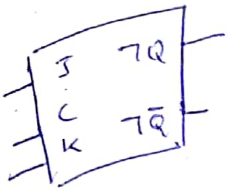
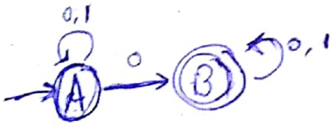
Master slave JK

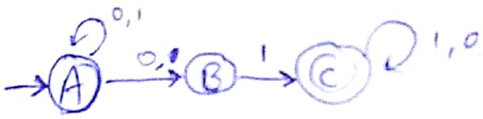


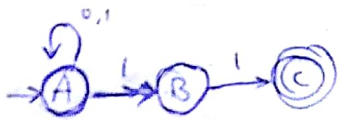
J	K	C	Q^+	$\bar{Q}^+$
0	0	1	Q	$\bar{Q}$
0	1	1	0	1
1	0	1	1	0
1	1	1	$\bar{Q}$	Q
x	x	0	Q	$\bar{Q}$

$1 \to 0$

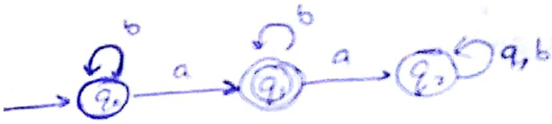
$$Q^+ = J\bar{Q} + \bar{K}Q$$



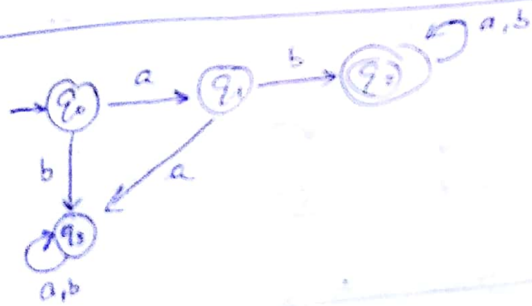




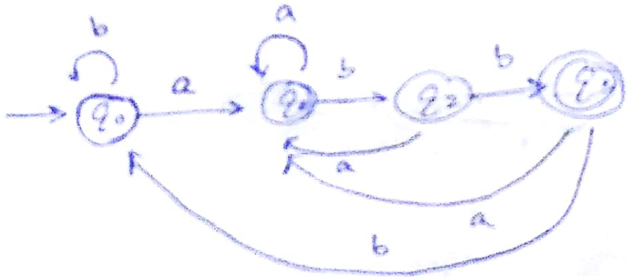
exactly one a



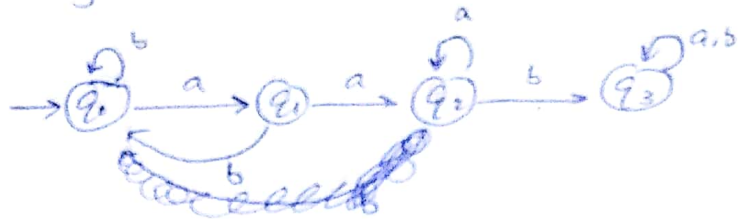
Starts with ab



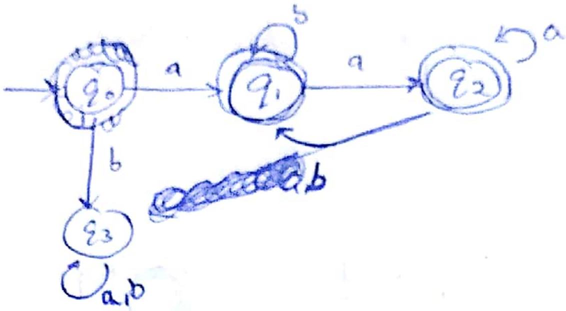
ending with abb



