①

Conversion of Dig into RE :-

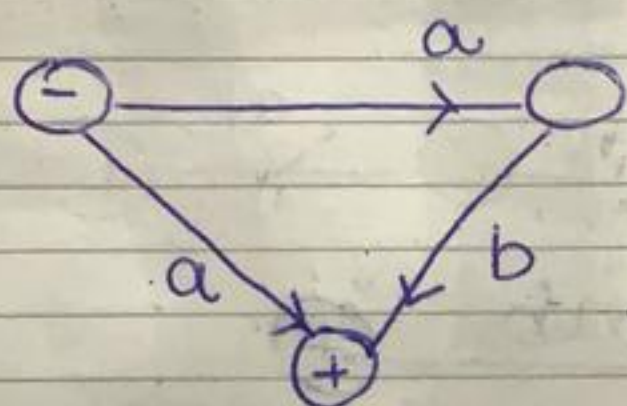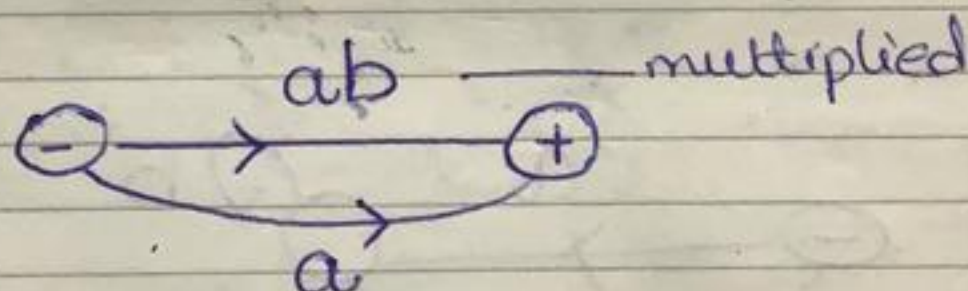②. **Rules :**

- It is done by removing states one by one.

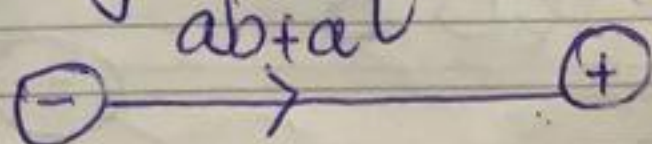- At the end, we will have one start and, one end, & one arrow.
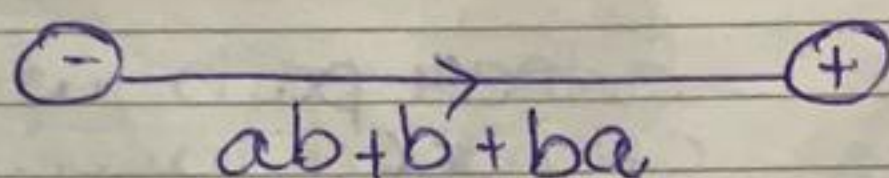
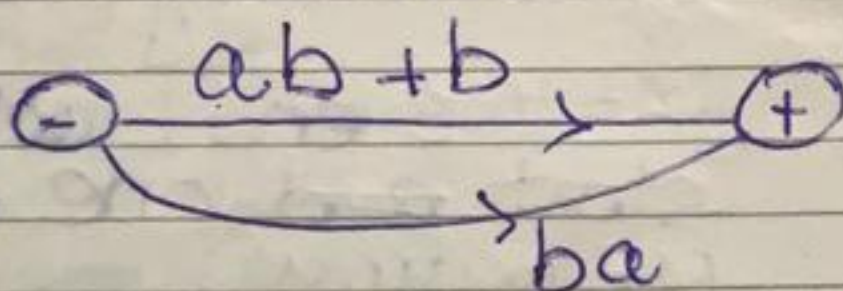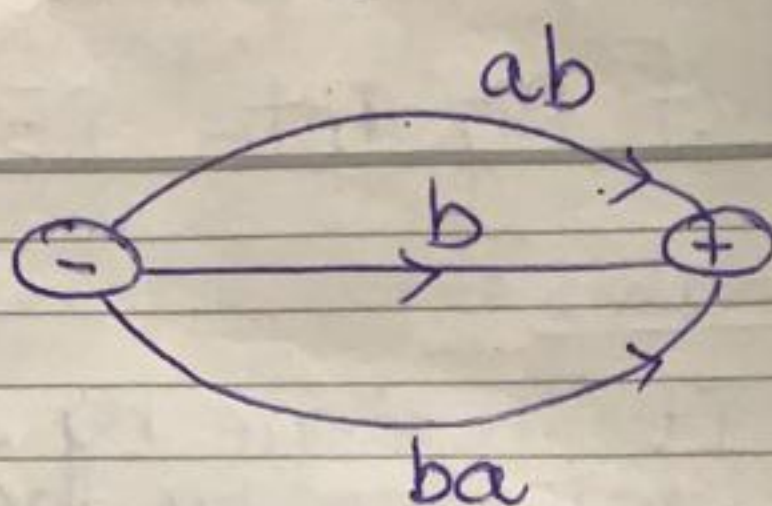- Either path will be multiplied or added, when one of the state is vanished.
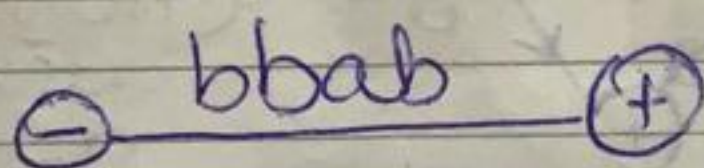

NFA (non-deterministic automata)

ab ——— multiplied

a

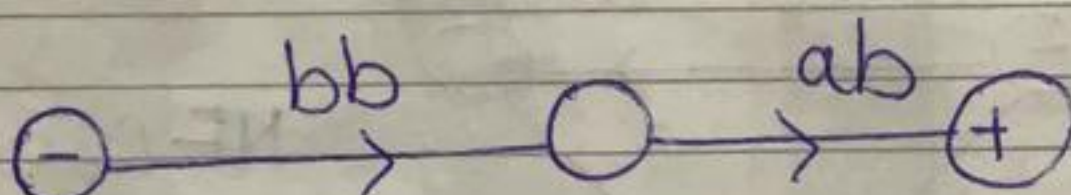③ Now one arrow should be there, so we will remove any one of them.

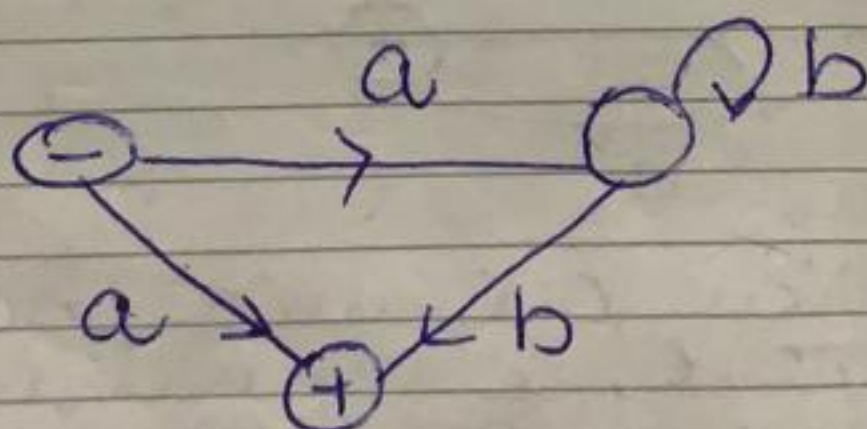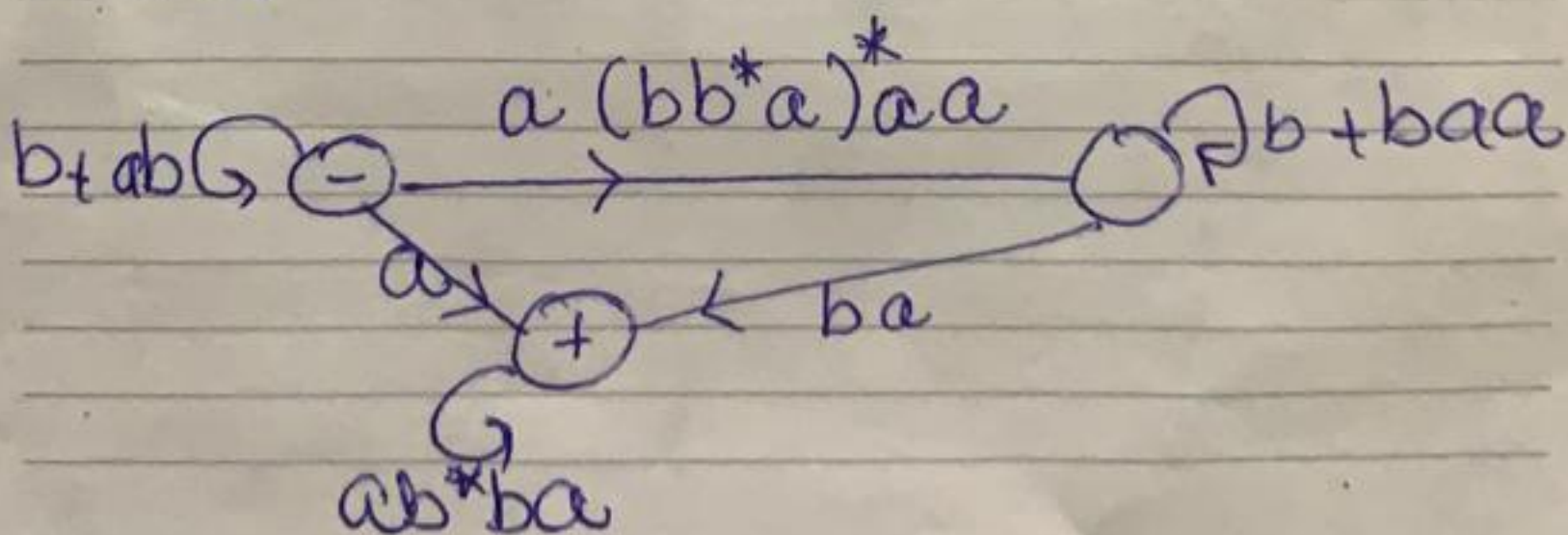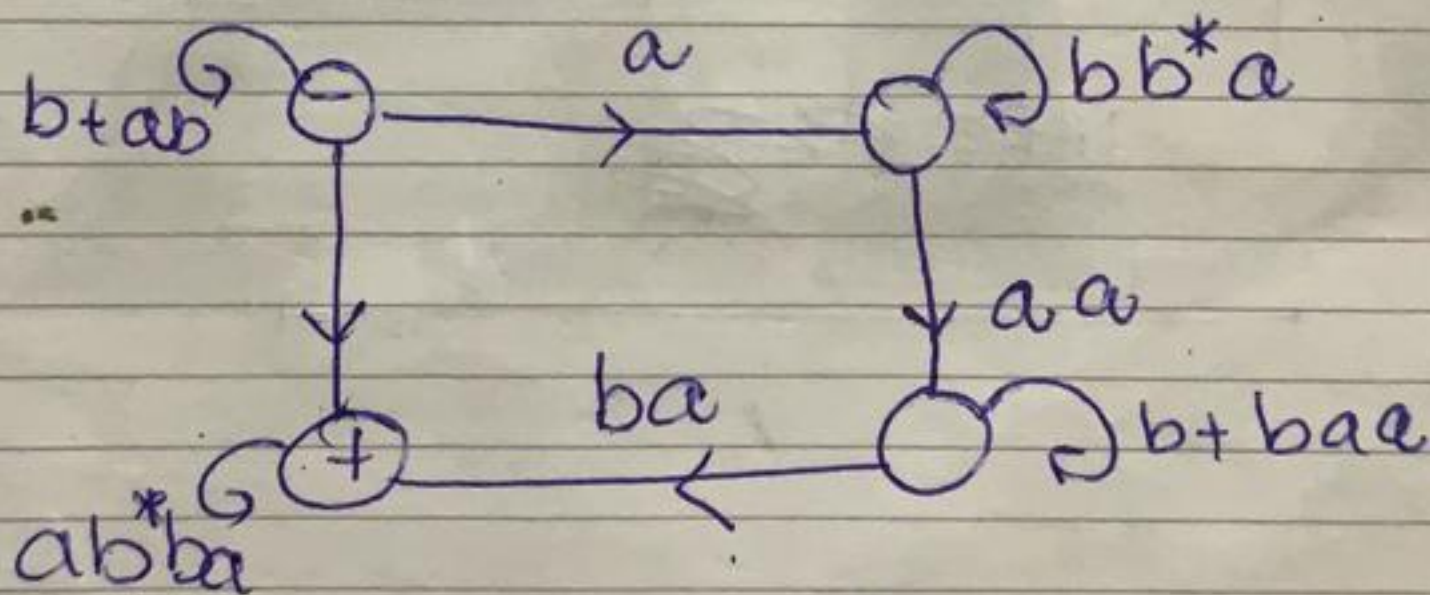ab+a

