Student Information

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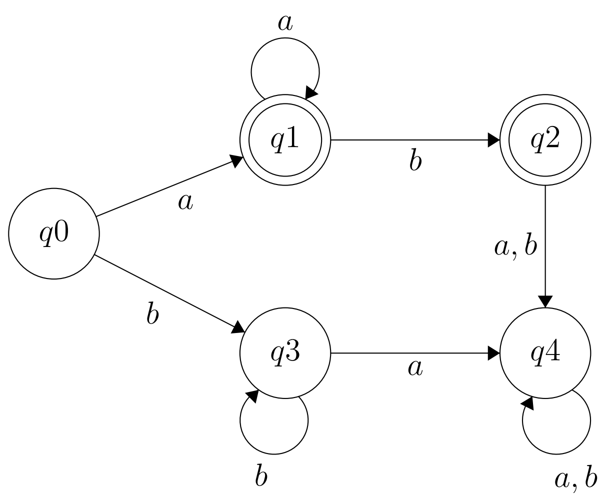
Answer 1

a.

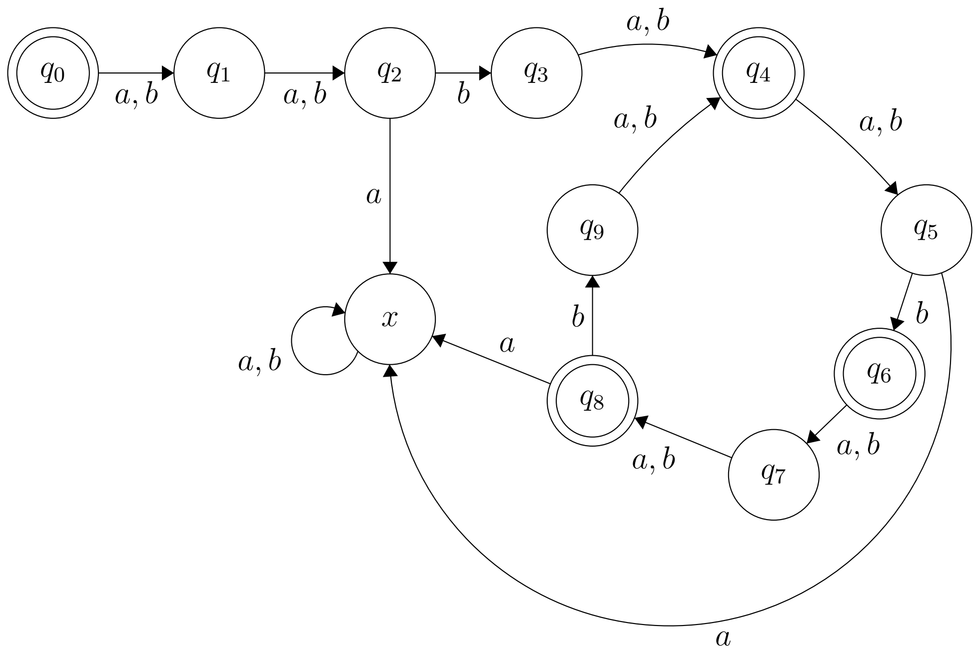
b.

Answer 2

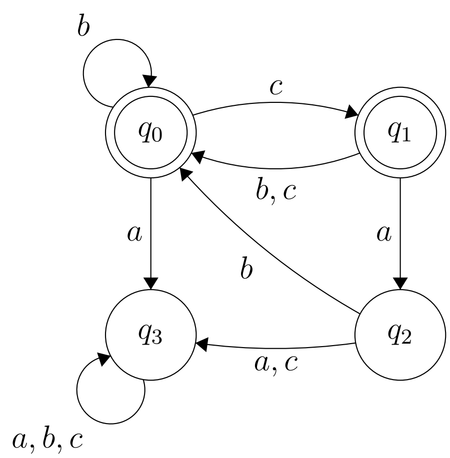
a.



b.



c.



