Student Information

Full Name : Can Erdoğar
Id Number : 1942069

Answer 1

a.

Table 1	
r_1	$-0.d_{11}d_{12}d_{13}d_{14}...$
r_2	$-0.d_{21}d_{22}d_{23}d_{24}...$
r_3	$-0.d_{31}d_{32}d_{33}d_{34}...$
r_4	$-0.d_{41}d_{42}d_{43}d_{44}...$
.	.
.	.

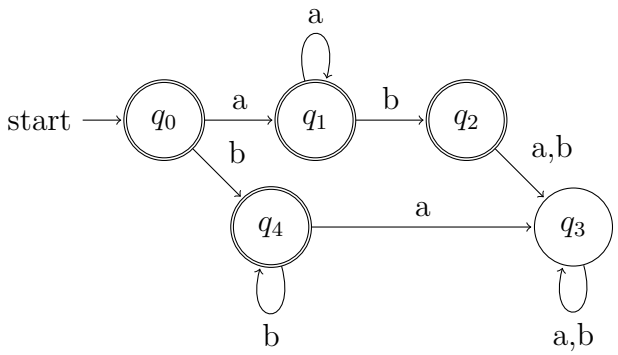
Table 1 shows decimal representation of the numbers between 0 and -1. Then form a new number $r = 0.d_1d_2d_3...$ and make $d_i = 9 - d_{ii}$.
However, this new number will differ from first number in the table with its first digit, second number with its second digit and so on.
This shows that r is not in the set and numbers between 0 and -1 cannot be listed, so it is uncountable.

b.

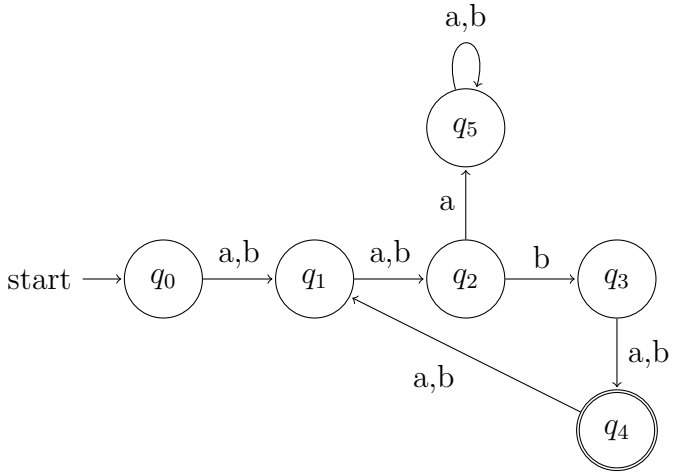
L is regular because it's finite as stated.That's why L^* and L^+ will also be regular which makes D an empty set.

Answer 2

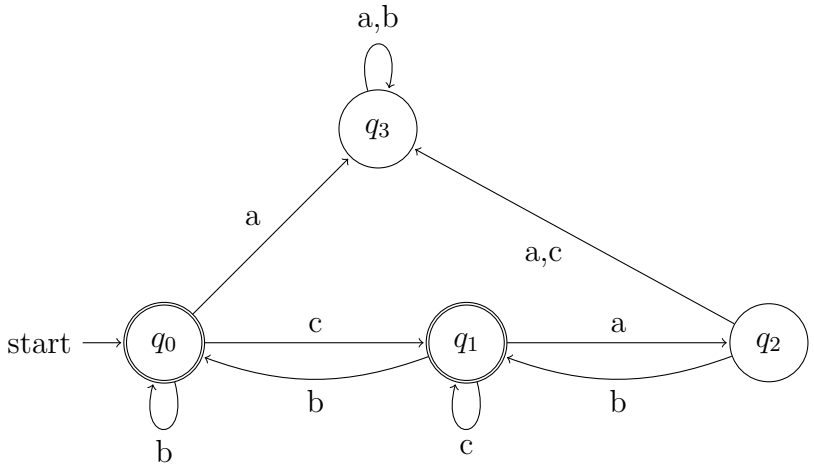
a)


start
q_0
q_1
q_2
q_3
q_4
a
b
a
b
a,b
a
b
a,b

b)


start
q_0
q_1
q_2
q_3
q_4
q_5
a,b
a,b
a
b
a,b
a,b
a,b

c)