(a)

⇒

ab
b
ba

ab + b
ba

ab + b + ba

⇒

bb   ab
bbab

→

a   b
a   b

ab*b
a

Diagram 1:

b (self-loop)

ab → (−) —a→ ( ) ⟲ bb*a

a ↓   ↓ aa

(+) ←ba— ( ) ⟲ b

—a→

Diagram 2:

b (self-loop)

ab → (−) —a→ ( ) ⟲ bb*a

↓   ↓ aa

ab*ba (+) ←ba— ( ) ⟲ b, ⟲ baa

Diagram 3:

b+ab (self-loop)

(−) —a→ ( ) ⟲ bb*a

↓   ↓ aa

ab*ba (+) ←ba— ( ) ⟲ b+bae

Diagram 4:

b+ab → (−) —a(bb*a)*aa→ ( ) ⟲ b+baa

a ↓ ←ba

(+) ⟲ ab*ba

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

$$b+ab$$

state transitions with labels a, ab^*ba

$$b+ab$$
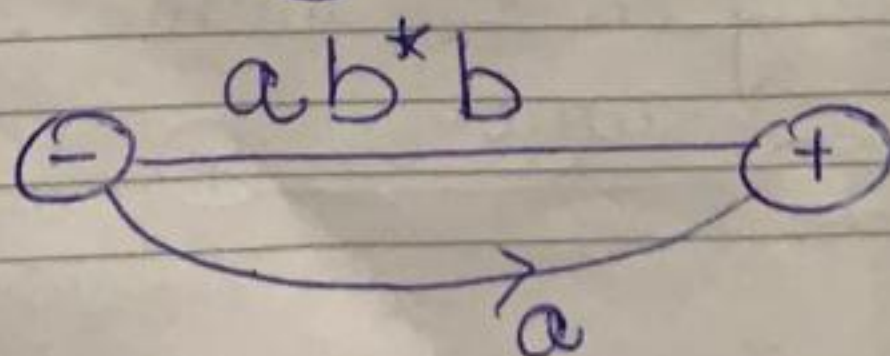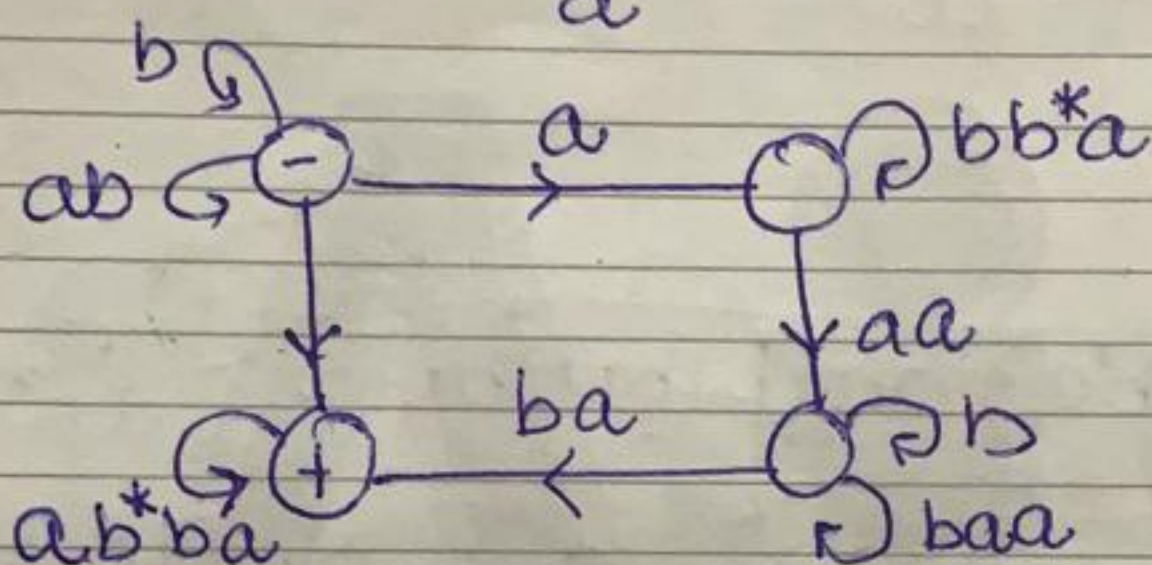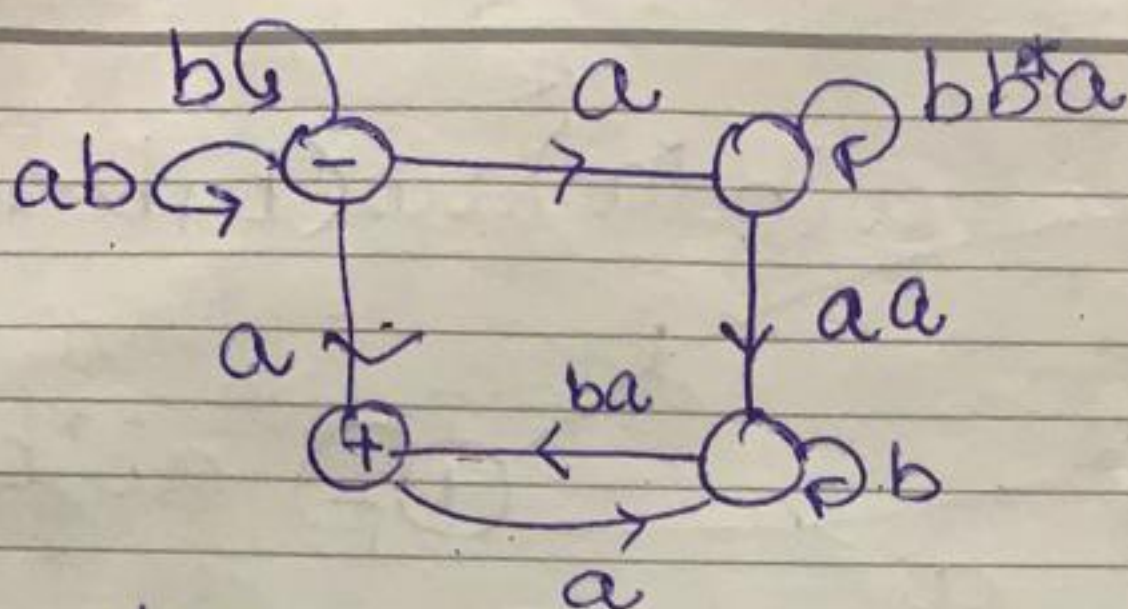
$$a(bb^*a)^*aa(b+baa)^*ba+a \quad ab^*ba$$
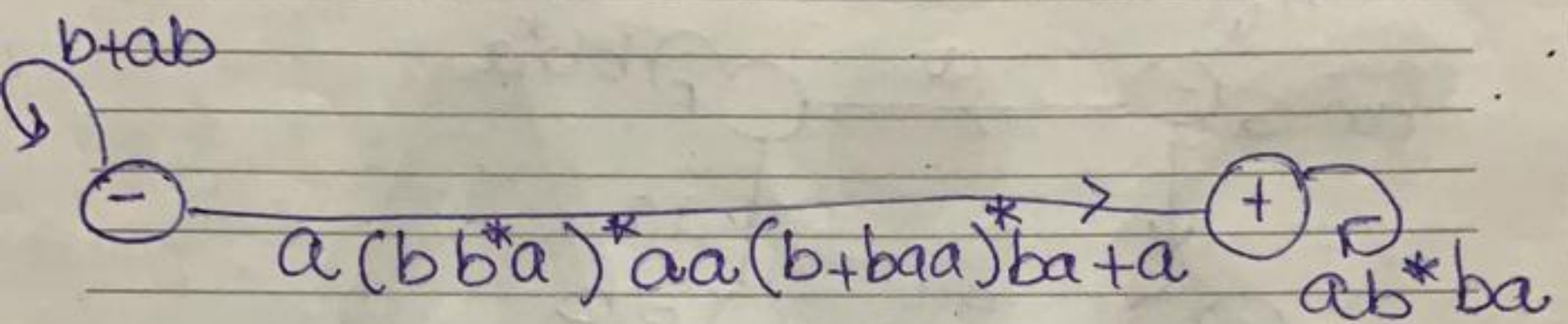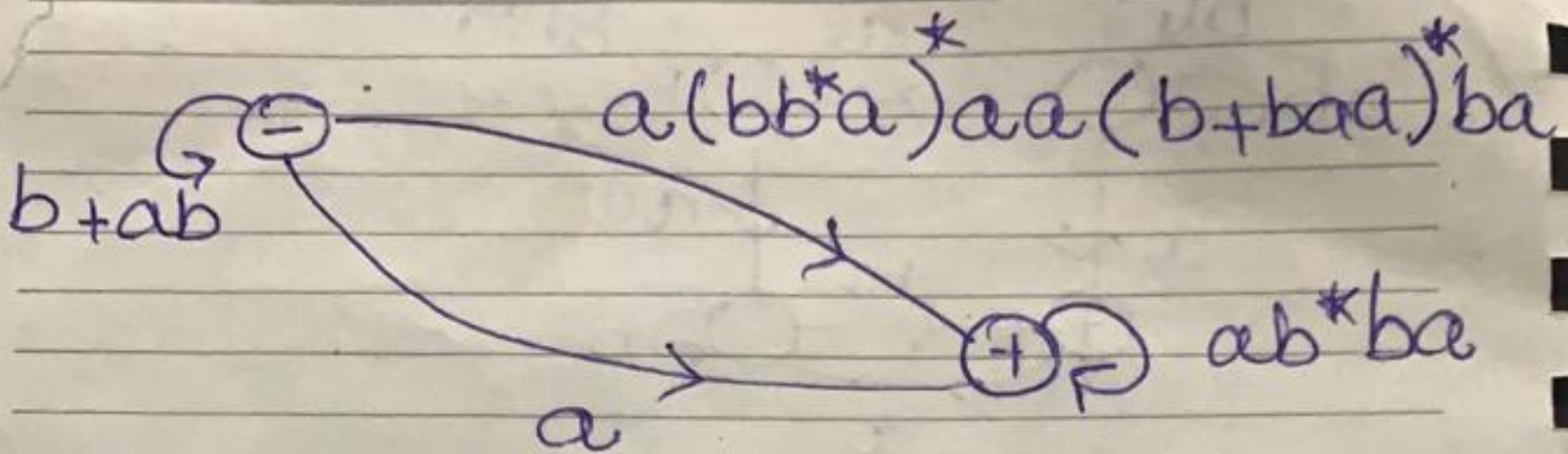
$$(b+ab)^* \left[a+a(bb^*a)^*aa(b+baa)^*ba \right](ab^*ba)^*$$

