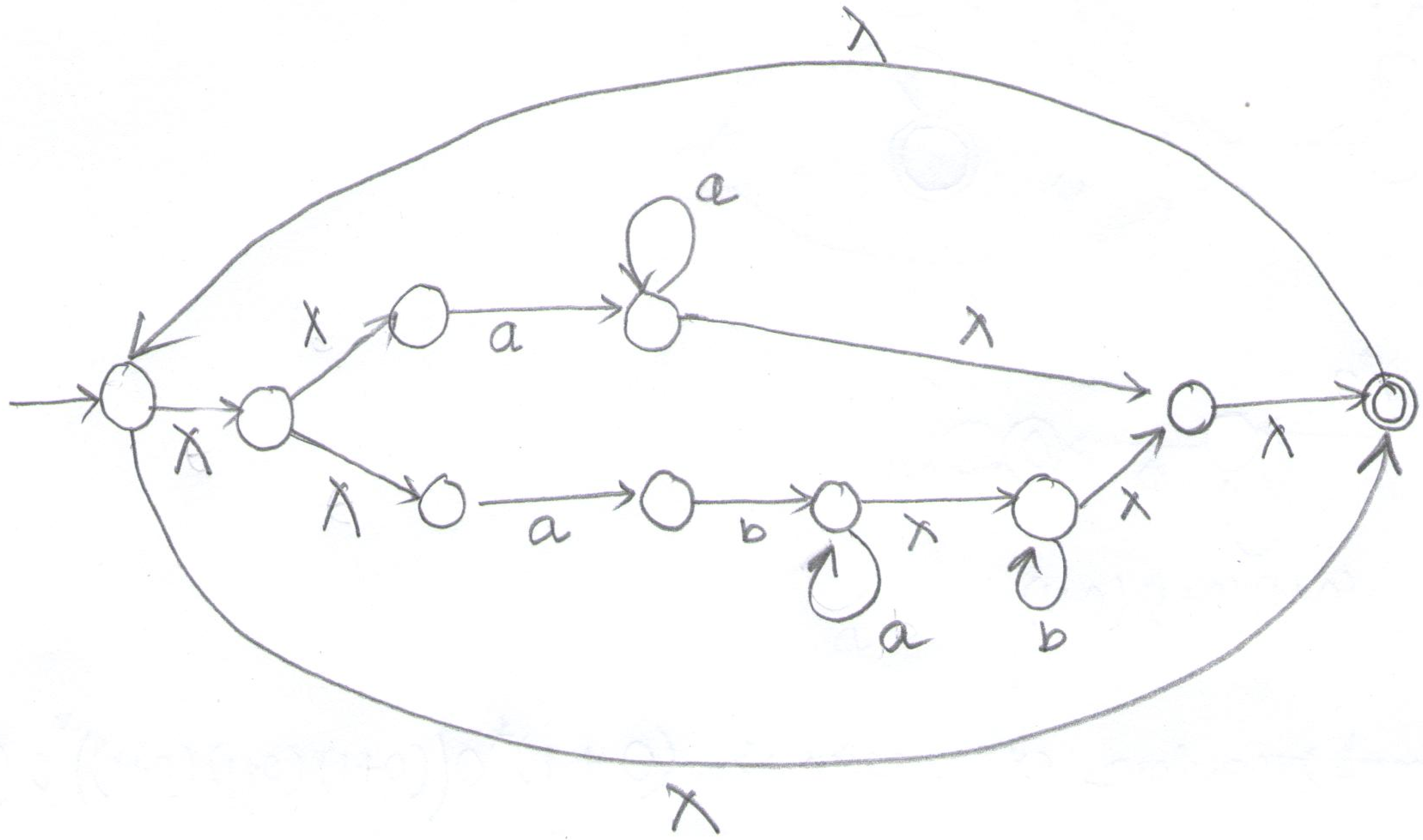
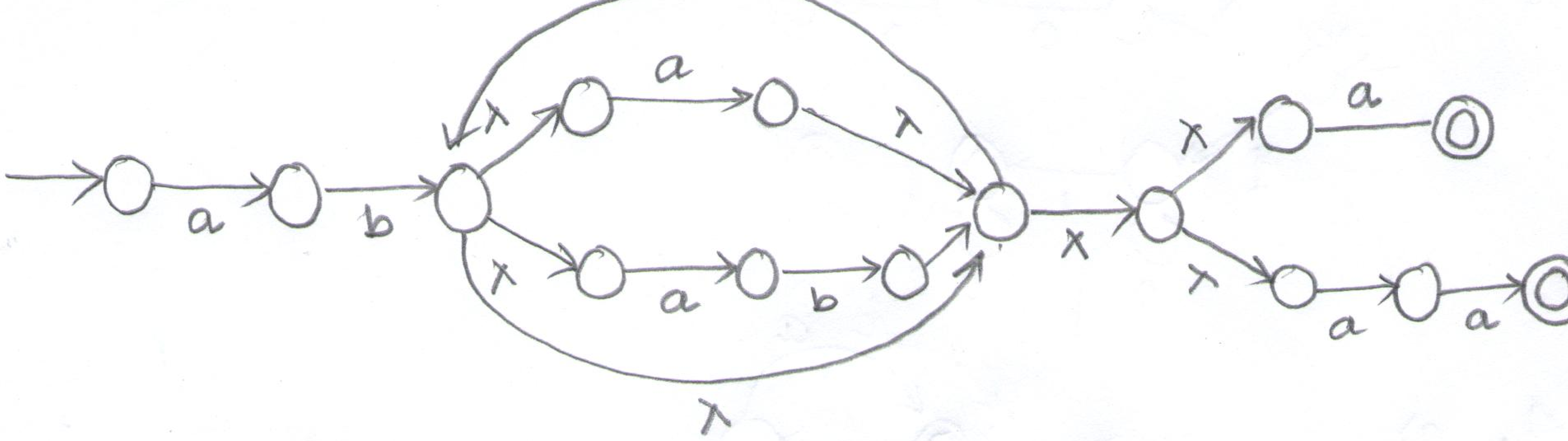