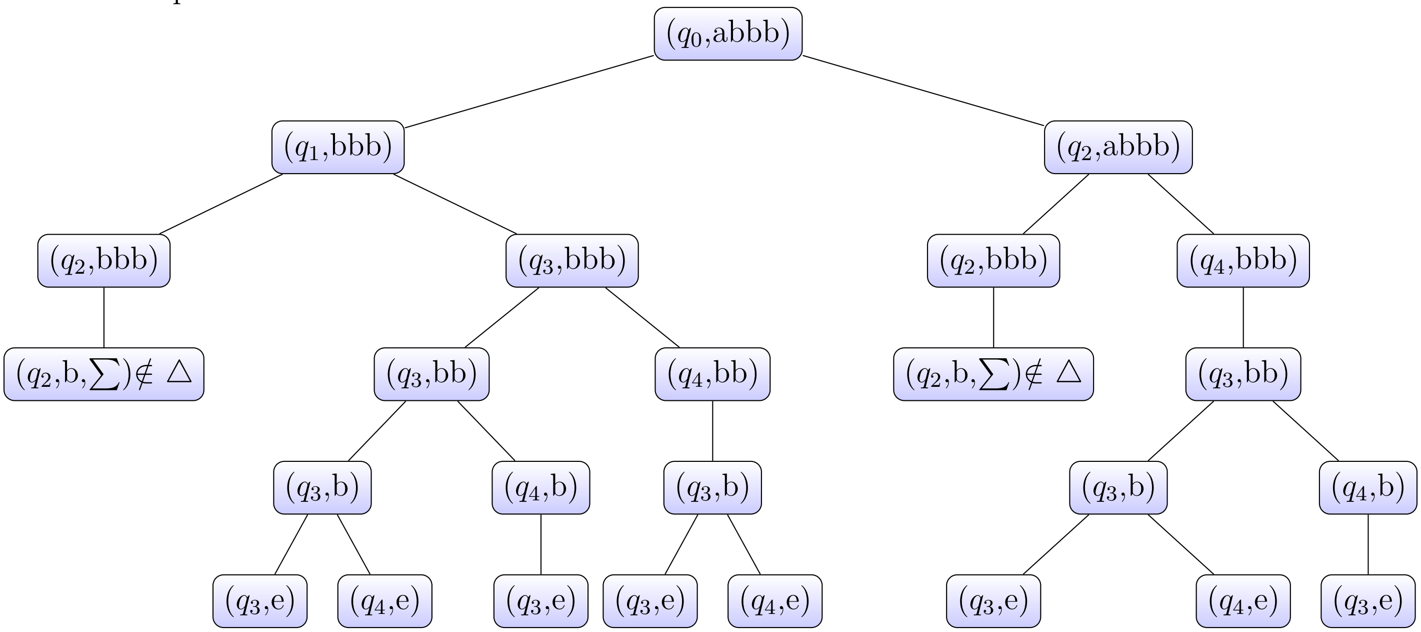
Answer 3

a.

By utilizing
E(q_0)=q_0,q_2
E(q_1)=q_1,q_2,q_3
E(q_2)=q_2
E(q_3)=q_3
E(q_4)=q_4

E(q_5)=q_1,q_5

Here are all possibilities:



So, as seen from above tree, when the machine finishes reading there is no q_5 as last state. Hence, w_1 is not in *L(N)*

b.

(q_0,ababa)$\vdash_M$(q_1,baba)
(q_1,baba)$\vdash_M$(q_3,baba)
(q_3,baba)$\vdash_M$(q_4,aba)
(q_4,aba)$\vdash_M$(q_5,ba)
(q_5,ba)$\vdash_M$(q_1,ba)
(q_1,ba)$\vdash_M$(q_3,ba)
(q_3,ba)$\vdash_M$(q_3,a)
(q_3,a)$\vdash_M$(q_5,e)
Since $q_5 \in F$, w_2 is in *L(N)*