~~Min string~~
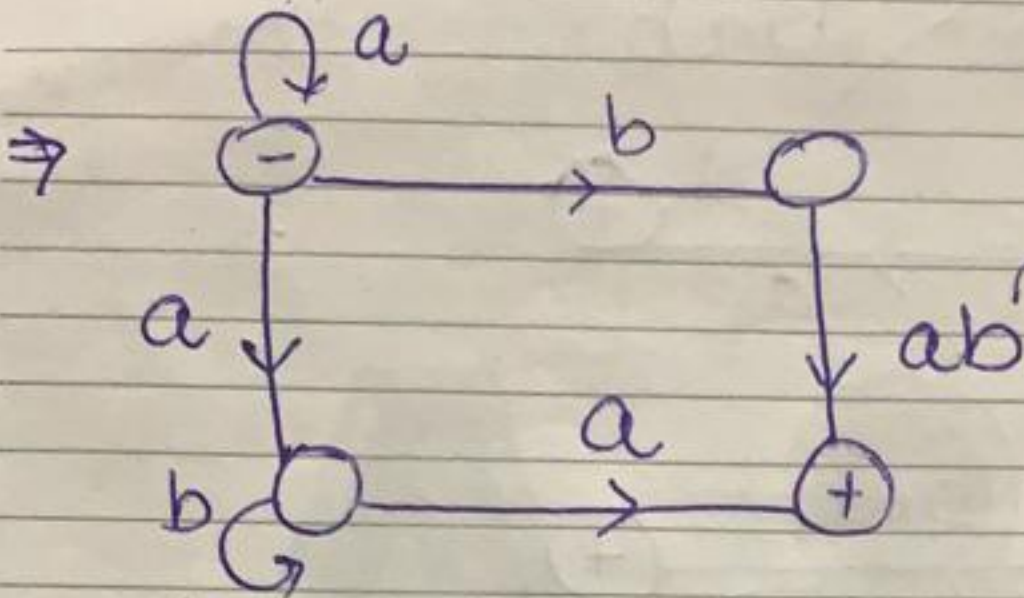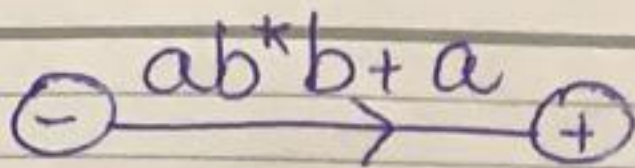
$\xrightarrow{ab^*b + a}$

$(-) \xrightarrow{ab^*b+a} (+)$

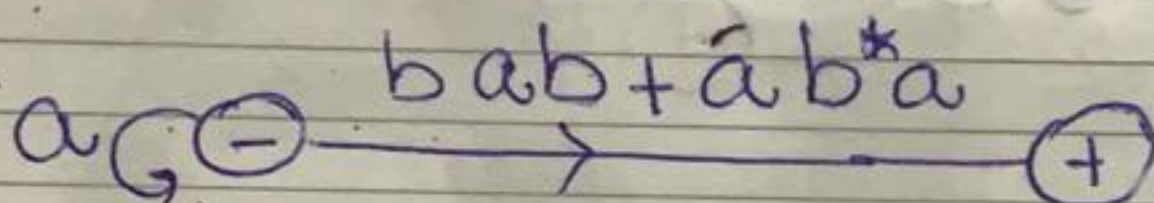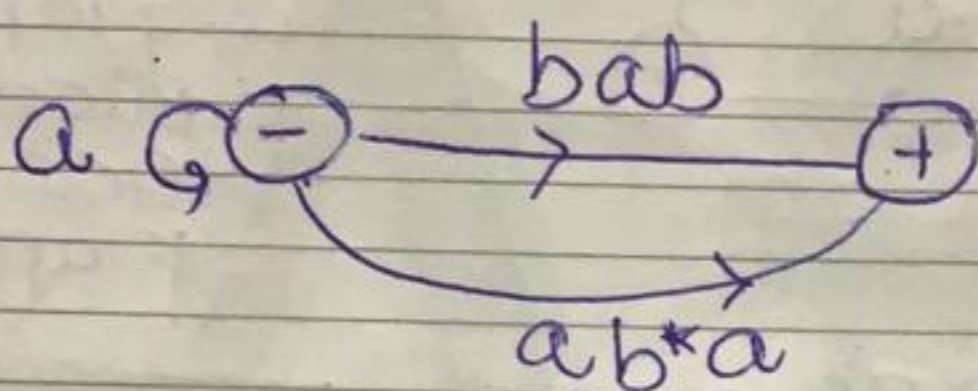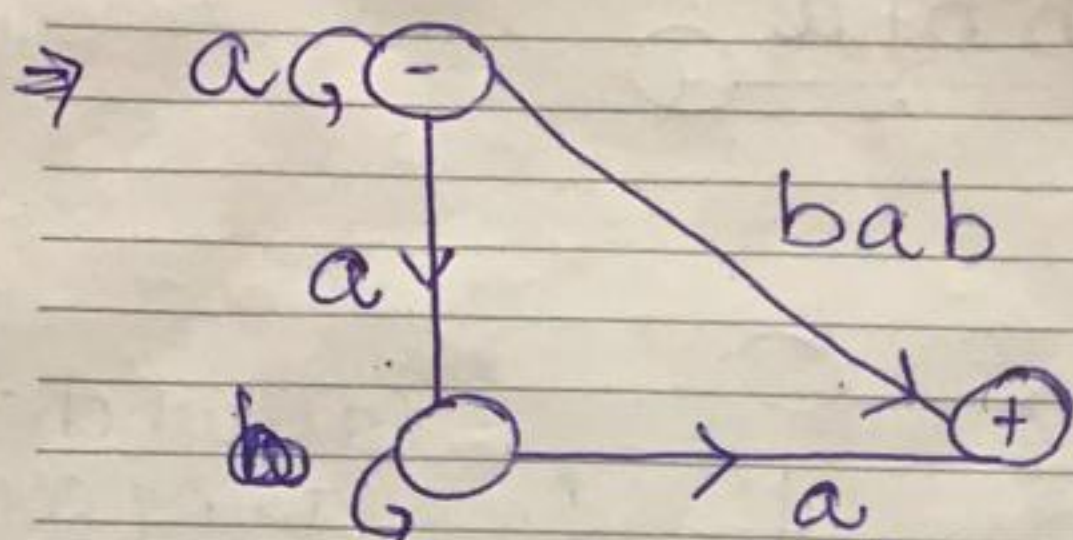$\to$ (as whole
string comes,
so such
a graph is
called a
transition
graph)