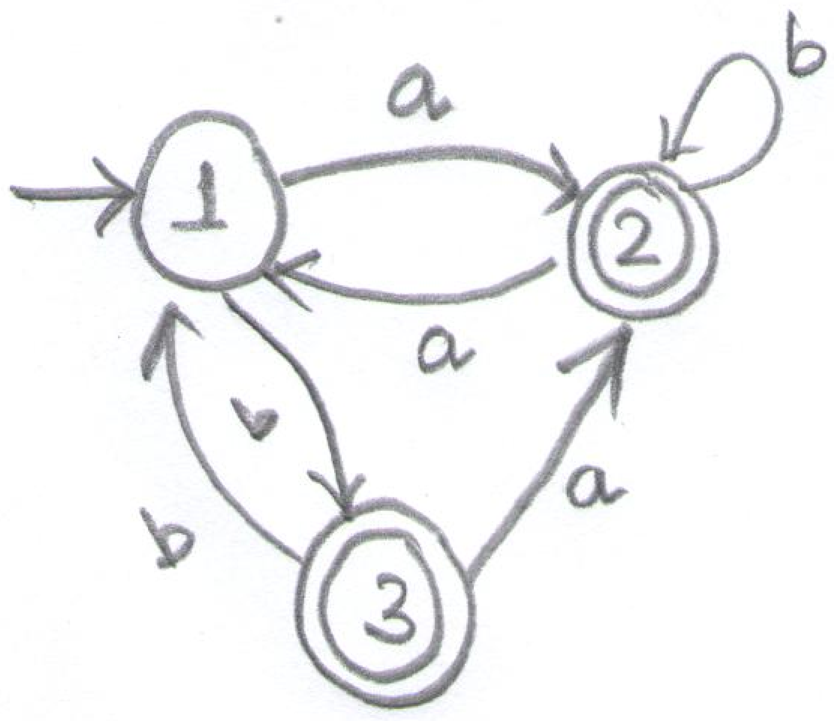
1. a)



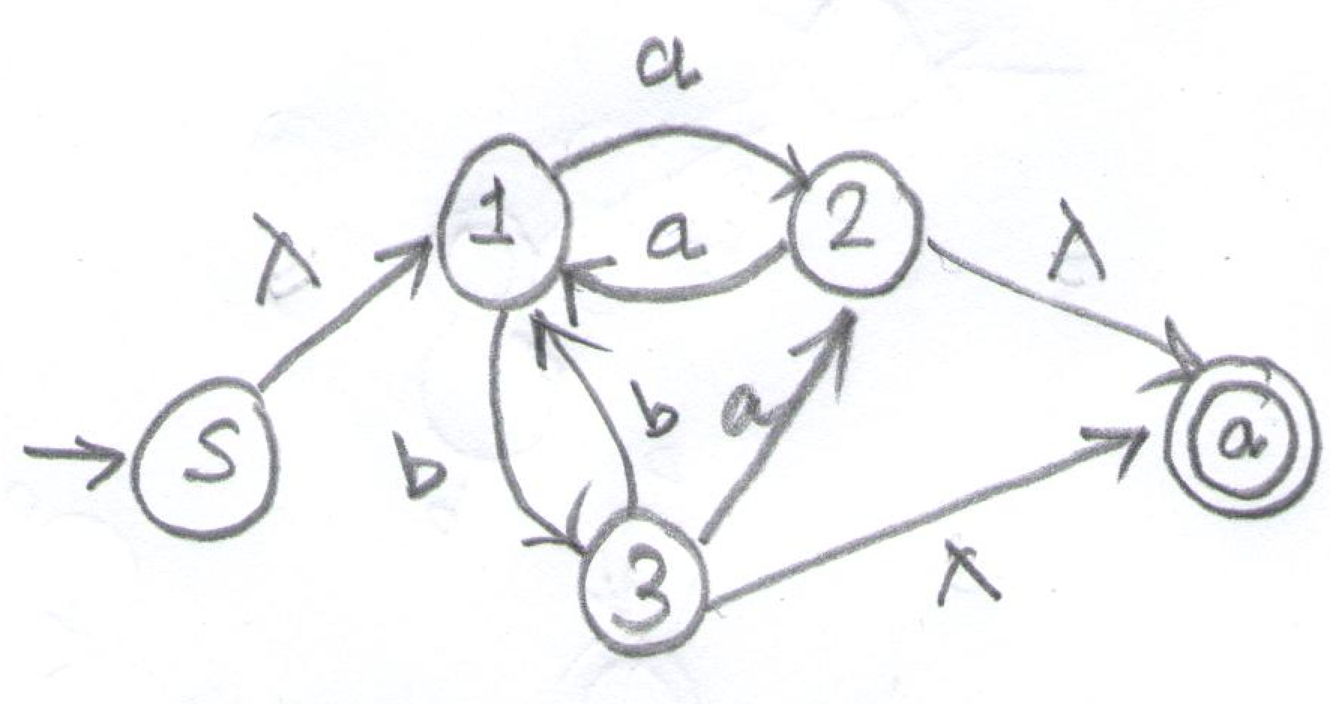
b)