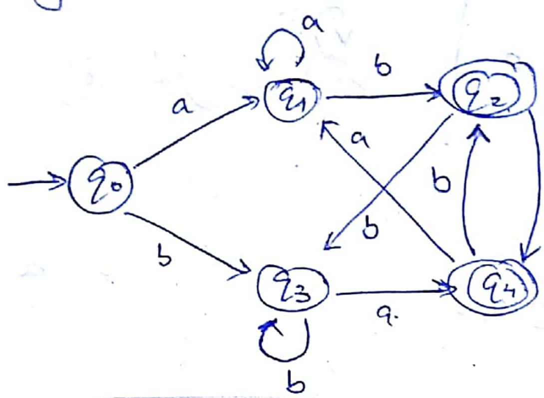
Substring aab



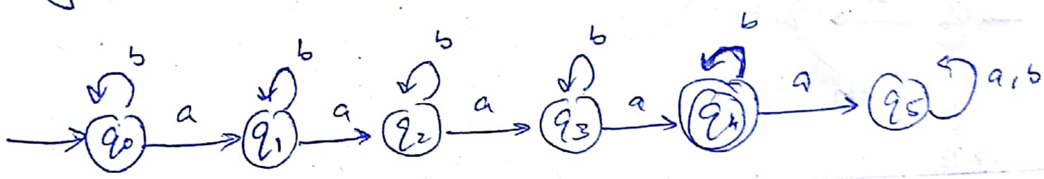
Starting and ending with a



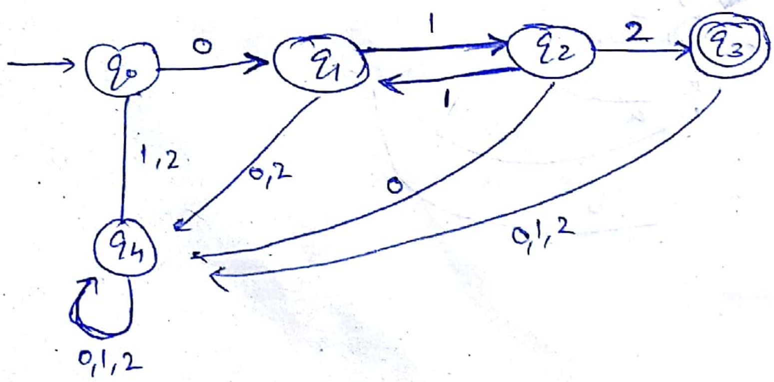
ending with ab or ba

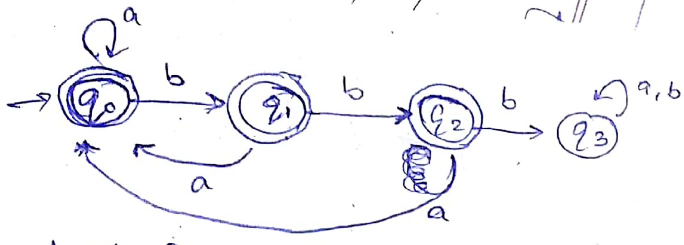


having 4 a's



0 followed by odd 1's ending with 2





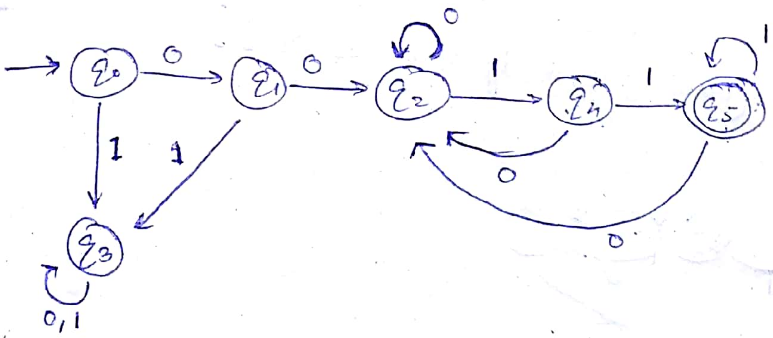
abbaaa

abbabb

0101

atmost 2 conecutive b's

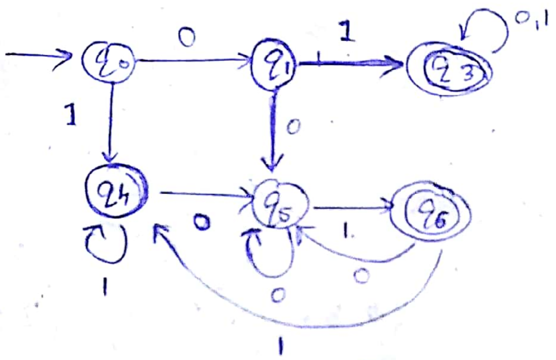
start with atleast 2 0's ending with at least 2 1's



110

begin or end or both with 01

0110



1101

0101

11 0001

10101

10101

0101

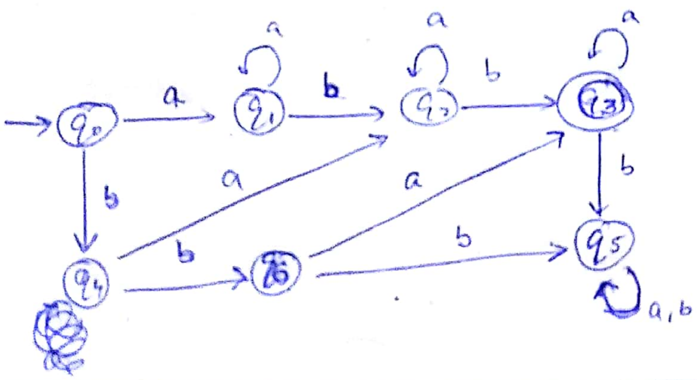
11101