(ab label on the vertical edge)

$a^* b\,ab$

bab

$ab^* a$

$(-) \xrightarrow{a^*(bab + ab^*a)} (+)$

⇒

$a \ominus \xrightarrow{bab} \oplus$

$\xrightarrow{ab^*a}$
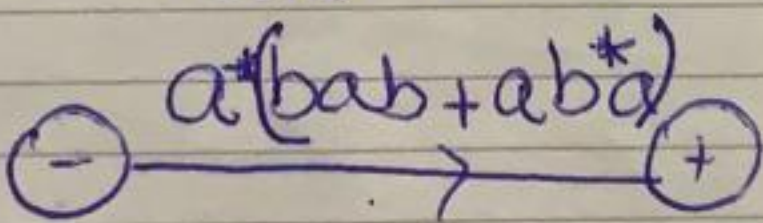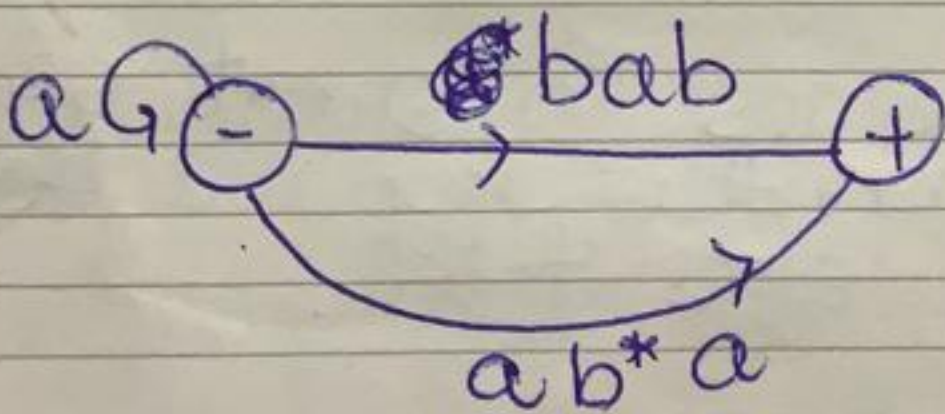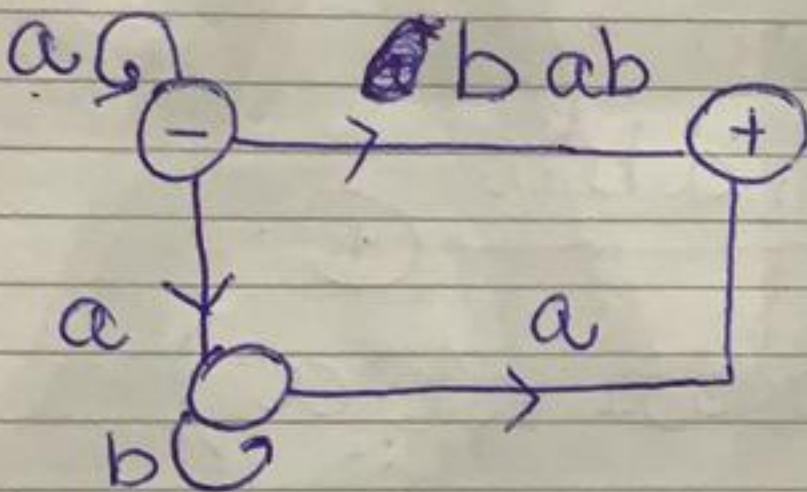
$a \ominus \xrightarrow{bab + ab^*a} \oplus$
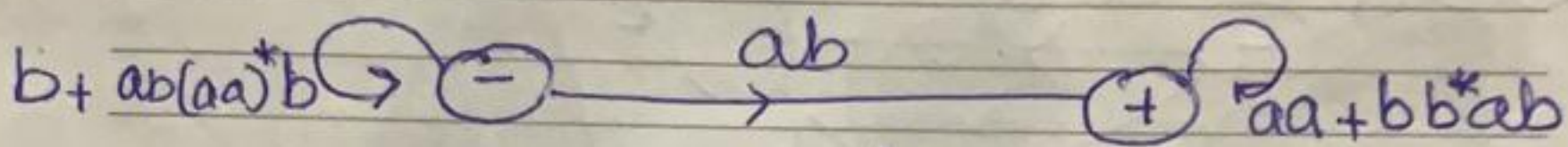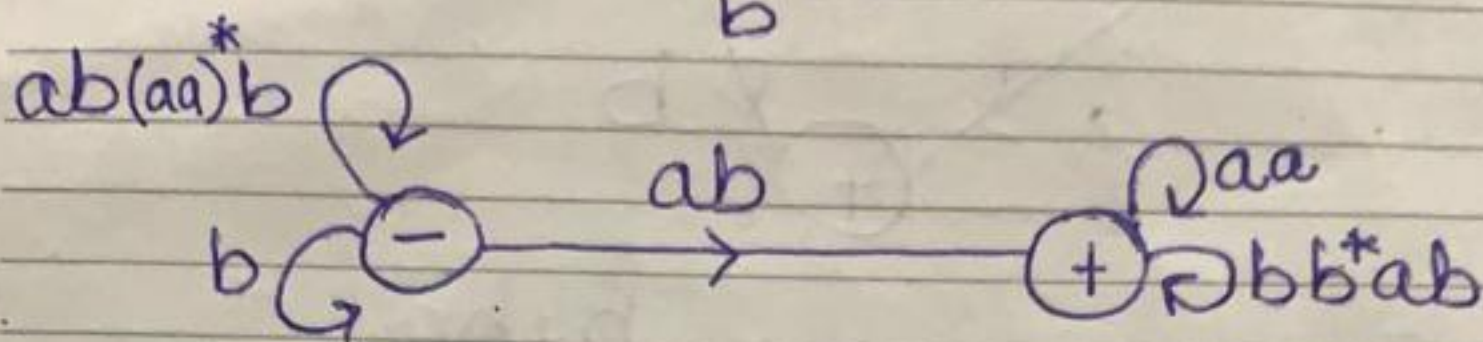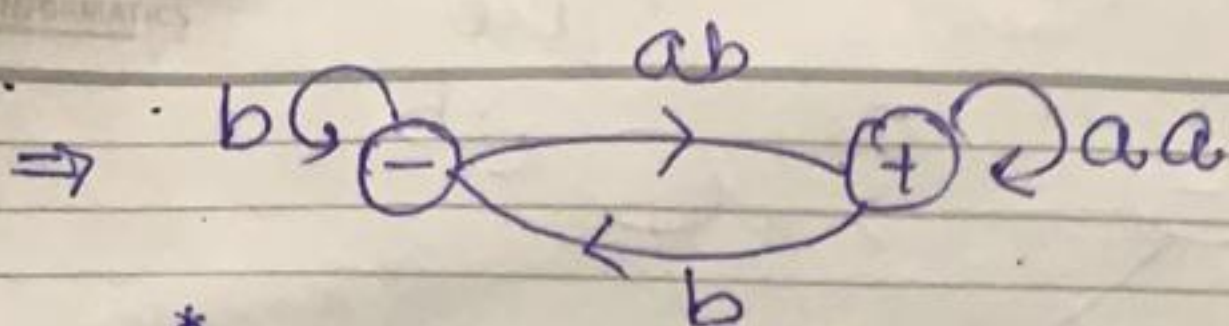
$R.E = a^*(bab + ab^*a)$

Rule:

so if loop comes in start, or at end, then that loop will be remain there as it is.