Answer 3

a.

w_1 doesn't belong to the language that NFA represents.

b.

w_2 is in the language. One of the possible configuration is as follows:
$(q_0, ababa) \vdash (q_1, baba) \vdash (q_3, baba) \vdash (q_3, aba) \vdash (q_5, ba) \vdash (q_1, ba) \vdash (q_3, ba) \vdash (q_3, a) \vdash (q_5, e)$

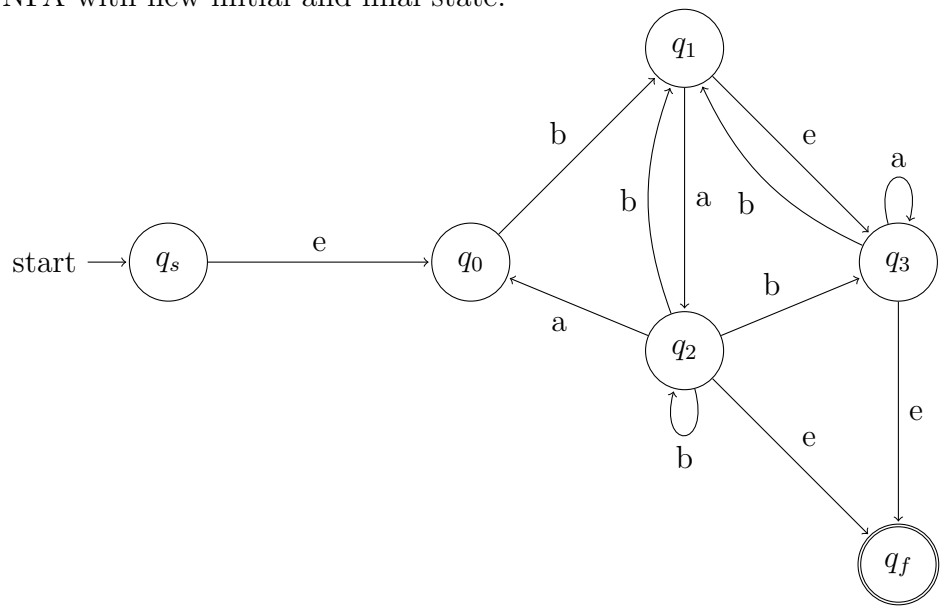
Answer 4

a.

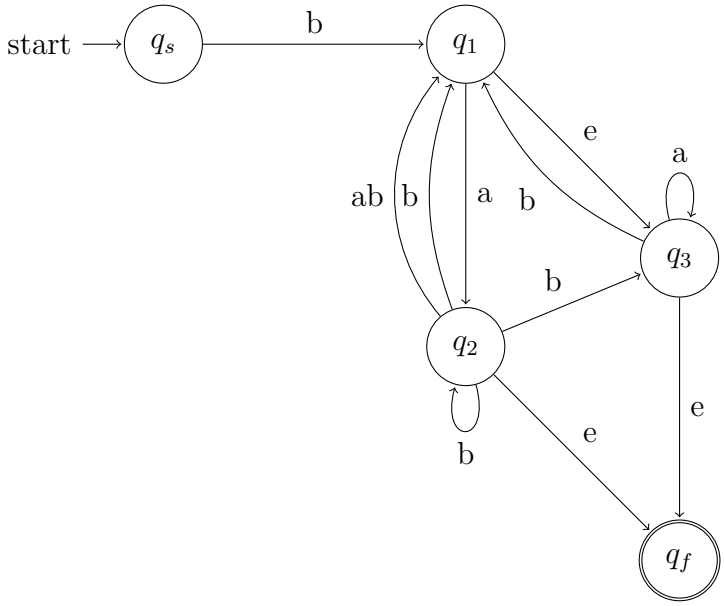
$bab^* \cup [b(a \cup b)^*(e \cup bab^*)] \cup [bab^*(b \cup ab)(a \cup b)^*(e \cup bab^*)]$

b.