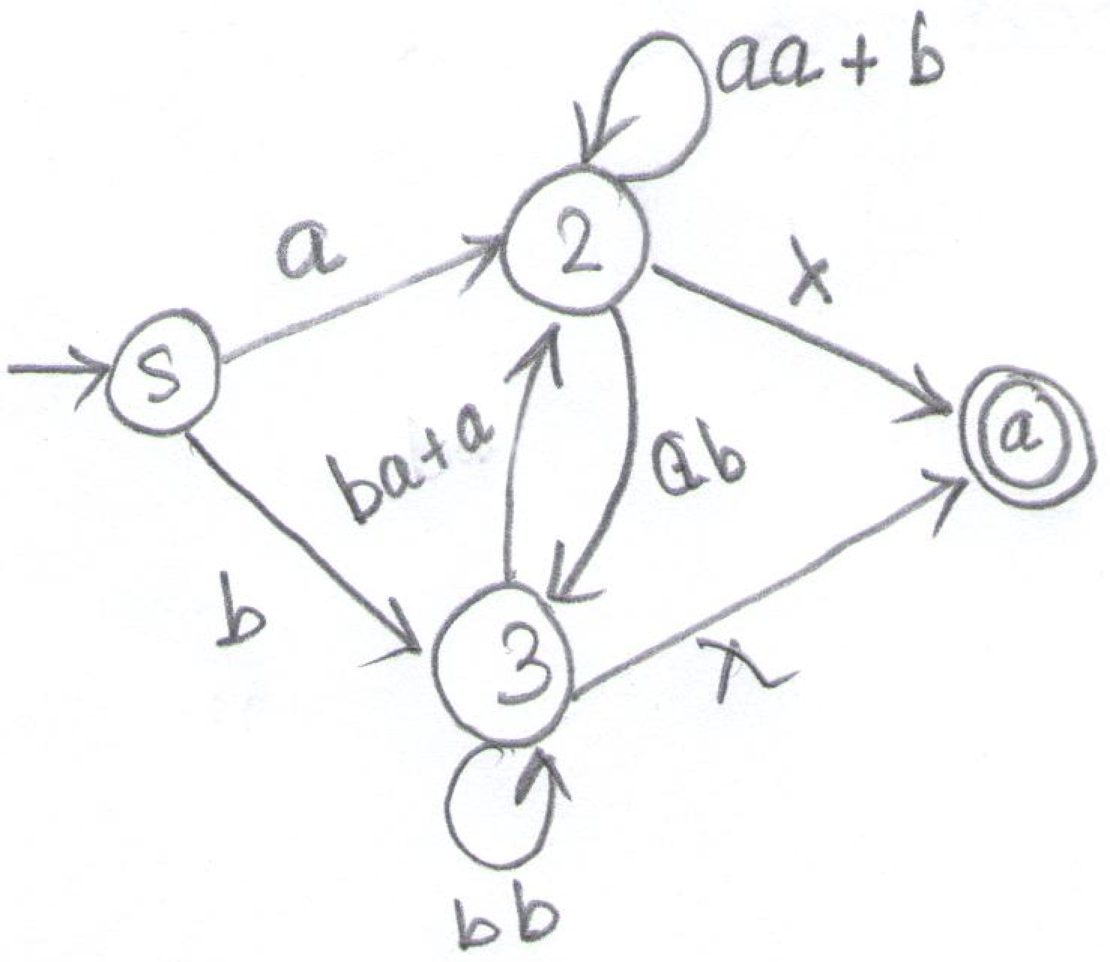
2. a)



1



2



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