$ab(aa)^*b$

$b + ab(aa)^*b$
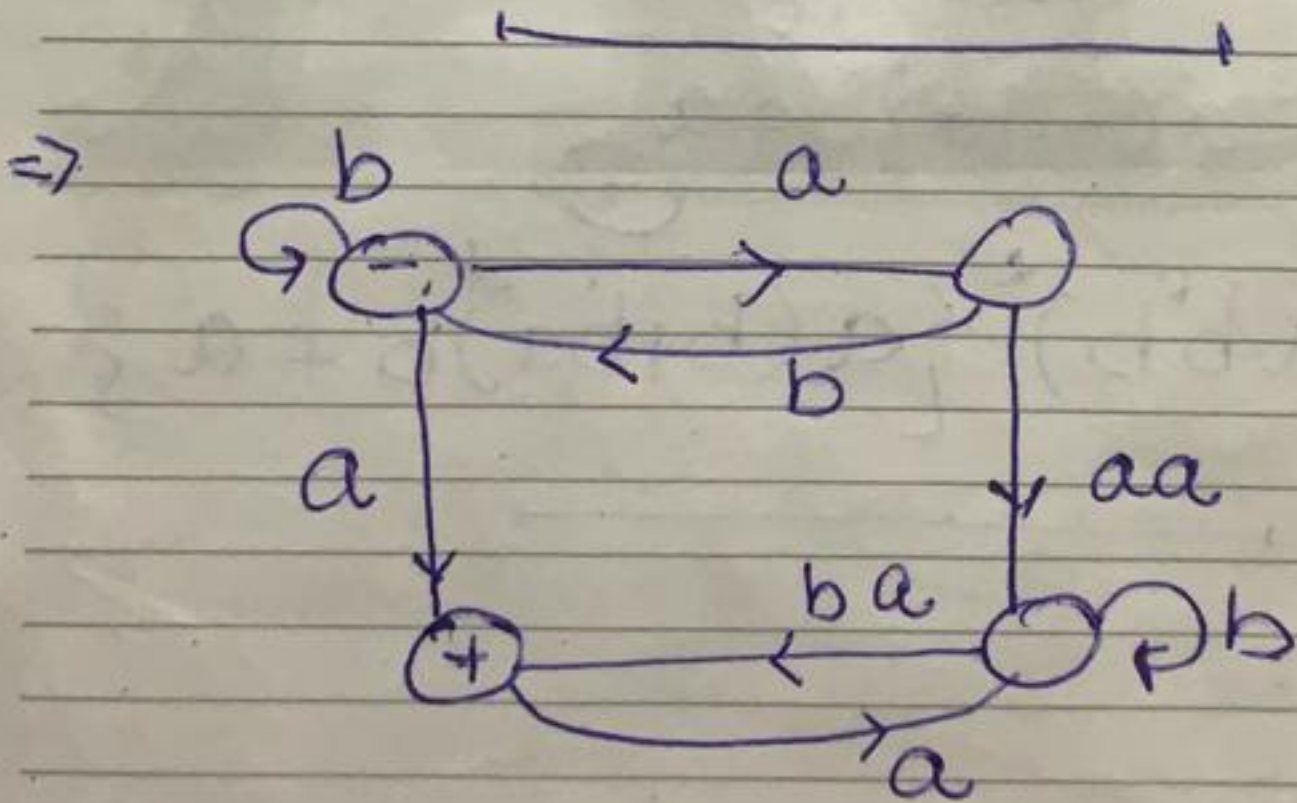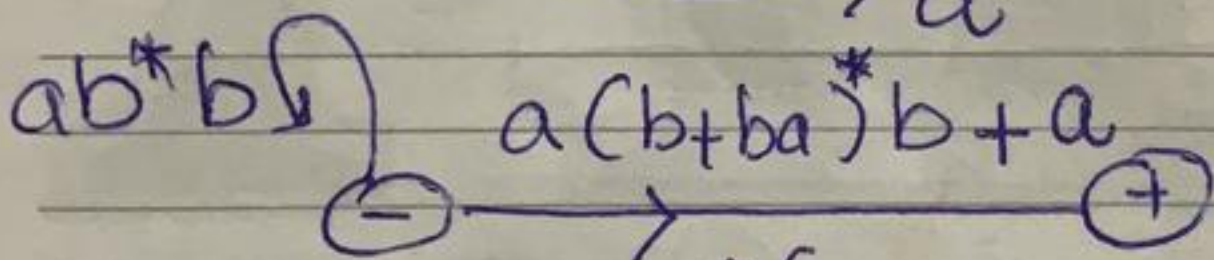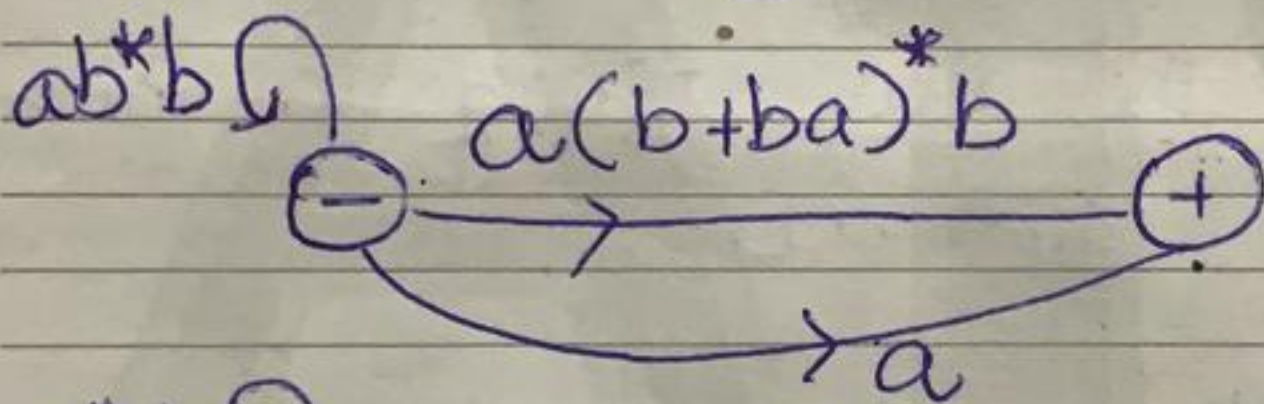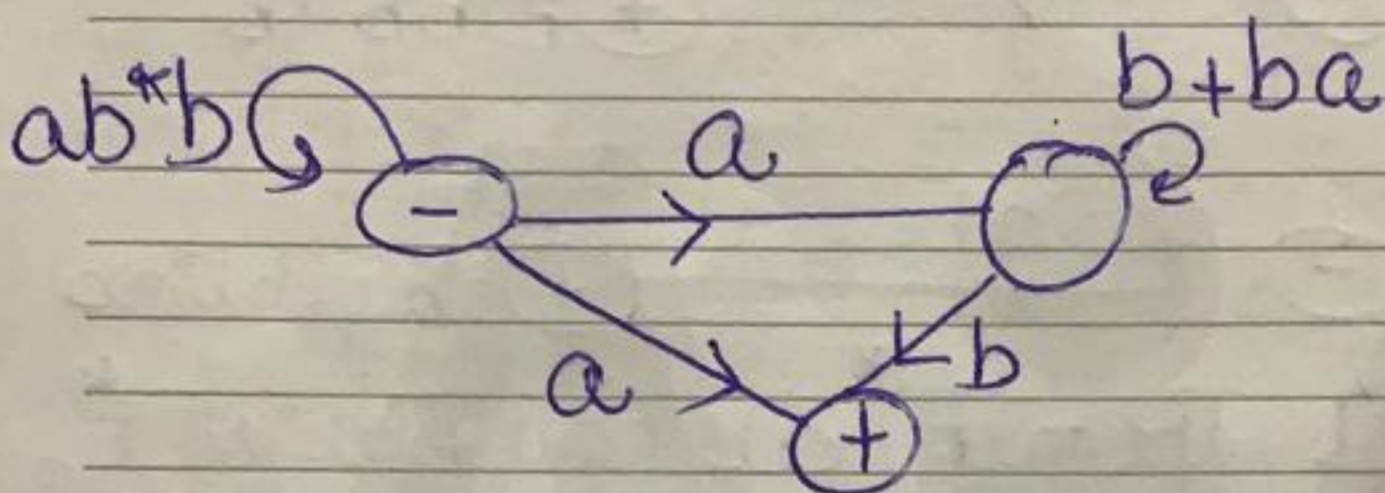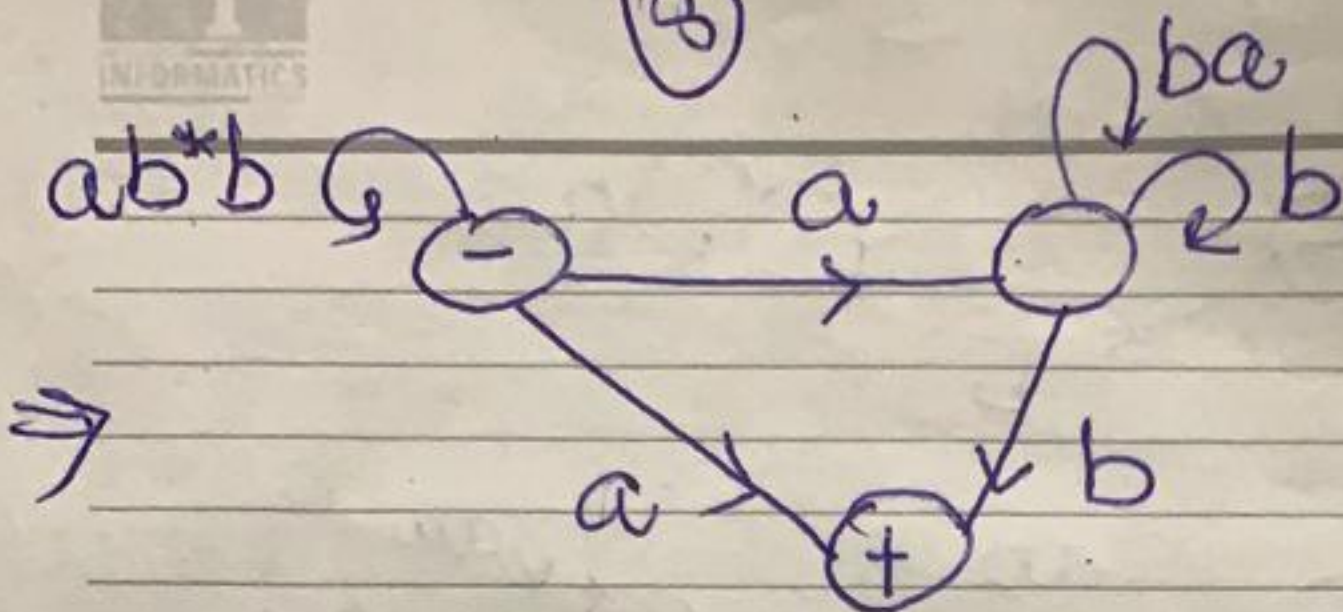

