Assignment

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① Define the following with example.

(i) Alphabet

A language is consist of various symbol from which the word, statement etc can obtain. These symbol is called alphabet.

example.

The Alphabet of C language has letter from A to Z, and digit from 0 to 9. Symbol such as +, −, *, /, (,), {, }, etc.

$\Sigma = \{a, b, c, \ldots z, 0, 1, 2, 3 \ldots 9, \#, \{, \}, [,], <, >\}$

(ii) String

A finite sequence of symbol from alphabet is called string.

denoted by ε

example

let $\Sigma = \{0, 1\}$ set of alphabet various string can generated

$\varepsilon = \{0, 1, 00, 01, 10, 11\}$

concatenation

The concatenation of two string u and v is the string obtain by writting the letter of string u followed by letter of string v.

$u = a_1 a_2 a_3 \ldots a_n$

$v = b_1, b_2, b_3 \ldots b_n$

$uv = a_1 a_2 a_3 \ldots a_n b_1 b_2 b_3 \ldots b_n$.

u : computer

v : science

uv : computerscience

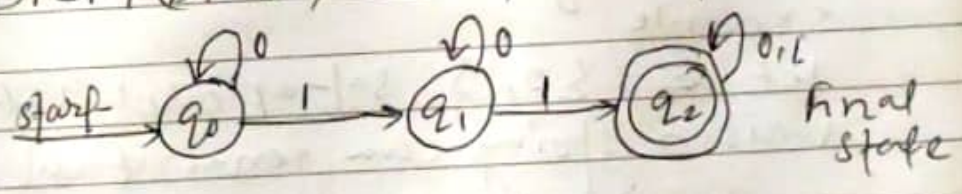
(III) Language:- language can be defined as a set of string obtain from Σ where Σ is the set of alphabet of particular language.

A language of string consist of equal nuses of 0's & 1's be represented {ε, 01, 10, 0011, 1010, 0101, 0011}

(IV) FSM (FA)
A Finite automaton is mathematical model which is used to study the abstract machine with the input chosen from Σ.

2. Define the following with example.
DFSM (DFA), NDFSM, and epsilon NFA

Ans:-



State:- The circle are called vertices or node or state. Each state is identified by name i.e q_0, q_1, q_2
q_0 is starting state
q_2 is final state.

Input alphabet
Each edge is label with 0,1, represent the input symbol which can denoted $\Sigma = \{0, 1\}$

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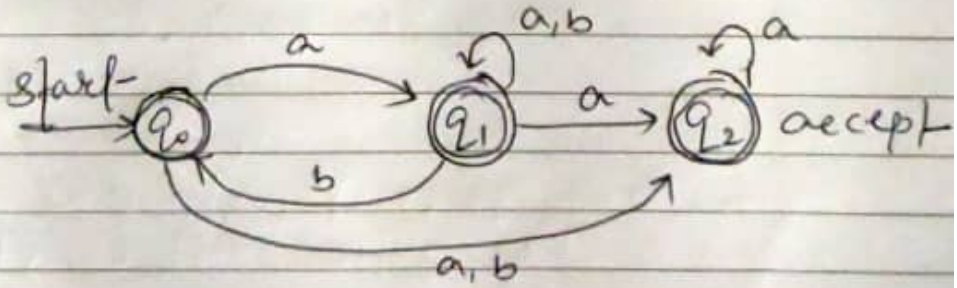
Transition:
Transition is nothing but change of state after consuming an input symbol. If there is a change of state from q_i to q_j on input symbol
$\delta(q_i, a) = q_j$

$M = (Q, \Sigma, \delta, q_0, F)$
where
M is the name of the machine
Q is non empty finite set of state.
E is non-empty finite set of input alphabet.
δ : $Q \times \Sigma$ to Q. δ is transition function.
q_0 : start state
F : Final state

* Non-Deterministic finite Automaton.



State: The NFA has three state q_0, q_1 and q_2 and can represented as
$Q = \{q_0, q_1, q_2\}$

Input alphabet :- Each edge is labeled with a or b and represent the input alphabet which can denoted as $\Sigma = \{a, b\}$.