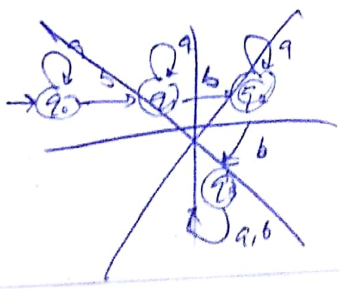
$n_a \geq 1$ $n_b = 2$

babb

bba

bab





Bin i/p mod 5 is zero.

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

radix of i/p = 2 for binary (base)

$$j = (r \times i + d) \bmod k$$

remainder after dividing by k

digits {0, 1} for bin

division

---

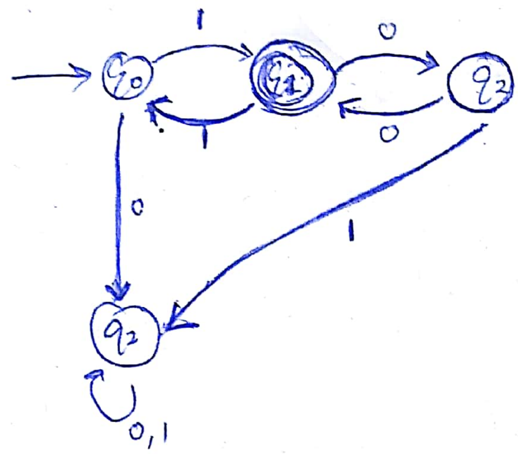
odd no of 1's followed by even no's of 0's

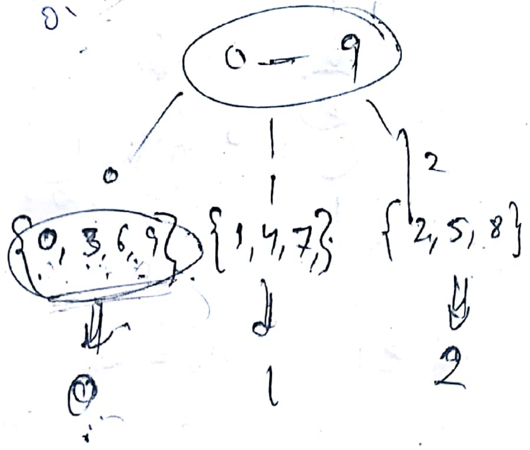
11100

1001

$\boxed{1010}$

1100





Relations

- Antisymmetry :- $(aRb \wedge bRa) \rightarrow a = b$

  If 2 objects are both related to each other, they are the same object.