$$RE = (b + ab(aa)^*b)^* \, ab \, (aa + bb^*ab)^*$$
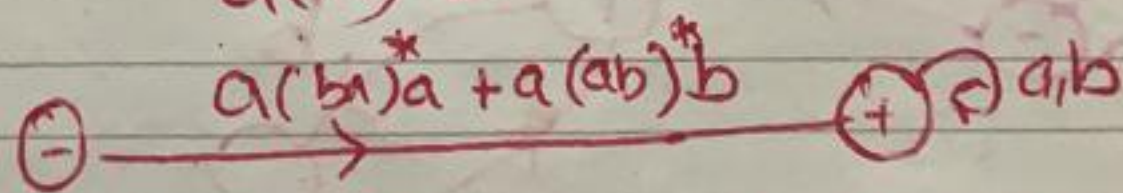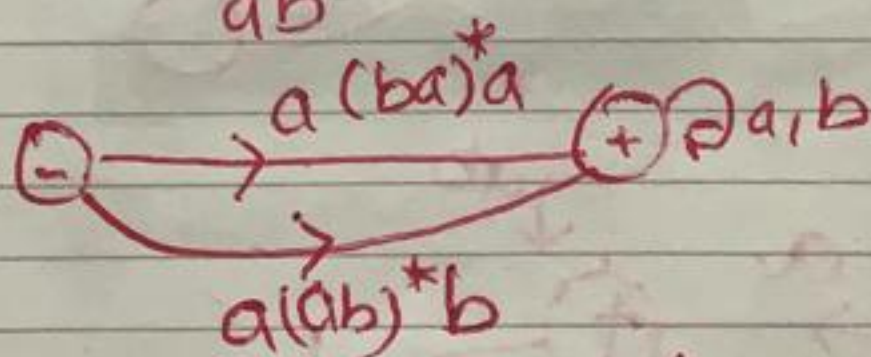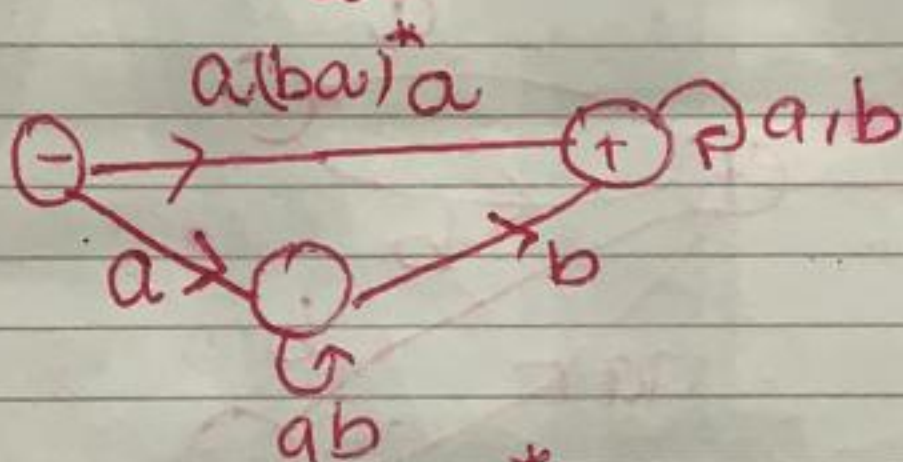
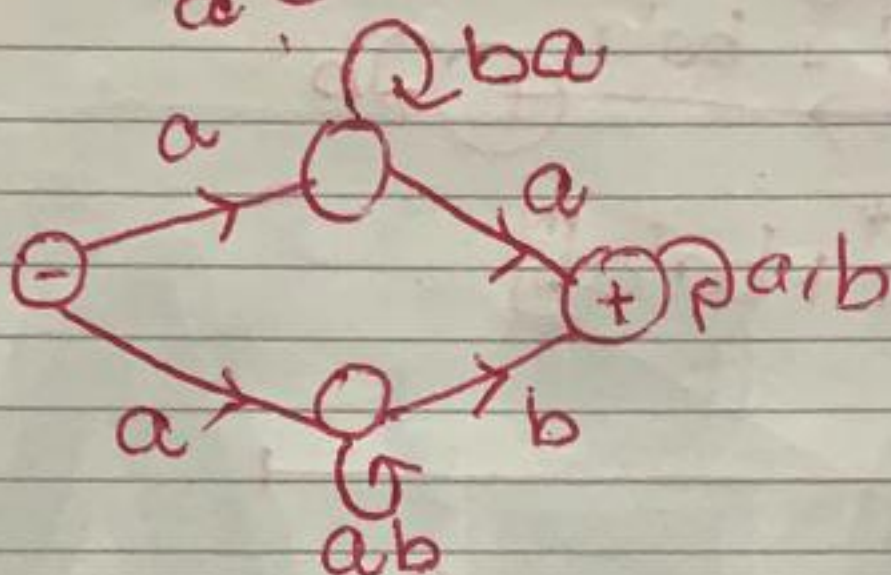- what is the min string in this dig

$$Min = ab$$

⑧

ab^*b

ba

b

a

a

b

ab^*b

$b+ba$

a

a

b

ab^*b

$a(b+ba)^*b$

a

ab^*b

$a(b+ba)^*b+a$

$$RE = (ab^*b)^* \{ a(b+ba)^*b + a \}$$

$$a(ba)^*a$$

$$a(ab)^*b$$

$$a(ba)^*a + a(ab)^*b$$

$$[a(ba)^*a + a(ab)^*b](a+b)^*$$

10
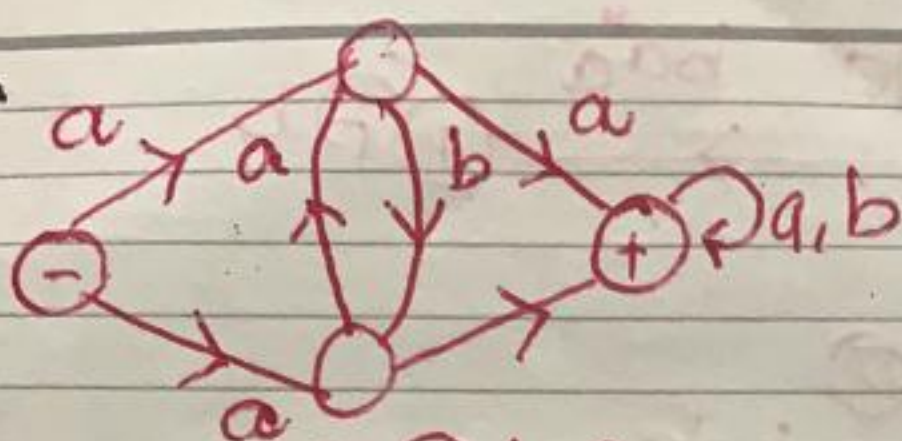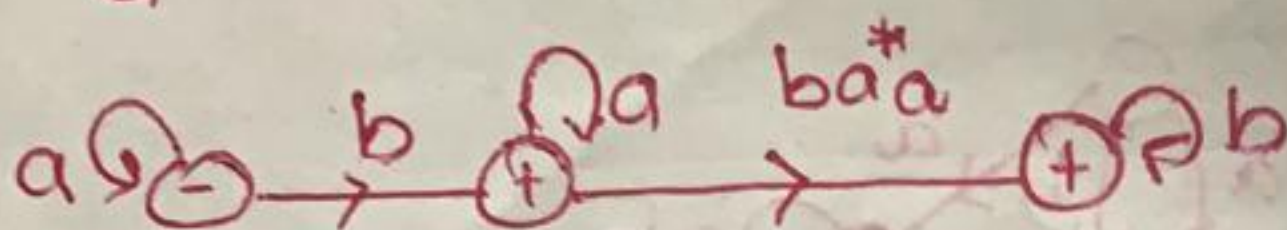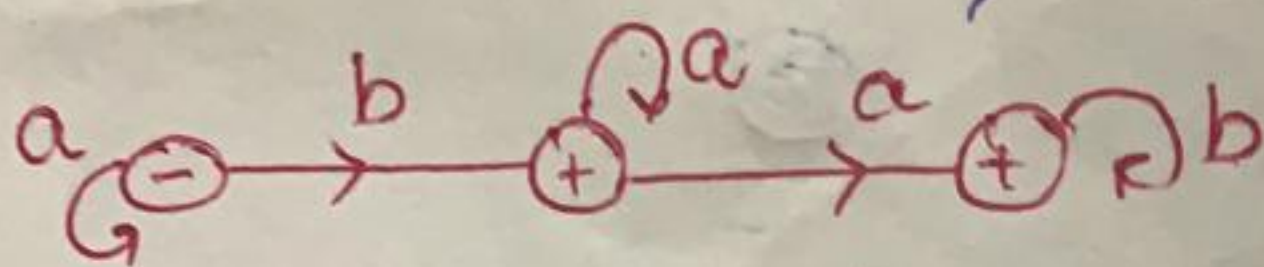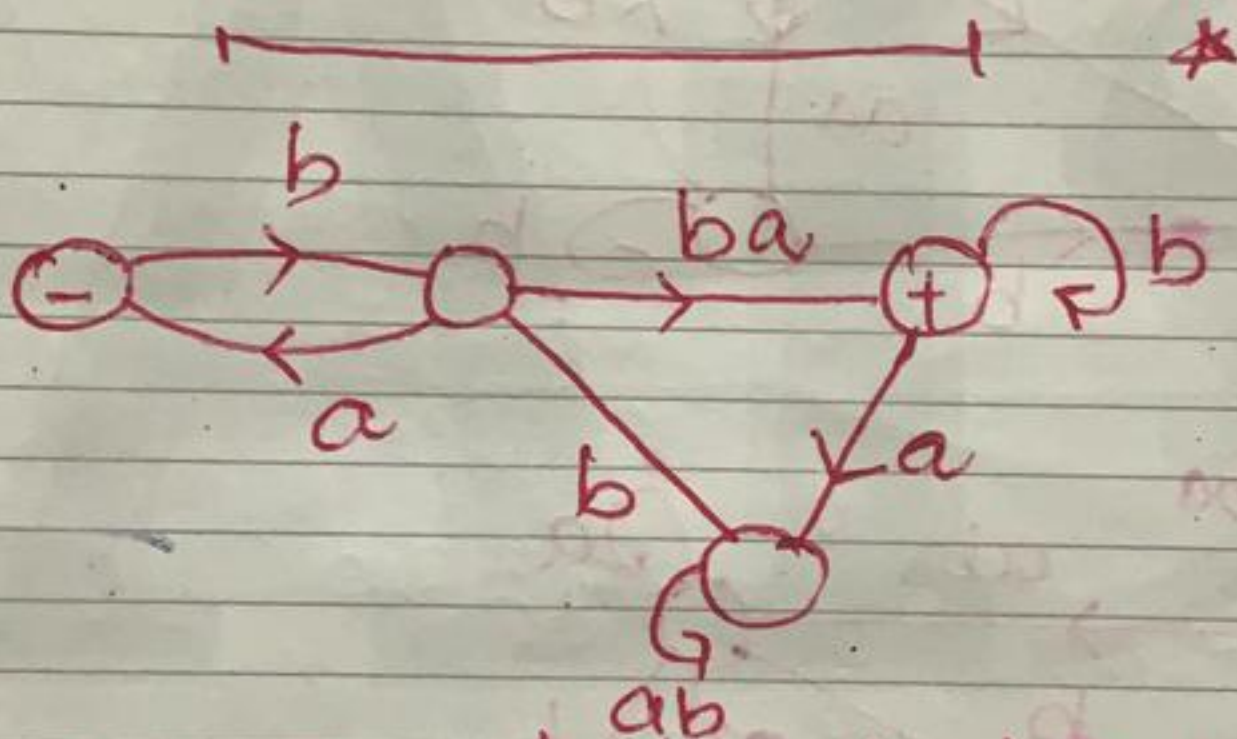
$$RE = a^*[ba^* + ba^*ab^*]$$

