Conversion of Non-deterministic System to Deterministic System :-

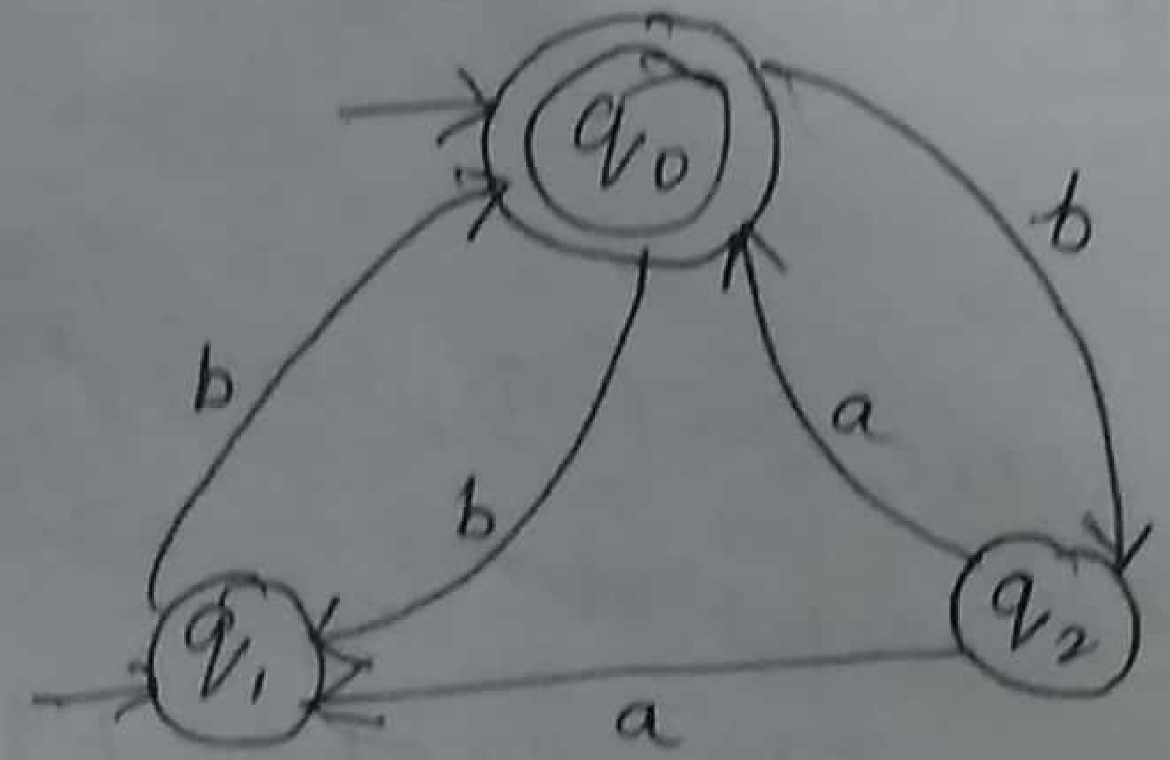
The construction we are going to give is similar to the construction of a DFA equivalent to an NDFA involves three steps :-

i> convert the given transition system into state transition table where each state correspond to a row and each input symbol correspond to a column.

ii> Construct the successor table which list subsets of the state reachable from the set of initial states.

iii> The transition graph given by the successor table is the required deterministic system. The final state contain some final state of NDFA if possible reduce the no. of state.

Ques. Obtain the deterministic graph equivalent to the transition system given in fig.