★ Partial order ($\preccurlyeq$)

- Antisymmetric
- Reflexive
- transitive

eg $x \leq y$ $2 \leq 4$ ref ✓ trans ✓ antisym ✓

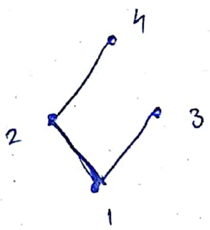
eg alphabetical order

★ Hasse Diagram (for Partial order)

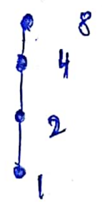
eg $A = \{1,2,3,4\}$ . . where xRy if $x \div y$

$R = \{(1,1)\ (1,2),(1,3)(1,4),(2,2)(2,4),(3,3),(4,4)\}$

- dont show reflexive
- dont show direction
- remove transitivity



eg- $A = \{1,2,4,8\}$ $xRy = x/y$



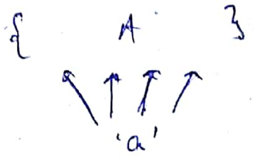
$\leftarrow$ total order (if we can connect all the element in a straight line)

⇒ Upper bound (A) means: all the element accessed by the all elements of set A below 'a'

a is upper bound.

least upper bound (A): should be a unique element closest to elements of set A

⇒ lower bound (A) all the elements below set A which can acess all elements of set A



upper lower bound (A): should be a unique element closest to elements of A.

⇒ maximal :- elements on the top level
if only 1 element then aka "greatest"

⇒ minimal :- elements on the bottom level
if only 1 element then aka "least"

Composition Relation :-

$R_1 \circ R_2 = \{ (x, z) \in R \quad , \quad x \in A, z \in C$ there exist $y \in B$, $(x, y) \in R_1$, $(y, z) \in R_2 \}$

A, B & C are sets with $R_1 \subseteq A \times B$, $R_2 \subseteq B \times C$

then composite relation is a relation from $A \to C$ defined by $R_1 \circ R_2$

- Power of relation

$R^1 = R$

$R^2 = R \circ R$

$R^3 = R^2 \circ R$

$R^{n+1} = R^n \circ R$

Matrix Rep of Relation

$$M_{ij} = \begin{cases} 1 & (x_i, y_i) \in R \\ 0 & (x_i, y_i) \notin R \end{cases}$$

eg $A = \{1, 2, 3, 4\}$ $\quad$ x divides y

$R = \{(1,1)(1,2)(1,3), (1,4), (2,2) (2,4) (3,3), (4,4)\}$

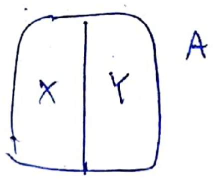
$$M(R) = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

partition

For each subset X, Y $\quad X \in A, \; Y \in A.$

i) $X \cap Y = \phi$

ii) $\bigcup X_i = A$



eg $A = \{a, b, c, d\}$

$P_1 = \{\{a, b\}, \{c\}, \{d\}\}$ ✓

$P_2 = \{\{a, b, c\}, \{c, d\}\}$ ✗

overlapping

$P_3 = \{\{a, b\}, \{d\}\}$ ✗

'c' not used

DFA : It is 5 tuples of $M = (Q, \Sigma, \delta, q_0, F)$

Q : non-empty, finite set of states

Σ : set of input alphabets

δ : $Q \times \Sigma$ to Q ie transition funⁿ mapping $Q \times \Sigma$ to Q

q_0 : $q_0 \in Q$ is the start state

F : $F \subseteq Q$ is set of final states

extended transition function (δ^*) : describes what happens to a state of machine when ip is a string