$$RE = b^*[a](ab+baa)^*$$

when every dead end state is there,
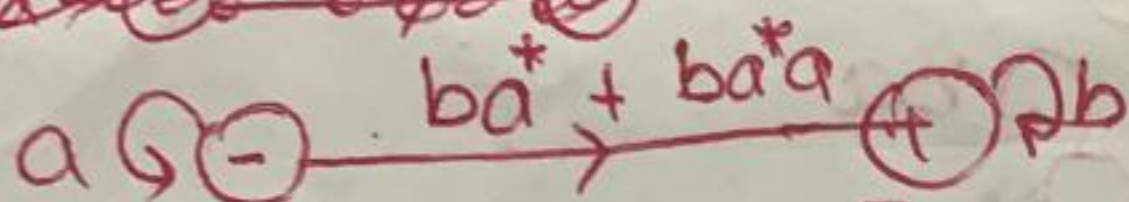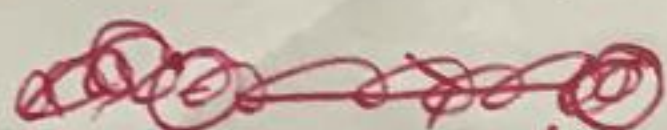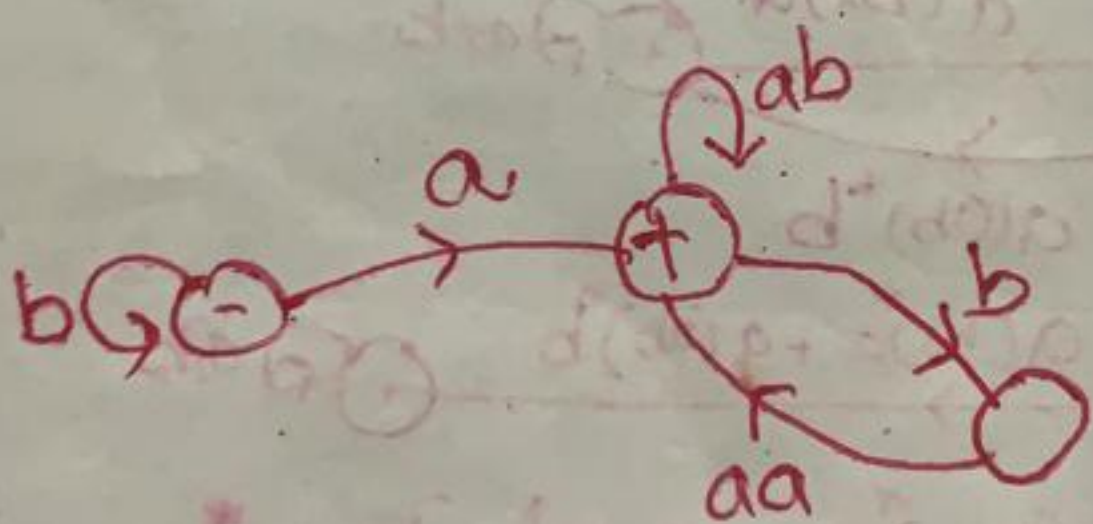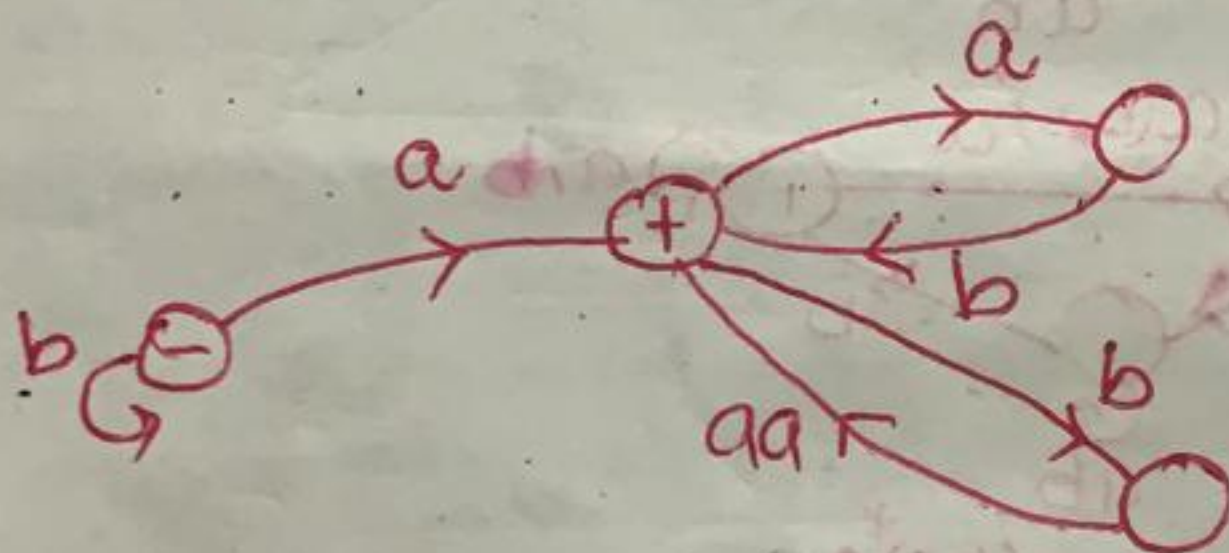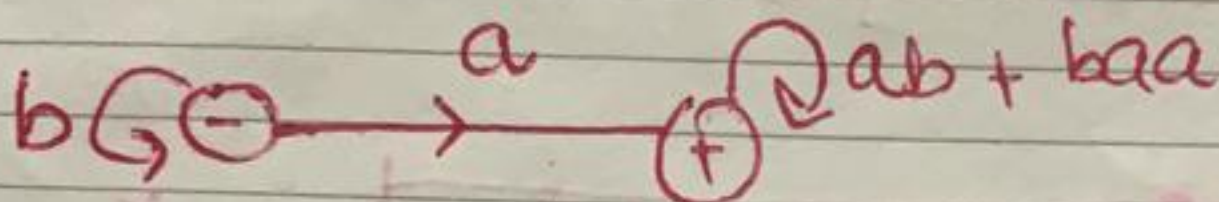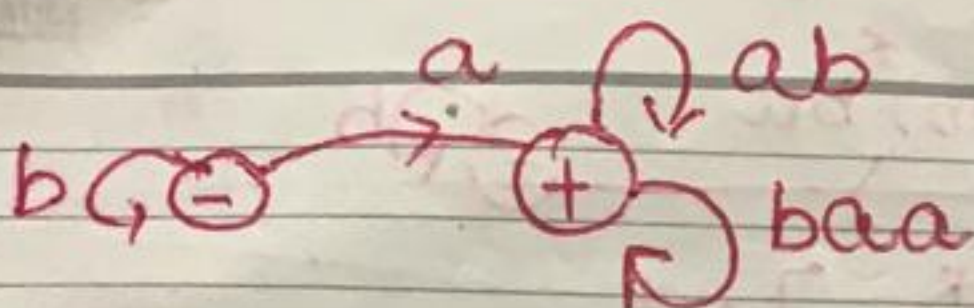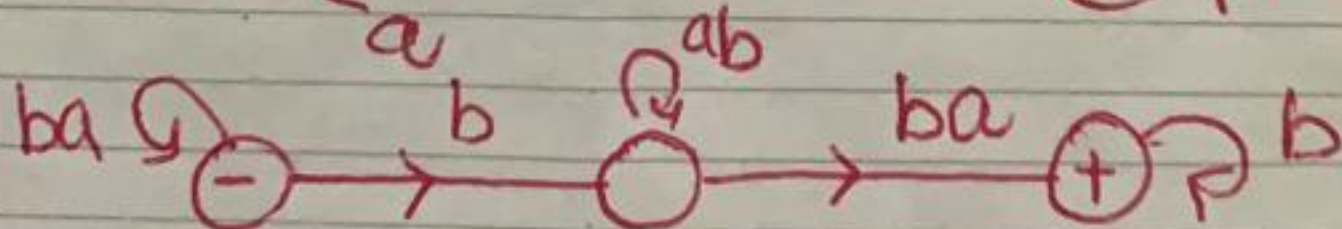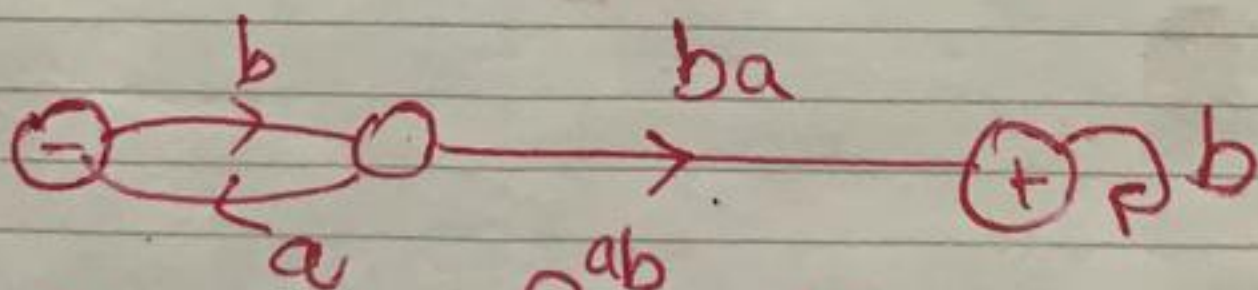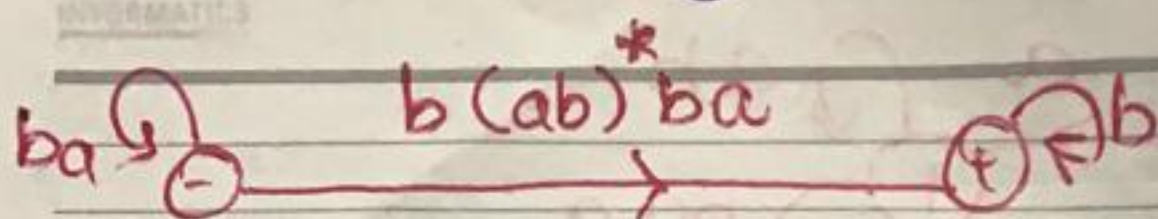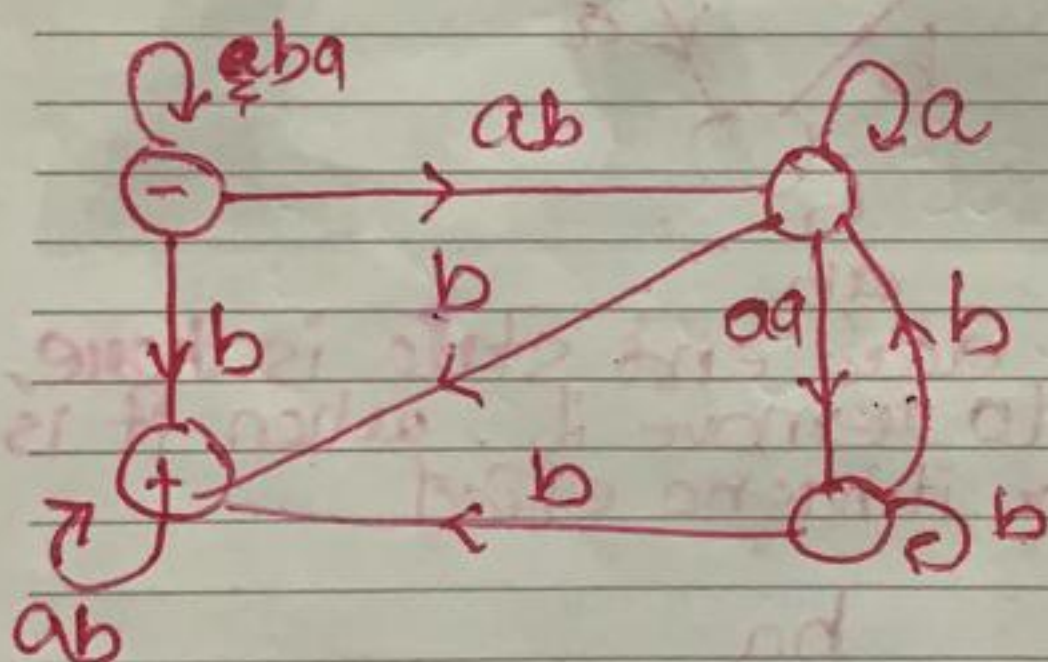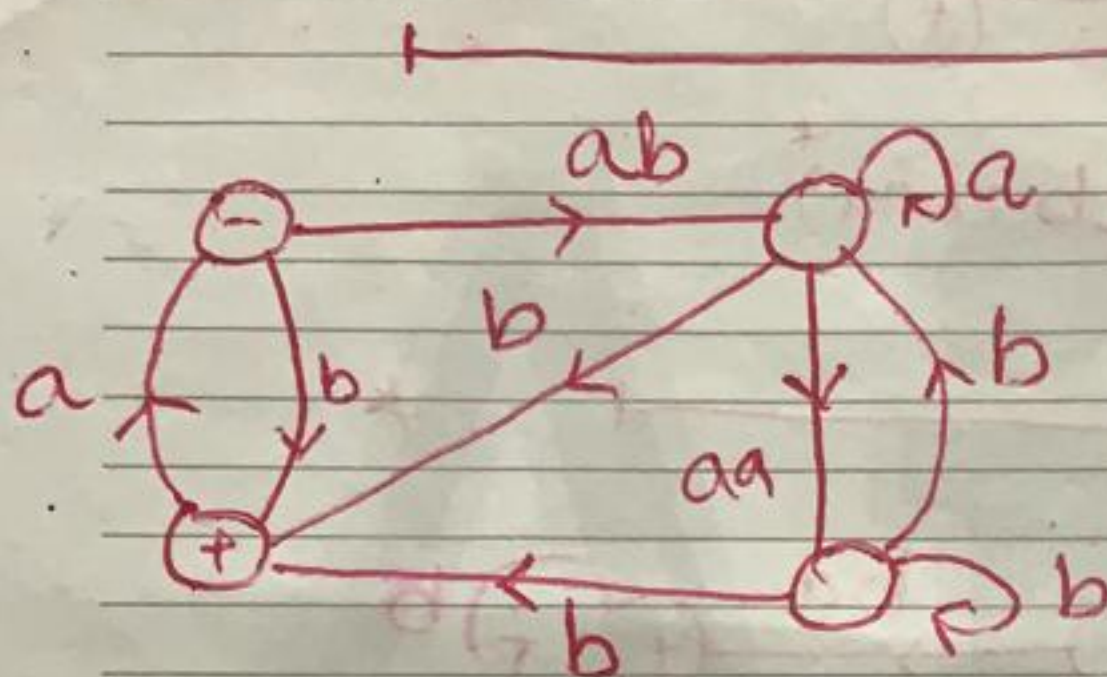u first hv to remove it. when it is
removed, then it has no effect.