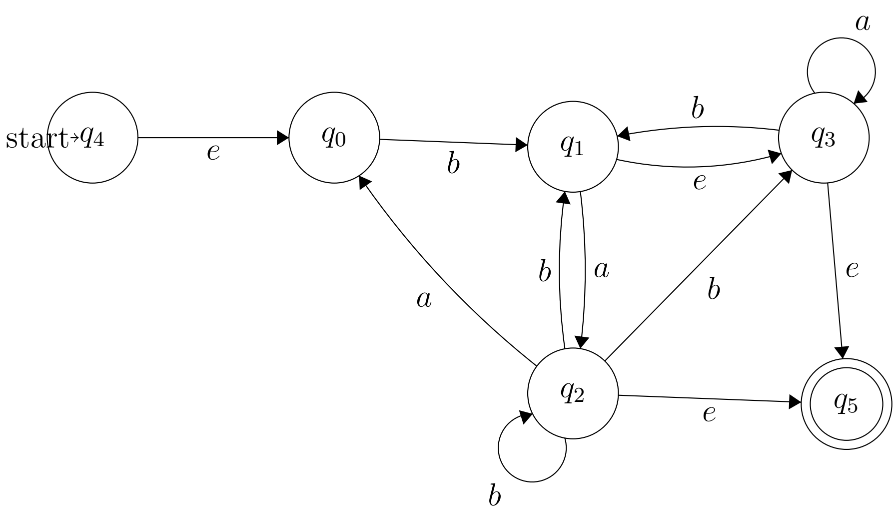
Answer 4

a.

Let's call GFA as G.
G=(K',$\sum$,$\triangle$',q_4,F')
in which K'=$q_0, q_1, q_2, q_3, q_4, q_5$
$\sum$=a, b
F'=q_5

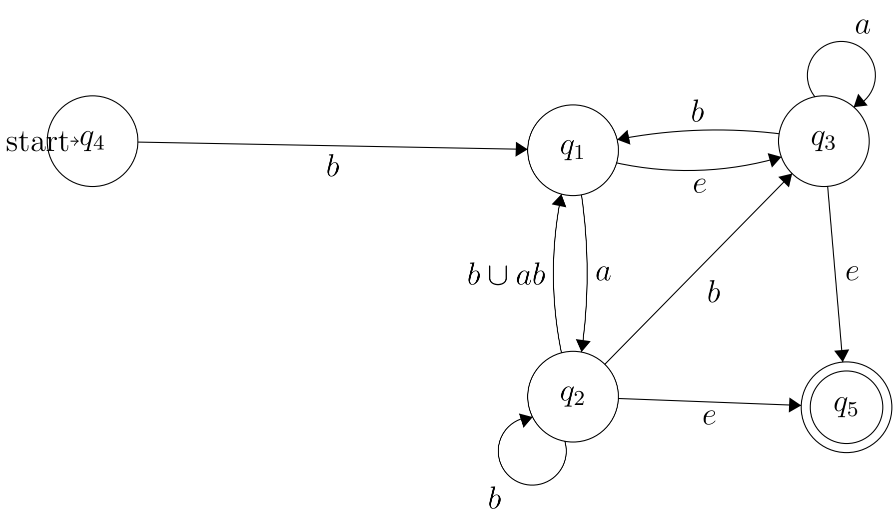
$\triangle' =$
(q_0, b, q_1),
$(q_1, a, q_2), (q_1, e, q_3)$,
$(q_2, a, q_0), (q_2, b, q_1), (q_2, b, q_2), (q_2, b, q_3), (q_2, e, q_5)$,
$(q_3, b, q_1), (q_3, a, q_3), (q_3, e, q_5)$,
(q_4, e, q_0)

And here is the diagram:



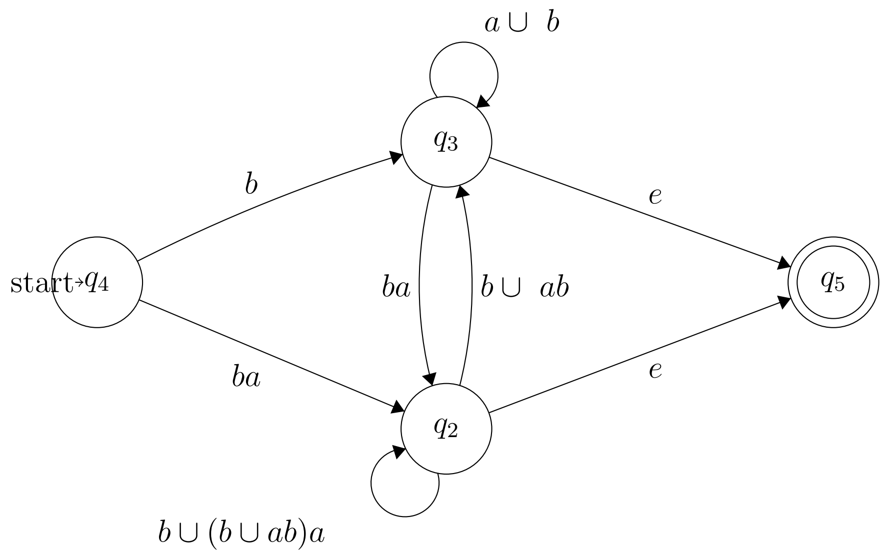
b.

Eliminating state q_0:

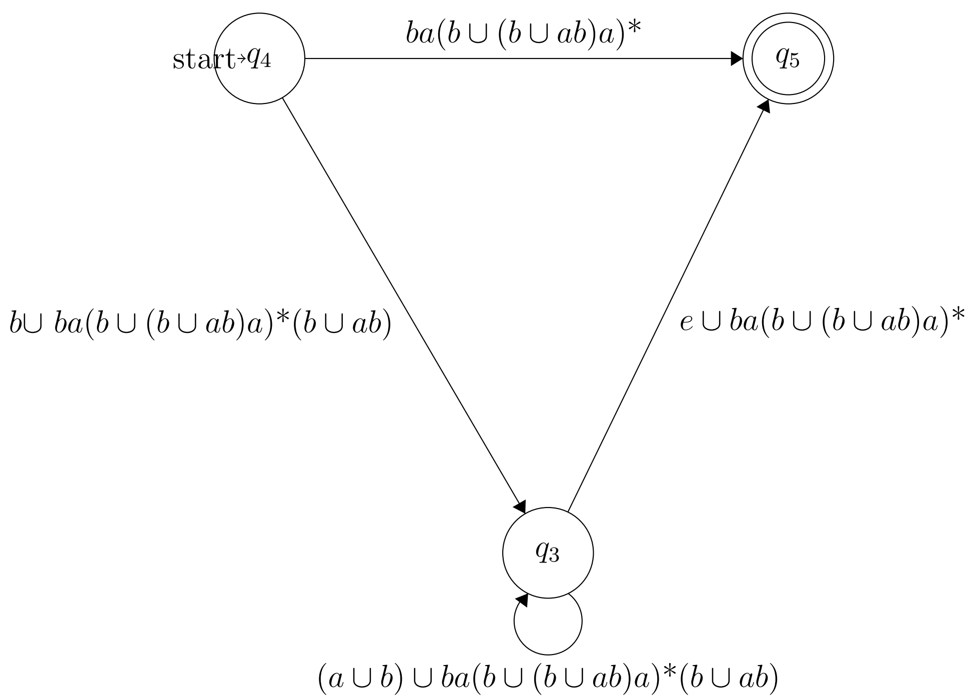


Eliminating state q_1:
R(2,3,1) = R(2,3,0)∪R(2,1,0)R(1,1,0)*R(1,3,0) = b∪(b∪ab) = b∪ab
R(2,2,1) = R(2,2,0)∪R(2,1,0)R(1,1,0)*R(1,2,0) = b*∪(b∪ab)a

R(3,3,1) = R(3,3,0) ∪ R(3,1,0)R(1,1,0)*R(1,3,0) = a*∪b
R(3,2,1) = R(3,2,0) ∪ R(3,1,0)R(1,1,0)*R(1,2,0) = ba
R(4,2,1) = R(4,2,0) ∪ R(4,1,0)R(1,1,0)*R(1,2,0) = ba
R(4,3,1) = R(4,3,0) ∪ R(4,1,0)R(1,1,0)*R(1,3,0) = b