$$\delta^* : Q \times \Sigma^* \rightarrow Q$$

$$\delta^*(q, \epsilon) = q$$

$$\delta^*(q, w) = \delta^*(q, xa) = \delta(\delta^*(q, x), a)$$

$$\delta^*(q, w) = \delta^*(q, ax) = \delta^*(\delta(q, a), x)$$

Language accepted by DFA =

$$L(M) = \{ w \mid w \in \Sigma^* \text{ and } \delta^*(q_0, w) \text{ is in } F \}$$

insert not for Language rejected by DFA

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Padma Reddy

NFA : $M = (Q, \Sigma, \delta, q_0, F)$

Q : non-empty, finite set of states

Σ : set of i/p alphabets

δ : $Q \times \Sigma \rightarrow 2^Q$

q_0 : $q_0 \in Q$ ~~start~~ state

$F \subseteq Q$: set of final states

Scanned by CamScanner

$$\delta^*: Q \times \Sigma^* \rightarrow 2^Q$$

$$\delta^*(q, \epsilon) = \{q\}$$

$$\delta^*(q, w) = \delta^*(q, xa) = \{\delta(\{\delta^*(q, x)\}, a)\}$$

$$\delta^*(q, w) = \delta^*(q, ax) = \{\delta^*(\{\delta(q, a)\}, x)\}$$

$$\delta^*(q, x) = \{p_1, p_2 \dots p_m\}$$

$$\delta(\{p_1, p_2, \dots p_m\}, a) = \{r_1, r_2, r_3 \dots r_k\}$$

i.e. $\bigcup_{i=1}^{m} \delta(p_i, a) = \{r_1, r_2, \dots r_k\}$

Page 100 for examples

ϵ-NFA: $M = (Q, \Sigma, \delta, q_0, F)$

Q: non empty, finite set of states

Σ: input alphabets

δ: $Q \times (\Sigma \cup \epsilon) \rightarrow 2^Q$

q_0: $q_0 \in Q$ start state

F: $F \subseteq Q$ set of final states.

$$\delta^*: Q \times (\Sigma \cup \epsilon)^* \rightarrow 2^Q$$

$$\delta^*(q, \epsilon) = \epsilon\text{-closure}(q)$$

$$\delta^*(q, w) = \delta^*(q, xa) = \epsilon\text{-close}(\delta(\delta^*(q, x), a))$$

$$\delta^*(q, w) = \delta^*(q, ax) = \epsilon\text{-clos}(\delta^*(\delta(q, a), x))$$

$\neg[\neg[(p \vee q) \wedge r] \vee \neg q]$

$[(p \vee q) \wedge (r \wedge q)]$

$p \vee (p \wedge q)$

$(p \vee q) \wedge (r \wedge q)$

$(p \vee q) \wedge (q \wedge r)$

$((p \vee q) \wedge q) \wedge r$

$p \vee q$

1) Modus Ponnens

$[p \wedge (p \rightarrow q)] \rightarrow q$

p

$p \rightarrow q$

$\therefore q$

2) Syllogism

$p \rightarrow q$

$q \rightarrow r$

$p \rightarrow r$

3) Modus Tollen

$p \rightarrow q$

$\neg q$

$\neg p$

$(p \rightarrow q) \wedge \neg q$

$p \rightarrow (q \wedge \neg q)$

$p \rightarrow F$

$\neg p$

4 Conjunction

p

q

$\therefore p \wedge q$

5 Disjunction Syllogism

$p \vee q$ $\qquad$ $(p \vee q) \wedge \neg p$

$\neg p$ $\qquad$ $p \vee q \wedge \neg p$

$\therefore q$ $\qquad$ $(p \vee \neg p) \wedge q$

$(p \wedge q)$

$\emptyset$

6. Contradiction

$\neg p \rightarrow F_0$

$\therefore p$

7. $p \wedge q$ $\qquad$ Conjunction Simp.

$\therefore p$

8. Disjunction Amplification

p

$\therefore p \vee q$