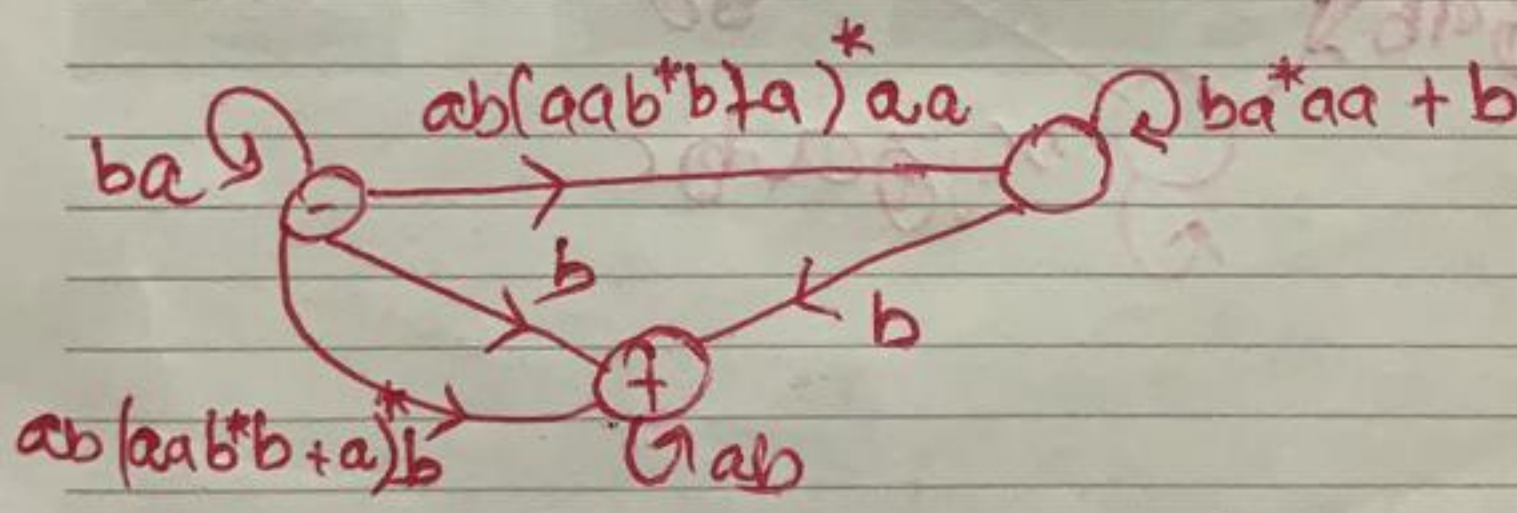$ba \circlearrowleft$ $(-)$ $\xrightarrow{\quad b(ab)^* ba \quad}$ $(f) \circlearrowleft b$

$RE_2 (ba)^* \left[b(ab)^* ba \right] b^*$

State diagram with self-loop ba on start state, transition ab to state with self-loops aab^*b and a, transition aa down to state with self-loops b and ba^*aa, transition b back, transition b down from start, self-loop ab on accept state (+).

Second diagram: start state with self-loop ba, transition ab to state with self-loops aab^*b and a, transition aa to state with self-loops b and ba^*aa, transition b back to accept state (+), with $ab(aabb+a)^*b$ and self-loop ab.

Third diagram: start state with self-loop ba, transition $ab(aab^*b+a)^*aa$ to state with self-loop ba^*aa+b, transitions b and b to accept state (+) with self-loop ab, and $ab(aab^*b+a)^*b$.

ba

$ab[aab^*b+a]^* aa[ba^*aa+b]^* b$

$ab(aab^*b+a)^* b+b$

$(ba)^*[ab[aab^*b+a]^* aa[ba^*aa+b]^* b]+[ab$

$(aab^*b+a)^* b+b](ab)^*$