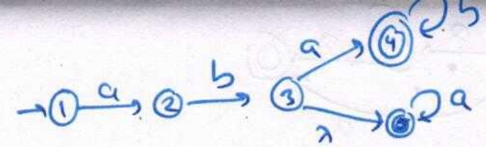
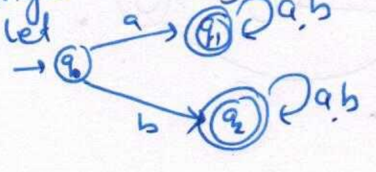
Q1

(a).



(b) NO, distinguishability relation of states in a DFA is not transitive. Let



Here (q_1, q_0) and (q_0, q_2) distinct. However (q_1, q_2) indistinct.

(c) TRUE.

$\overline{L_1}$ is finite

$\Rightarrow \overline{L_1}$ is regular

$\Rightarrow \overline{(\overline{L_1})}$ is also regular

$\Rightarrow L_1$ is regular.

(d) TRUE.

L is regular.

$\Rightarrow$ There is an NFA with a unique final state that accepts L.

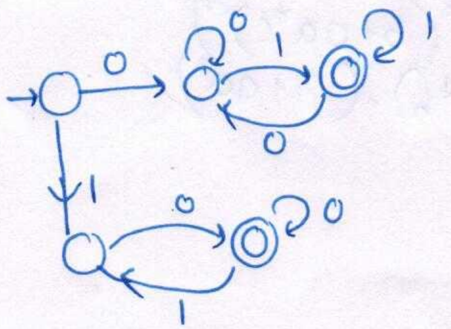
The reverse of the NFA will accept L^R.

The reverse of NFA is obtained by (i) making initial state → final state.

(ii) making final state → initial state

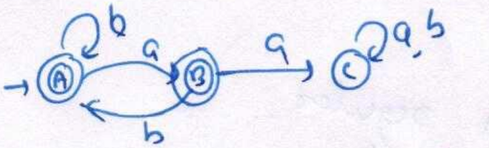
(iii) Reverse all arrow direction.

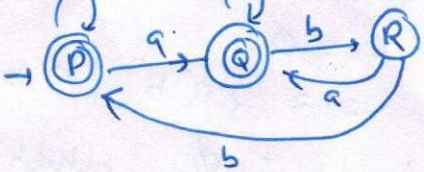
(e)

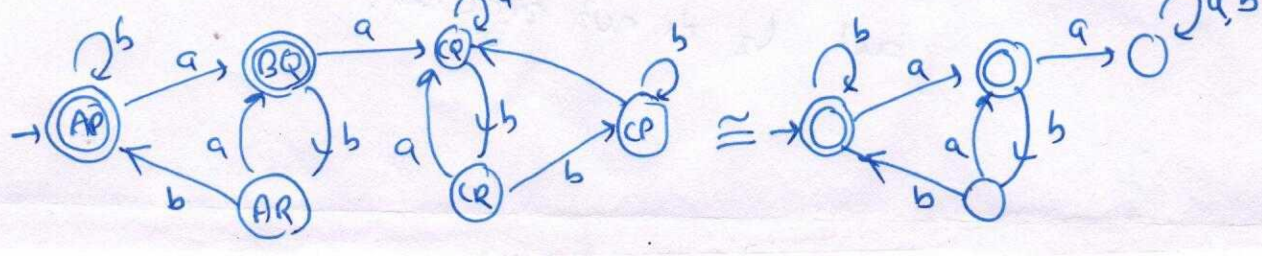


Q-2

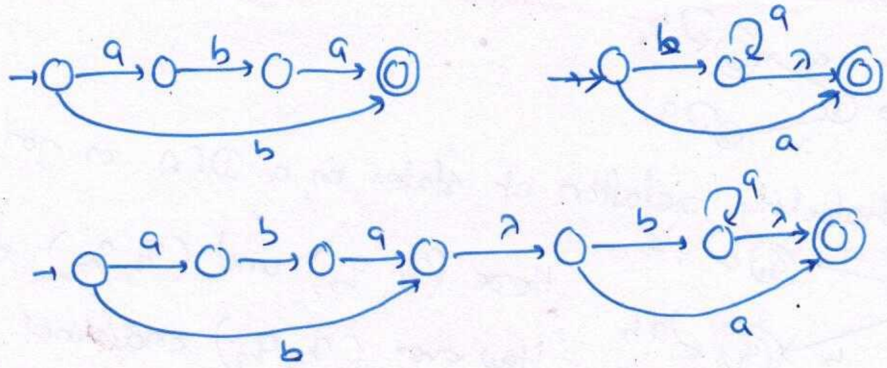
(a)







(b)



Q-3

(a) $(b+ab)^*(\lambda+a+aa+aaa+aab(b+ab)^*aa)(b+ba)^*$

(b) $(aa)^*(bb)^* + a(aa)^*b(bb)^*$

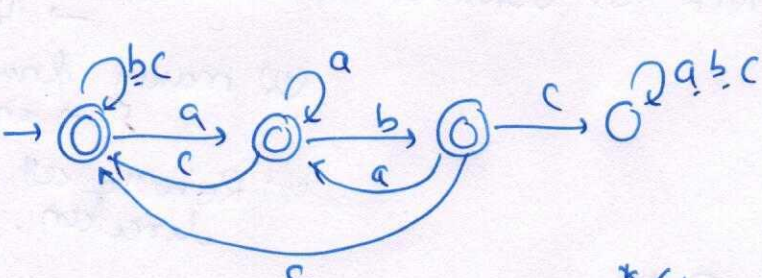
(c) $(a+b)^*(aaa+aab+abb+baa+bab+bba+bbb)+(a+b+\lambda)^2$

