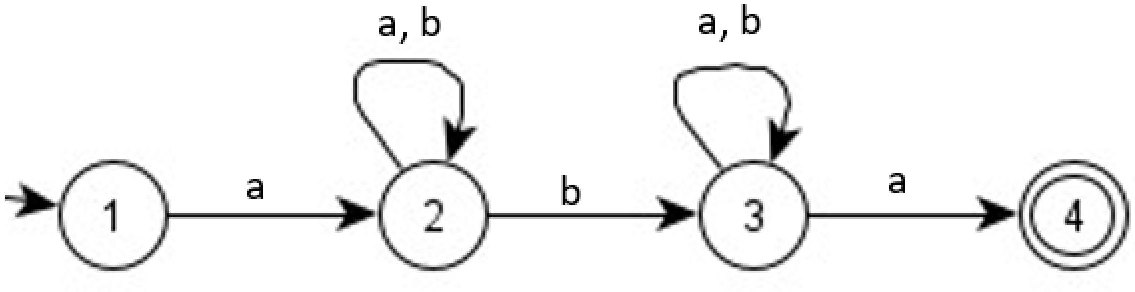
The class of languages accepted by NFA's includes the languages accepted by DFA's. Note that automata are equivalent if they accept the same language.

Theorem: Let L be a set accepted by an NFA.

Then there exists a DFA that accepts L.

A DFA can be converted to an equivalent NFA accepting the same language ((set of input strings), likewise, every NFA can be converted into a DFA that accepts the same language.

Example



Let us try converting the above NFA to DFA through the use of transition table.

Step 1. Let us convert the diagram to its equivalent transition table.

States	a	b

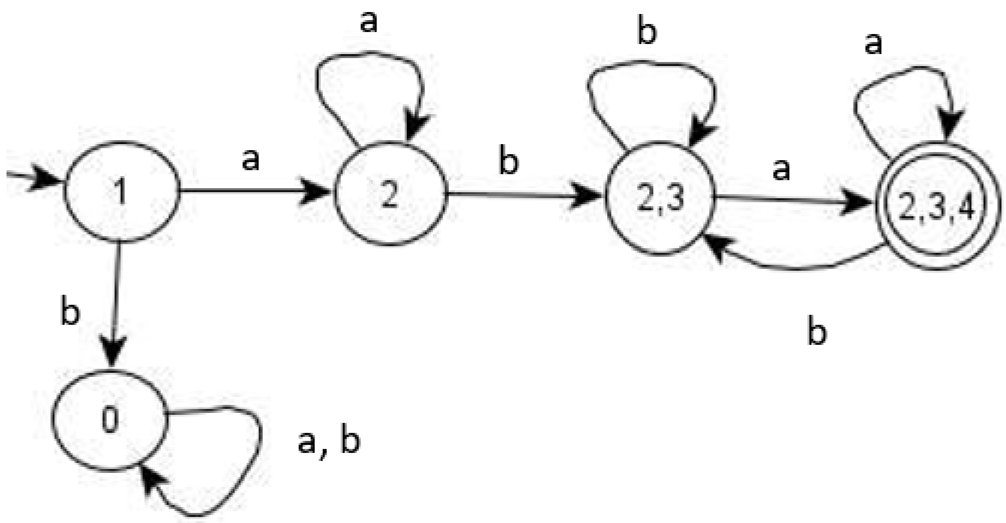
States	a	b
$\rightarrow 1$	2	-
2	2	2, 3
3	3, 4	3
$\ast 4$	-	-

Note: Right arrow denotes "initial state" while asterisk denotes "final state

Step 2. Base on the table in `Step 1`, we start with state `1` (initial state) for every input. The next state will be based on the transition state on the previous state. In this case, we have state `2`. So, from state 2, we put the transition for every input. The procedure will be repeated until all transition states are declared as states.

States	a	b
$\rightarrow 1$	2	-
2	2	2, 3
2, 3	2, 3, 4	2, 3
$\ast$ 2, 3, 4	2, 3, 4	2, 3

Step 3. Convert the transition table to its equivalent transition diagram for the final DFA. The final state shall be that which has the final which is state 4.


a
b
a
1
a
2
b
2,3
a
2,3,4
b
b
0
a, b