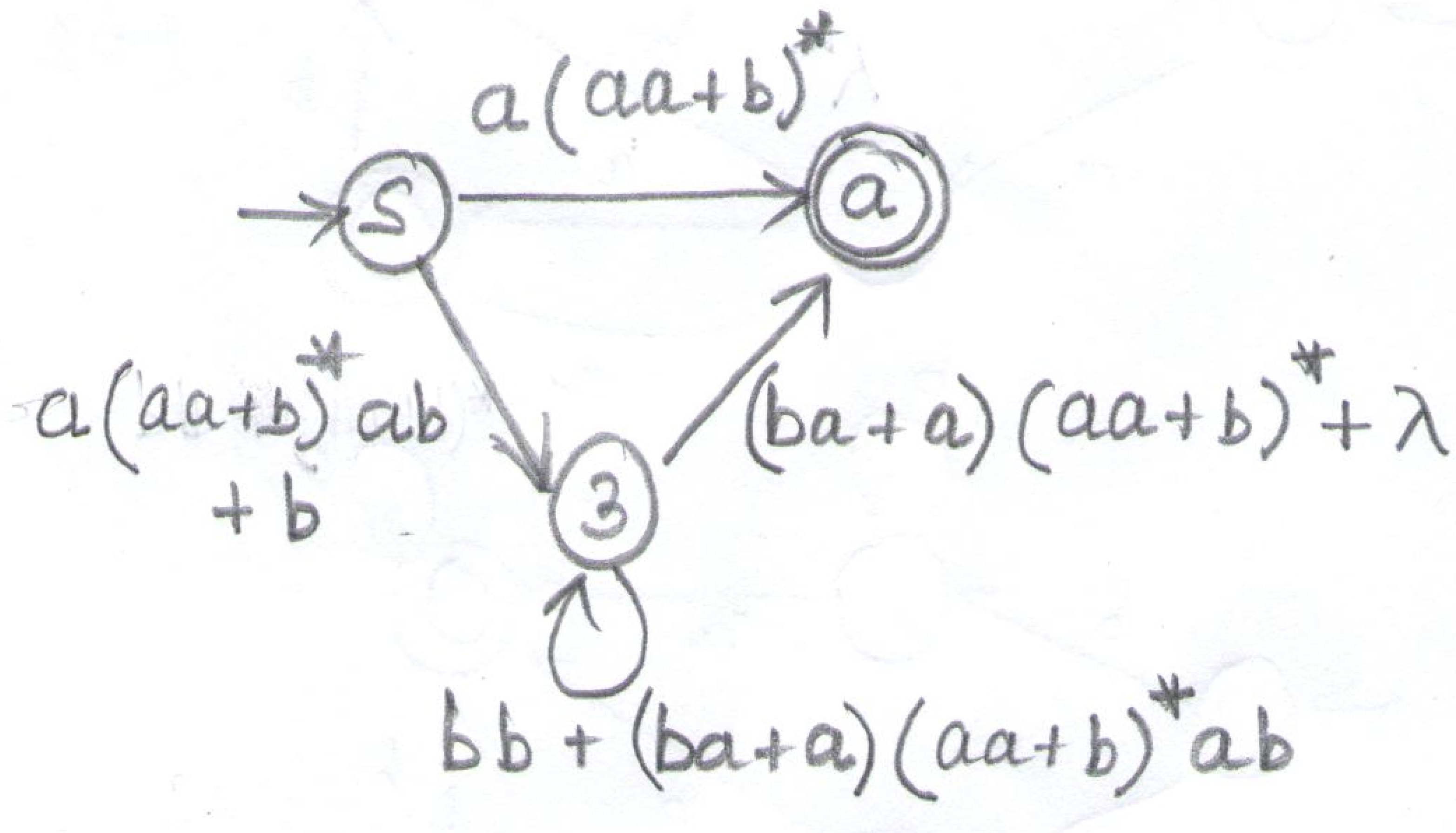
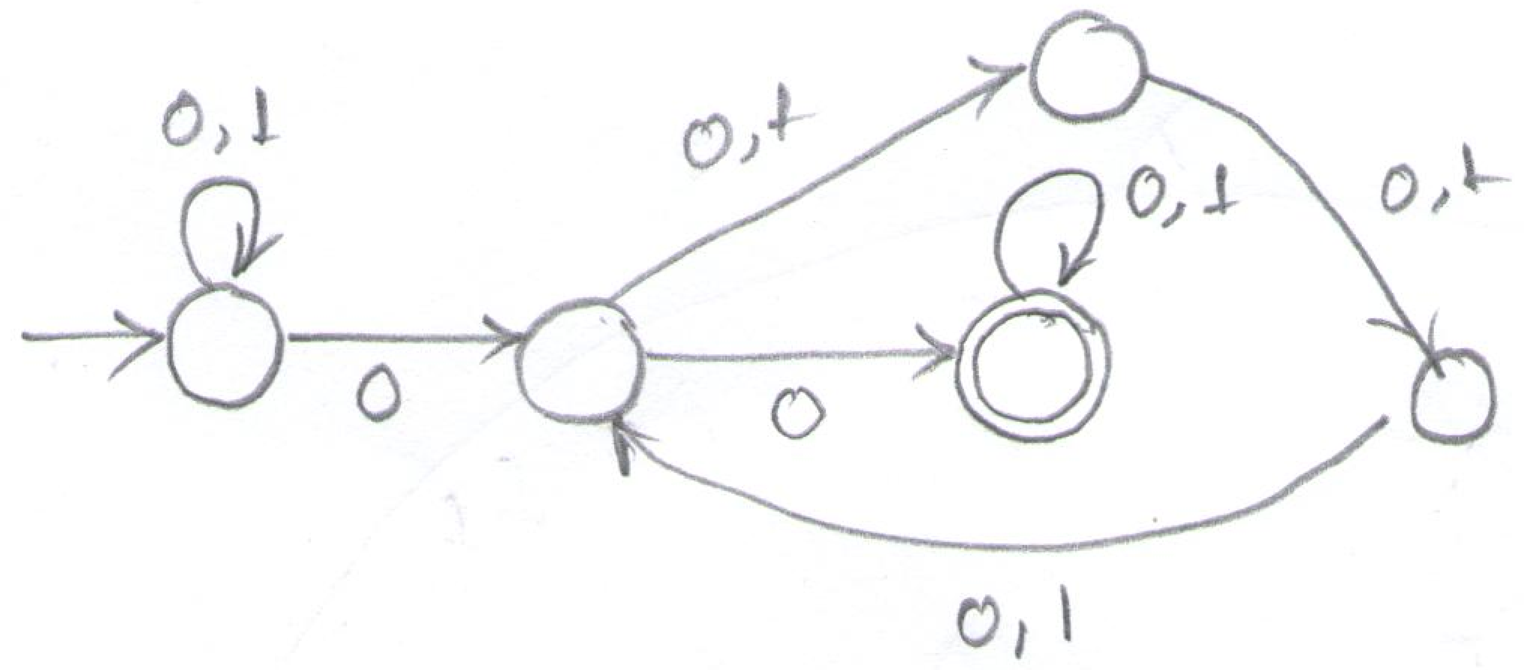