(d) $b(b+ab^*a)^*abb^*$

(e) $(a+b)^{10}(a+b+\lambda)^{40}$

Q-4

(a)



$$R.E = (b+c+aa^*c+aa^*b(aa^*b)^*(b+aa^*c)^*b)^* \cdot (aa^*+\lambda+aa^*b(aa^*b)\cdot(\lambda+aa^*))$$

(b) FALSE.

let consider by an example

$L_1 = \phi.$

$L_2 = \{a^n b^n \mid n \geq 0\}$

$L_1 \cdot L_2 = \phi$ which is regular.

but L_2 is not regular.

Q-5

(a) states are A, B, C, D, E, F, G, H,

by considering un reachability state D is removed.

A, B, C, E, F, G, H,

by considering N.F and F state. all remaining 7 states are divided into two blocks.

$\underline{A, B, E, F, G, H}_{N.F.}$, $\underline{C}_{F.}$

Among Non final state

A, $\underline{BH}$, $\underline{E}$, F, G, $\underline{C}$ — BH. state behave same with any ω.

$\underline{AE}$, $\underline{BH}$, $\underline{F}$, $\underline{G}$, $\underline{C}$ — AE = behave same with any ω.

so finally ~~5 no. of~~ 5 numbers of states are present.

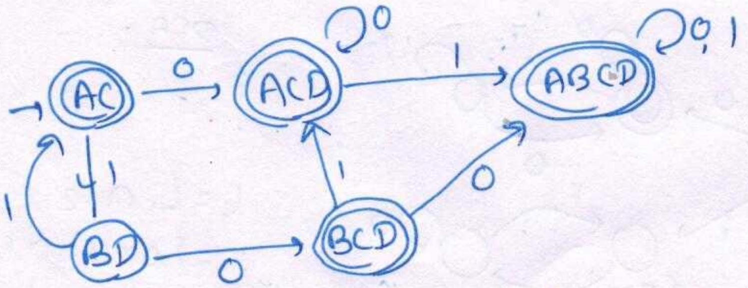
(b) $\phi^* = \{\lambda\}$ empty string.

$a\phi = \phi$ empty set.

$\lambda^* = \{\lambda\}$ empty string.

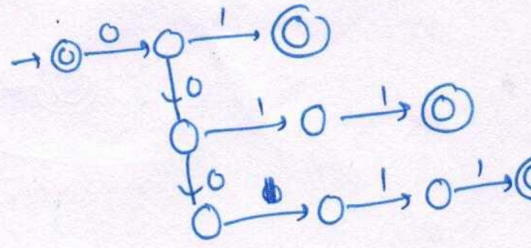
Q-6

(a)



(b) $L = \{0^n 1^n \mid 0 \le n \le 3\}$

$\lambda + 01 + 0011 + 000111$



Q.7

(a) Two states P & q of a DFA are called indistinguishable

if $\delta^*(P, \omega) \in F \Rightarrow \delta^*(q, \omega) \in F$

and $\delta^*(P, \omega) \notin F \Rightarrow \delta^*(q, \omega) \notin F$. for all $\omega \in \Sigma^*$.

This relationship is transitive.

Let. (P, q) indistinguishable and (q, r) indistinguishable

for any ω, $\delta^*(P, \omega) \in F \Rightarrow \delta^*(q, \omega) \in F$

$\Rightarrow \delta^*(r, \omega) \in F \Rightarrow (P, r)$ indistinguishable.

Similarly for non-final case.

(b) $L_1 \cap L_2$ is regular.

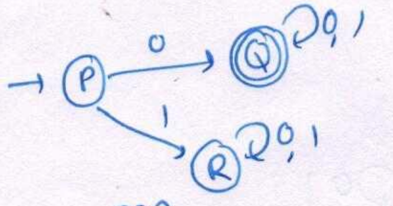
proofe by consider two Languge L_1 & L_2.

let L_1 & L_2 are regular.

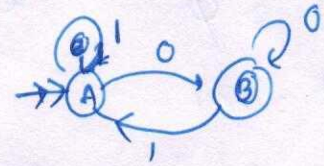
1) Design DFA for both L_1 and L_2.

2) Design the DFA for $L_1 \cap L_2$.

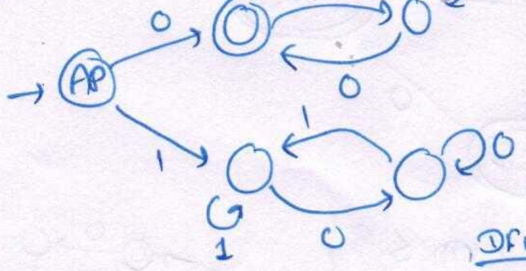
$L_1 = \{0x \mid x \in \{0,1\}^*\}$. $L_2 = \{x0 \mid x \in \{0,1\}^*\}$



DFA



DFA



$L = L_1 \cap L_2$
$= \{0x0 \mid x \in \{0,1\}^*\}$.

DFA

— end —