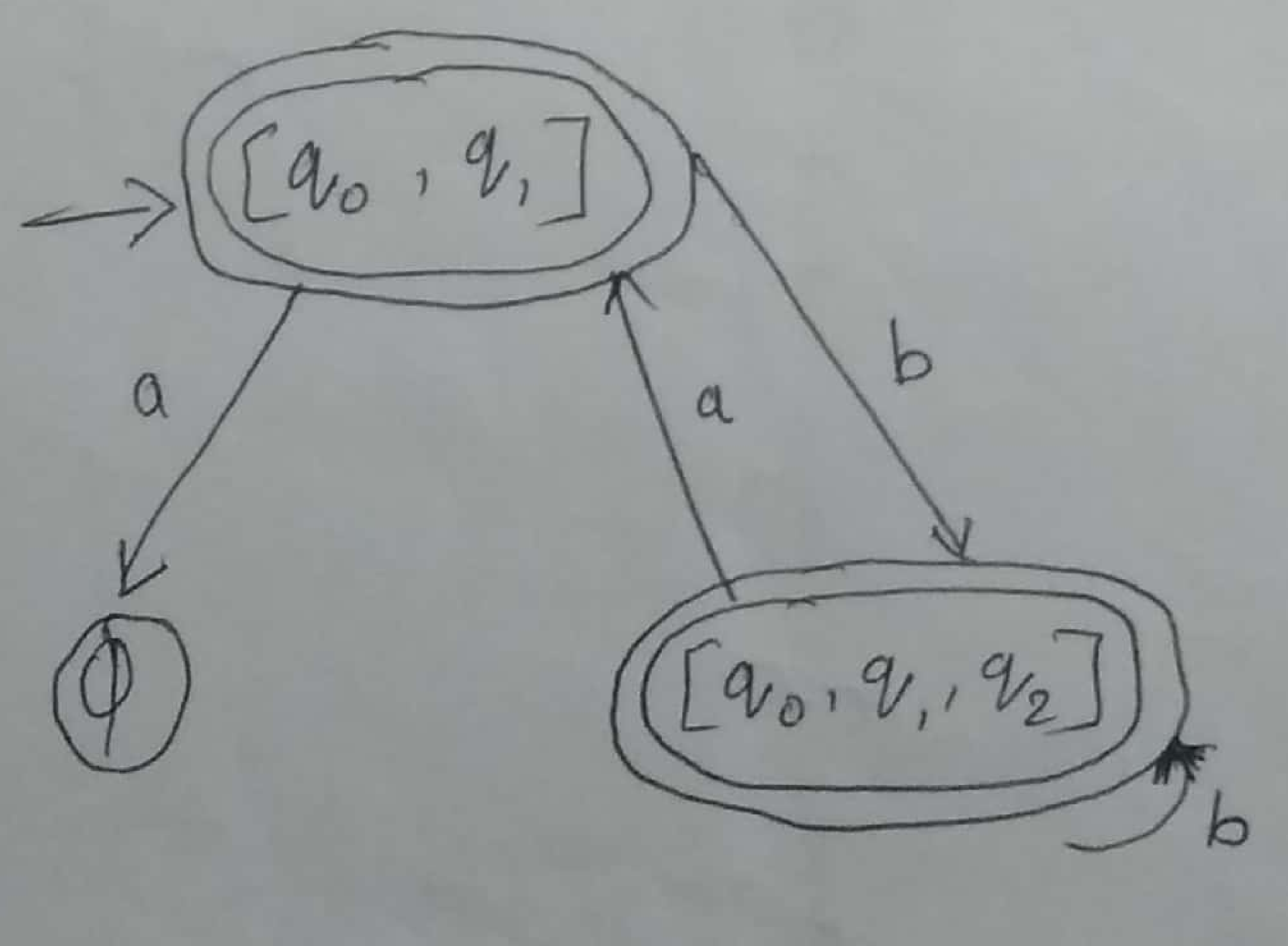
Sol:- we construct the transition table corresponding to the given non-deterministic system

State / Σ	a	b
→ q_0	ϕ	q_1, q_2
→ q_1	ϕ	q_0
q_2	$q_0 q$	ϕ

we construct the successor table by starting with $[q_0, q_1]$. From the table. we see that $[q_0, q_1, q_2]$ is reachable from $[q_0, q_1]$ by a b-path. There are no path from a to $[q_0, q_1]$. Similarly $[q_0, q_1]$ is reachable from $[q_0, q_1, q_2]$ by an a-path and $[q_0, q_1, q_2]$ is reachable from itself. we proceed with the construction for all the elements in Q_a for every $a \in \Sigma$