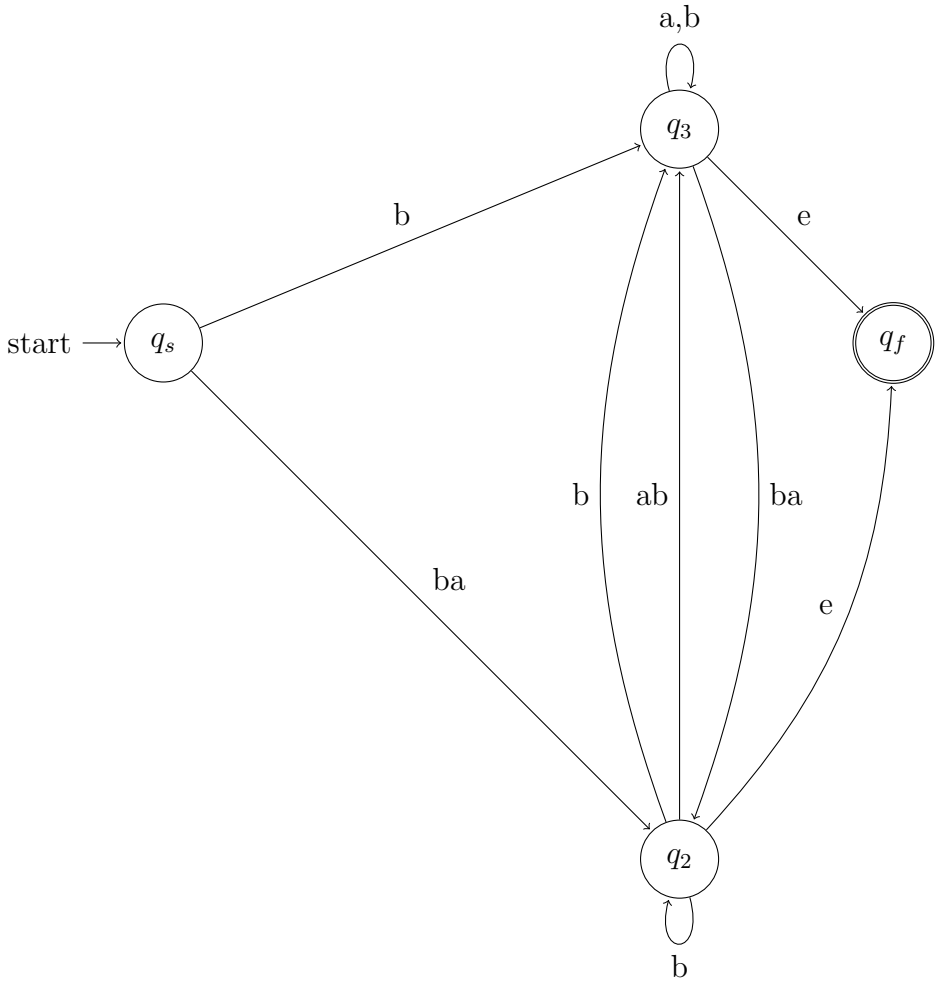
NFA with new initial and final state:



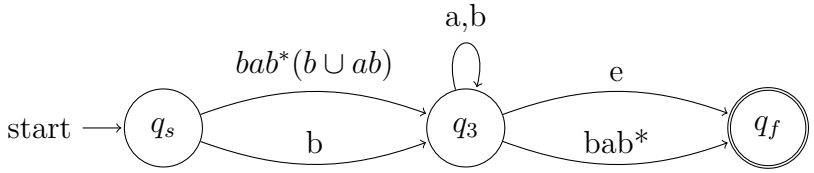
q0 eliminated:



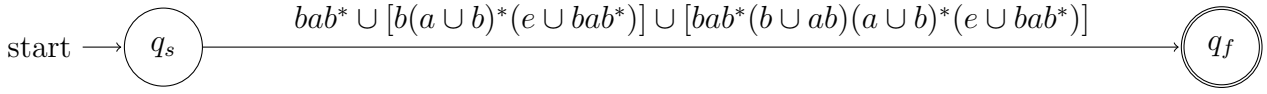
q1 eliminated:



q2 eliminated:

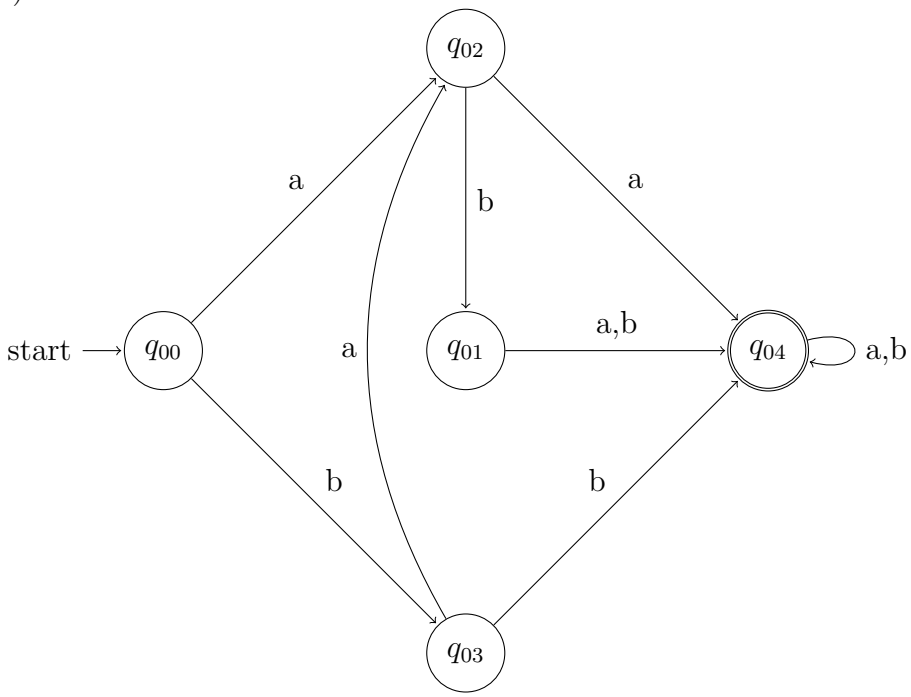


q3 eliminated:



Answer 5

a)



q_{00} is the set that includes q_0 , q_1 , q_2.
q_{01} is the set that includes q_1 .
q_{02} is the set that includes q_1 , q_3.
q_{03} is the set that includes q_2.
q_{04} is the empty set.

b)

Answer 6

We know that regular languages are closed under intersection and complementation. Because $L1 - L2 = L1 \cap \overline{L2}$ and every NFA has an equivalent DFA , regular languages are closed under set difference.

Answer 7

a.

Let's choose the pumping length as $\frac{p^2}{2}$ and get a string of length p^2 which is $a^{p^2} = s$ from the language and assume that L is a regular language. Then, it must satisfy the pumping lemma.
Make $s = xyz$, $x = a^{p^2}$ and $y = a^{p^2}$. Then, xy^iz becomes $a^{\frac{p^2(i+2)}{2}}$.
This xy^iz must be in the language for all i. However, it only satisfies for 1,7,17... So, L is not regular.

b.