Discrete Mathematics Scribed Notes

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Deterministic and Non-Deterministic Finite State Automata-

If you have a target language each word must either be accepted or rejected by the machine. There is no room for ambiguity, there must not be any false positive or false negative.

Each language identified by a non-deterministic finite state automata can be applied to a finite state automata.

NDFSA(Non-Deterministic Finite State Automata) can be compared to multiple choice answers, i.e. accepting condition states that you need to succeed in at least one of the possible conditions.
i.e. an existential quantifier.

Convert NFA(Non Deterministic Finite State Automata) to DFA(Deterministic Finite State Automata)-

We start from all possible start states, the next state is a union of all possible states that can be obtained from the current start state.
Also State of DFA = Power set of NFA.

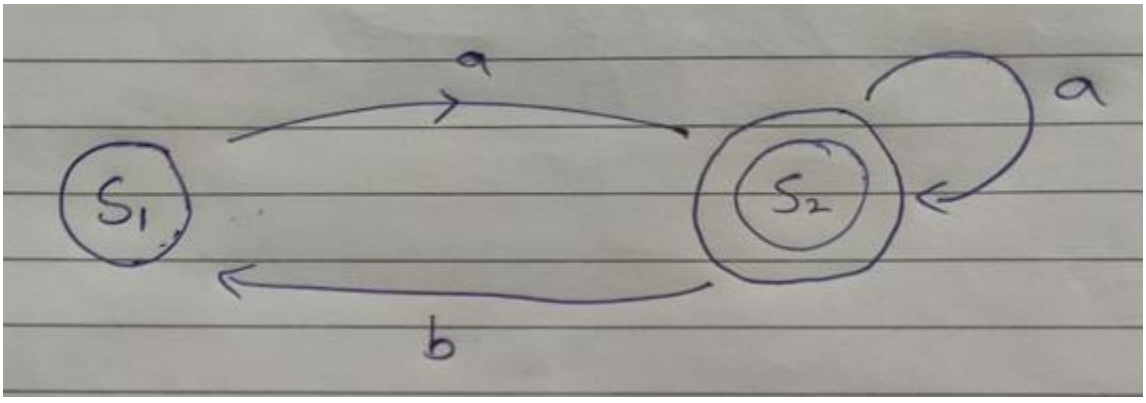
N - NFA $(Q, \sum, \Delta, S, F)$
M - DFA $(2^Q, \sum, \delta, s, Fm)$

Q - Set of All States.
∑: finite set of input symbol where δ: Q x ∑ →Q
Δ: Transition Function
Δ: Transition Relation
S: State
Fm: All subsets that intersect with the final state
F: final state

Given a NFA as follows:-

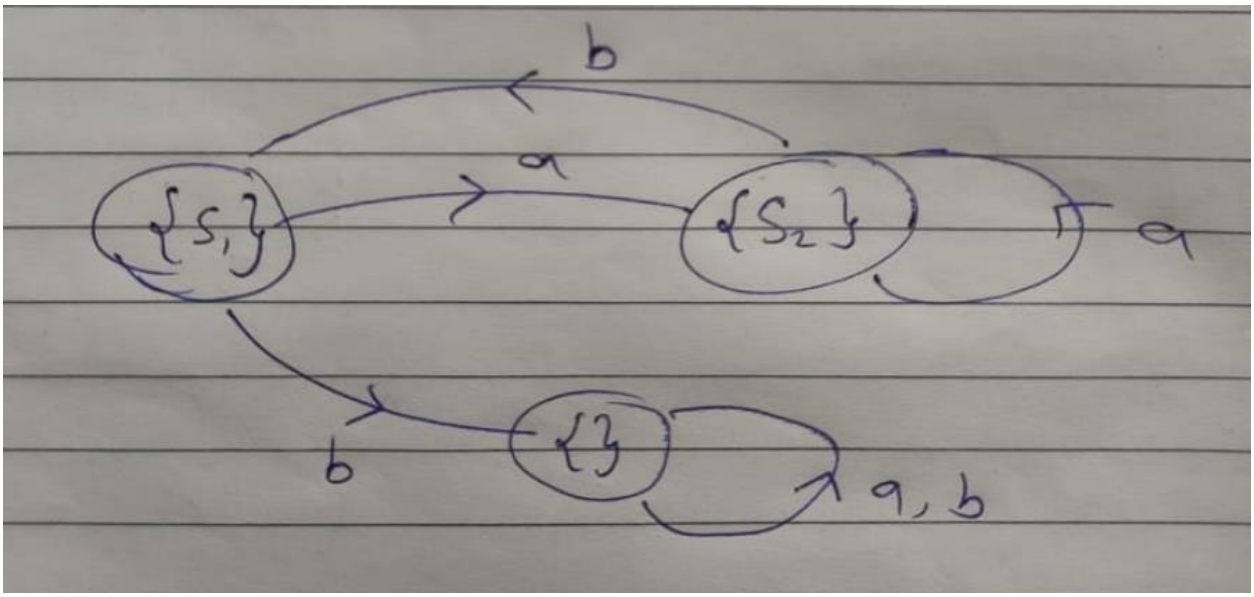
Language - Words which start with ‘a’ and end with ‘a’, and there are no consecutive ‘b’ .

NFA -



Here start state is S1. When we encounter an ‘a’ state changes to S2 and if we encounter ‘b’ if will be rejected.
Then if we encounter a ‘a’ state will remain unchanged indicated by the self loop.
If we encounter a ‘b’ state will change back to S1.
S2 is an end state here.

DFA-



Here we use construction on the fly to generate only those states which are required by us, rather than constructing all states and using only few.
Here {S1} is a start state, If we encounter a ‘b’ at the start the state changes to {}. If we encounter a ‘a’ state changes to {S2}. From {S2} if we encounter an ‘a’ state remains the same and if we encounter a ‘b’ state changes to {S1}.