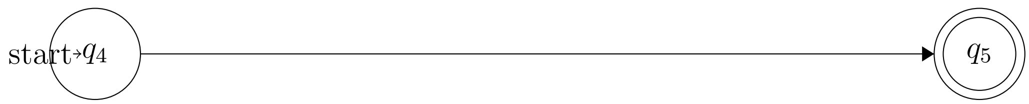


Eliminating state q_2:
R(4,3,2) = R(4,3,1)∪R(4,2,1)R(2,2,1)*R(2,3,1) = b∪ba(b∪(b∪ab)a)*(b∪ab)
R(4,5,2) = R(4,5,1) ∪ R(4,2,1)R(2,2,1)*R(2,5,1) = ba(b∪(b∪ab)a)*
R(3,3,2) = R(3,3,1)∪R(3,2,1)R(2,2,1)*R(2,3,1) = (a∪b)∪ba(b∪(b∪ab)a)*(b∪ab)
R(3,5,2) = R(3,5,1)∪R(3,2,1)R(2,2,1)*R(2,5,1) = e∪ba(b∪(b∪ab)a)*



Eliminating state q_3:

$ba(b\cup(b\cup ab)a)^*\cup(b\cup ba(b\cup(b\cup ab)a)^*(b\cup ab))((a\cup b)\cup\ ba(b\cup(b\cup ab)a)^*(b\cup ab))^*(e\cup ba(b\cup(b\cup ab)a)^*)$

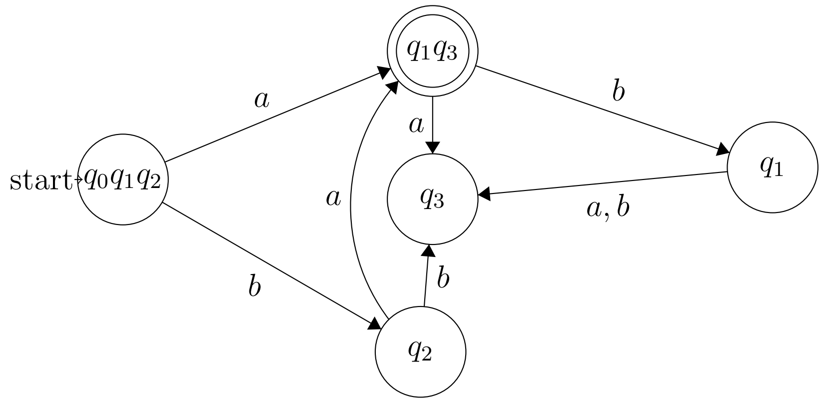


Hence;
G=$ba(b\cup(b\cup ab)a)^*\cup(b\cup ba(b\cup(b\cup ab)a)^*(b\cup ab))((a\cup b)\cup\ ba(b\cup(b\cup ab)a)^*(b\cup ab))^*(e\cup ba(b\cup(b\cup ab)a)^*)$ is a regular expression form of GFA.

Answer 5

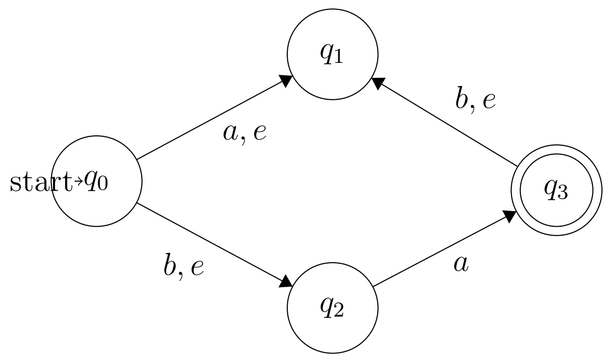
a.