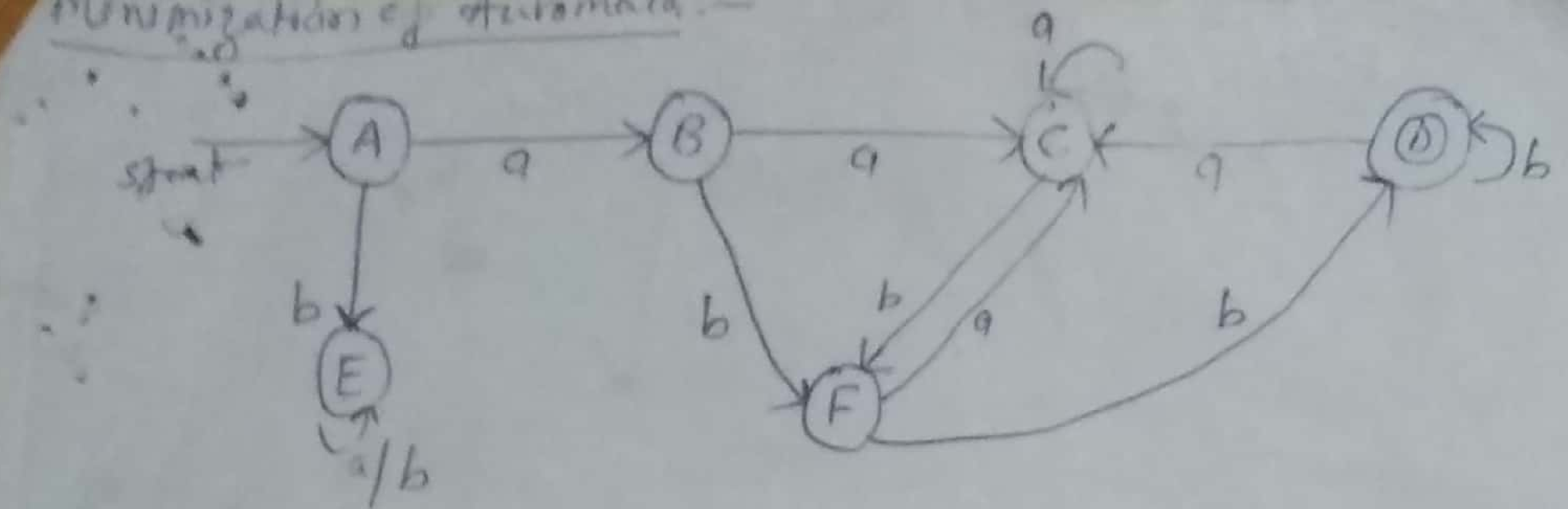
Q	Q_a	Q_b
$[q_0, q_1]$	ϕ	$[q_0, q_1, q_2]$
$[q_0, q_1, q_2]$	$[q_0, q_1]$	$[q_0, q_1, q_2]$
ϕ	ϕ	ϕ

we terminate the construction when all the elemen[ts] in Q from the Q_a for every $a \in \Sigma$ are already in Q from the successor table it is easy to construct the determinin[istic] transition system given in fig.



Minimization of Automata

(10)



Initially we have two groups as shown below

$\boxed{A, B, C, E, F}$ Group I

$\boxed{D}$ Group II

Since

$\delta(A,a) = B$ $\qquad$ $\delta(A,b) = E$

$\delta(B,a) = C$ $\qquad$ $\delta(B,b) = F$

$\delta(C,a) = C$ $\qquad$ $\delta(C,b) = F$

$\delta(E,a) = E$ $\qquad$ $\delta(E,b) = E$

$\delta(F,a) = C$ $\qquad$ $\delta(F,b) = D$

State F is distinguishable from rest of the members of group I. Hence we divide group I into two groups one containing A, B, C, E and other containing F as shown below.

$\boxed{A, B, C, E}$ Group I

$\boxed{F}$ Group II

$\boxed{D}$ Group III

Since

$\delta(A,a) = B$ $\qquad$ $\delta(A,b) = E$

$\delta(B,a) = C$ $\qquad$ $\delta(B,b) = F$

$\delta(C,a) = C$ $\qquad$ $\delta(C,b) = F$

$\delta(E,a) = E$ $\qquad$ $\delta(E,b) = E$

States A and E are distinguishable from stat[illegible] B and C. Hence we devide group I into t[illegible] groups one containing A, E and other conta[illegible] B, C as shown belo[illegible]

$\boxed{A, E}$ $\boxed{B, C}$ $\boxed{F}$ $\boxed{D}$

Group I Group II Group III Group IV

Since

$\delta(A, a) = B$

$\delta(E, a) = F$

State A is distinguishable from state E. Hence we divide group I into two groups one containing A and other containing E

$\boxed{A}$ $\boxed{E}$ $\boxed{B, C}$ $\boxed{F}$ $\boxed{D}$

Group I Group II Group III Group IV Group V

Since

$\delta(B, a) = C$ $\delta(B, b) = F$

$\delta(C, a) = C$ $\delta(C, b) = F$

Hence B and C are non distinguishable states therefore we merge B and C to form a single state B_1 as shown in figure.