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Transition

Transition is nothing but change of state after consuming an input symbol. If there is a change of state from q_i to q_j on an input symbol a, then we write

$$\delta(v_i, a) = q_j$$

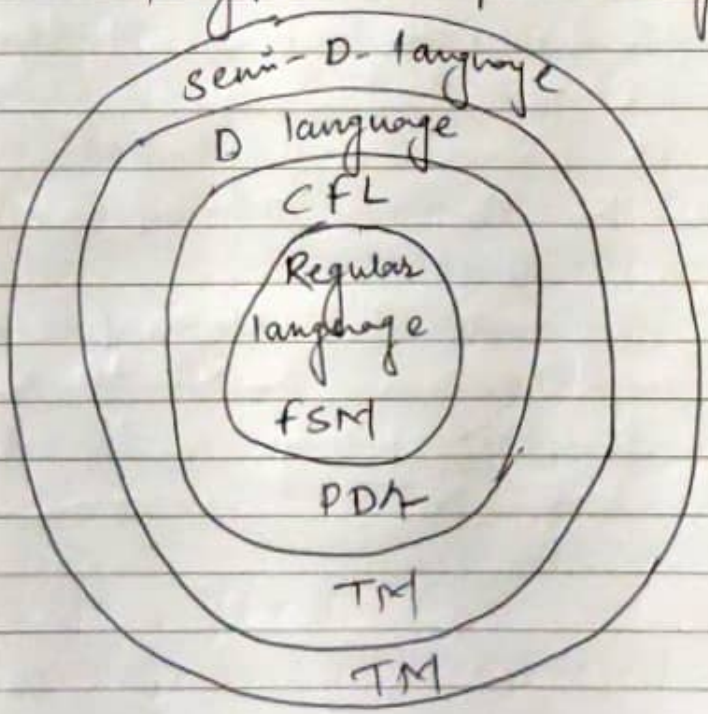
3. With a neat diagram, explain a hierarchy of language class in Automata Theory and list the application of Finite Automata

Ans:

1. Regular language (FSM)
2. Context free language (PDA)
3. Decidable language (TM)
4. Semi decidable language (some TM)

Tool can be selected based on.

1. Computational efficiency:
   FSM grow linearly in the length of I/P string.
   PDA grows cube of length of I/P string.
   TM grows exponentially with length of I/P string.



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2. Decidability.
FSM are decidable for example does FSM accept some particular string.
Is FSM is minimal? Are 2 FSMs are identical? PDA is also decidable but question D.n.t. TM can't be answer.

3. clarity.
there are tools to design FSM and every regular language can also be described using Regular expression. Every CFL recorded by some PDA can be described by CF grammar.

5. Write the procedure for conversion from NDFSM to DFSM
Subset construction

Step 1. Identify the ~~alphabet~~ start state of DFA:
Since q_0 is the start state of DFA

Step 2: Identify the alphabet of DFA
The input alphabet of DFA are the input alphabet of NFA. So $\Sigma = \{a, b\}$

Step 3: Identify Q_D which are the state of DFA: The set of subset of Q_N will be state of DFA Q_D. So Q_N has n state then Q_D will have 2^n states
let $Q_N = \{q_0, q_1, q_2\}$ then $|Q_N| = 3$
$Q_D = \{\{\}, \{q_0\}, \{q_1\}, \{q_2\}, \{q_0, q_1\}, \{q_0, q_2\}, \{q_1, q_2\}, \{q_0, q_1, q_2\}\}$.

$Q_D = 8$.

4. Identify the final state of DFA.
5. Identify the transitions of DFA.

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(8) Write a notes on finite state transducers.

⇒ Transducer.
A device that convert various in a physical quantity, such as pressure, brightness into an electric signal or vice versa.

There are two type of finite state
* Moore Machine
* Mealy Machine

(1) Moore Machine :- A moore Machine M is a seven tuple $(K, \Sigma, O, \delta, D, s, A)$ where
K is finite set of states
Σ is the input Alphabet.
O is output Alphabet.
$s \in K$ is the set of accepting state.
& δ is the transition function it map from $K \times \Sigma$ to K.
D is the display output function from the $K \to O$ *