M=(K',$\sum$,δ,s,F')
Firstly, we should find s:
s=E(q_0)=$q_0q_1q_2$
Then, we should find a and b transitions from s:
δ(s,a) = E(q_1) $\cup E(q_3) = q_1q_3$
δ(s,b) = E(q_2) = q_2
We should keep going until we don't see any new state.
δ(q_1q_3,a) = $\emptyset$
δ(q_1q_3,b) = E(q_1) = q_1
δ(q_2,a) = E(q_3) = q_1q_3
δ(q_2,b) = $\emptyset$
$\delta(q_1, a) = \emptyset$
$\delta(q_1, b) = \emptyset$
At the end, we should also add a trap state q_3 and make the transitions which are empty set to go this state. Also, we should have:
δ(q_3,a)=q_3
δ(q_3,b)=q_3
So M=(K',$\sum$,δ,s,F')
K'=$q_1, q_2, q_3, q_1q_3, q_0q_1q_2$
δ is as above
s=$q_0q_1q_2$
F'=q_1q_3
And here is the diagram:

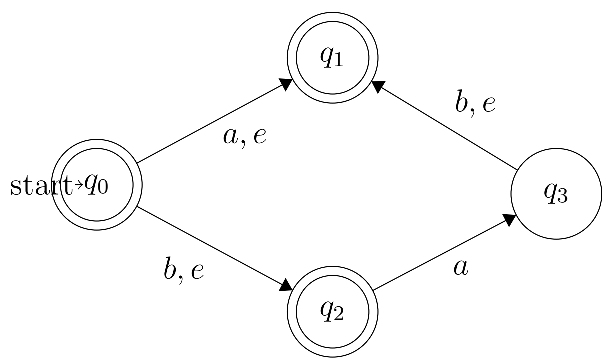


b.

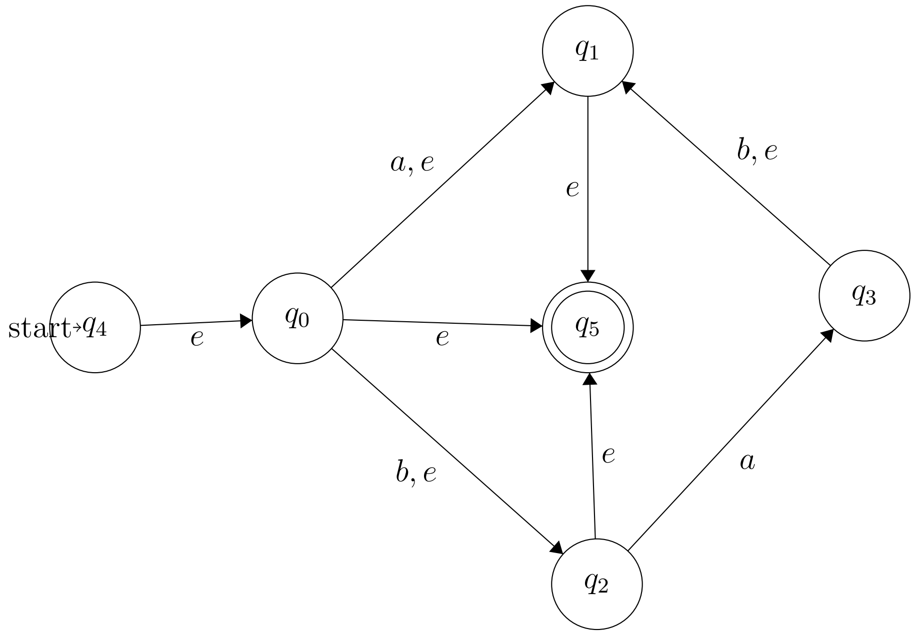
Here is the diagram of L:



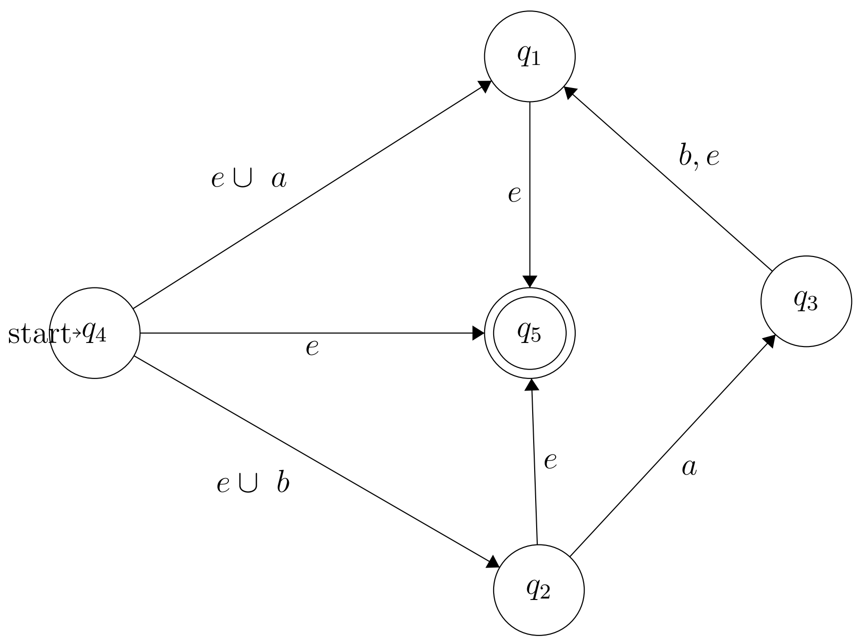
To find $\overline{L}$ we need to make final states nonfinal, and nonfinal states final.So here is the diagram of $\overline{L}$:



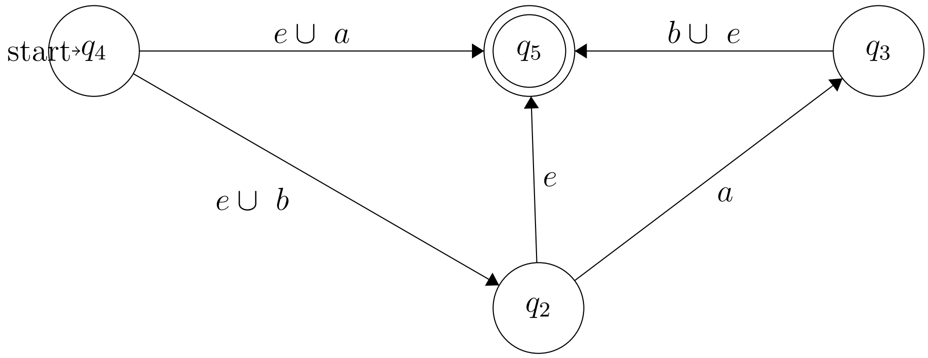
To apply state elimination, here is the GFA form of $\overline{L}$:



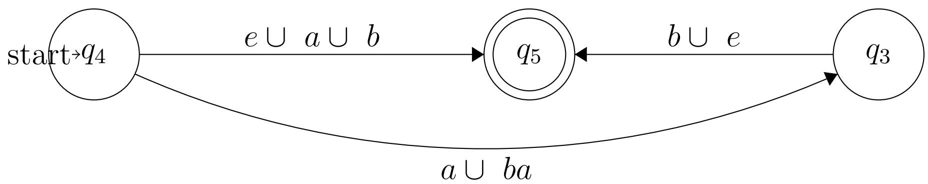
Eliminating q_0, we have:



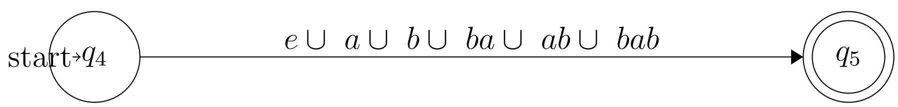
Eliminating q_1, we have:



Eliminating q_2, we have:



Eliminating q_3, we have:



Hence regular expression for $\overline{L}$ is:
$e \cup a \cup b \cup ba \cup ab \cup bab$
$\overline{L}$=w$\in a, b^*$:(|w| $\leq$2 $\wedge$ (aa,bb)$\notin \overline{L}$) $\vee$ (aba) $\in$ w

Answer 6

Answer 7

a.

b.