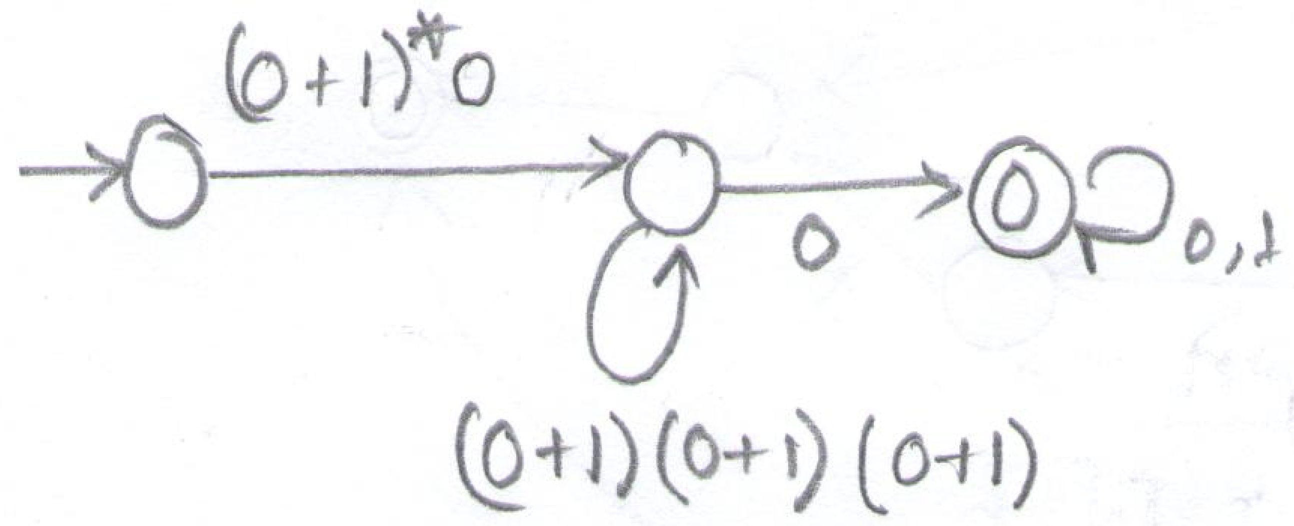


4

So the final expression is $a(aa+b)^* + (a(aa+b)^*ab + b) \cdot (bb + (ba+a)(aa+b)^*ab)^* \cdot ((ba+a)(aa+b)^* + \lambda)$

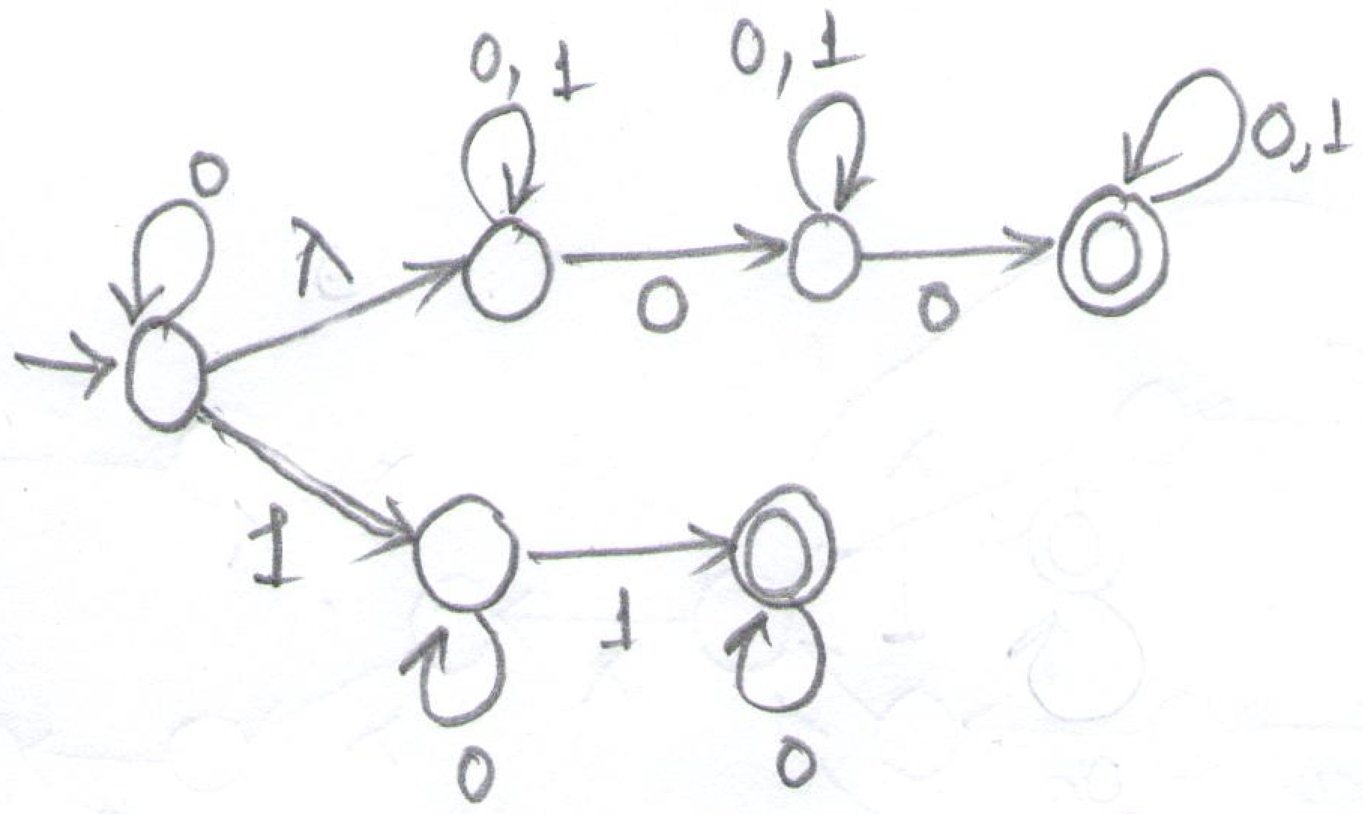
2.b)



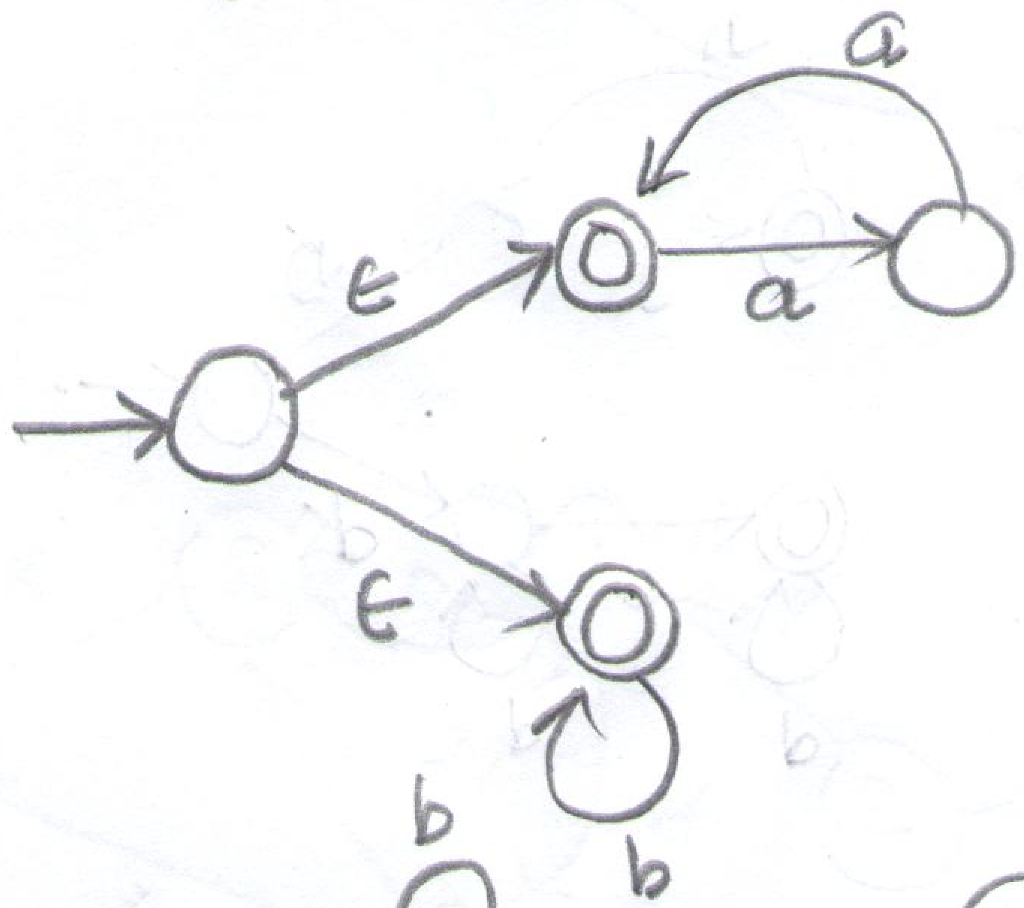


The final regular expression is $(0+1)^*0\left((0+1)(0+1)(0+1)\right)^*0(0+1)^*$

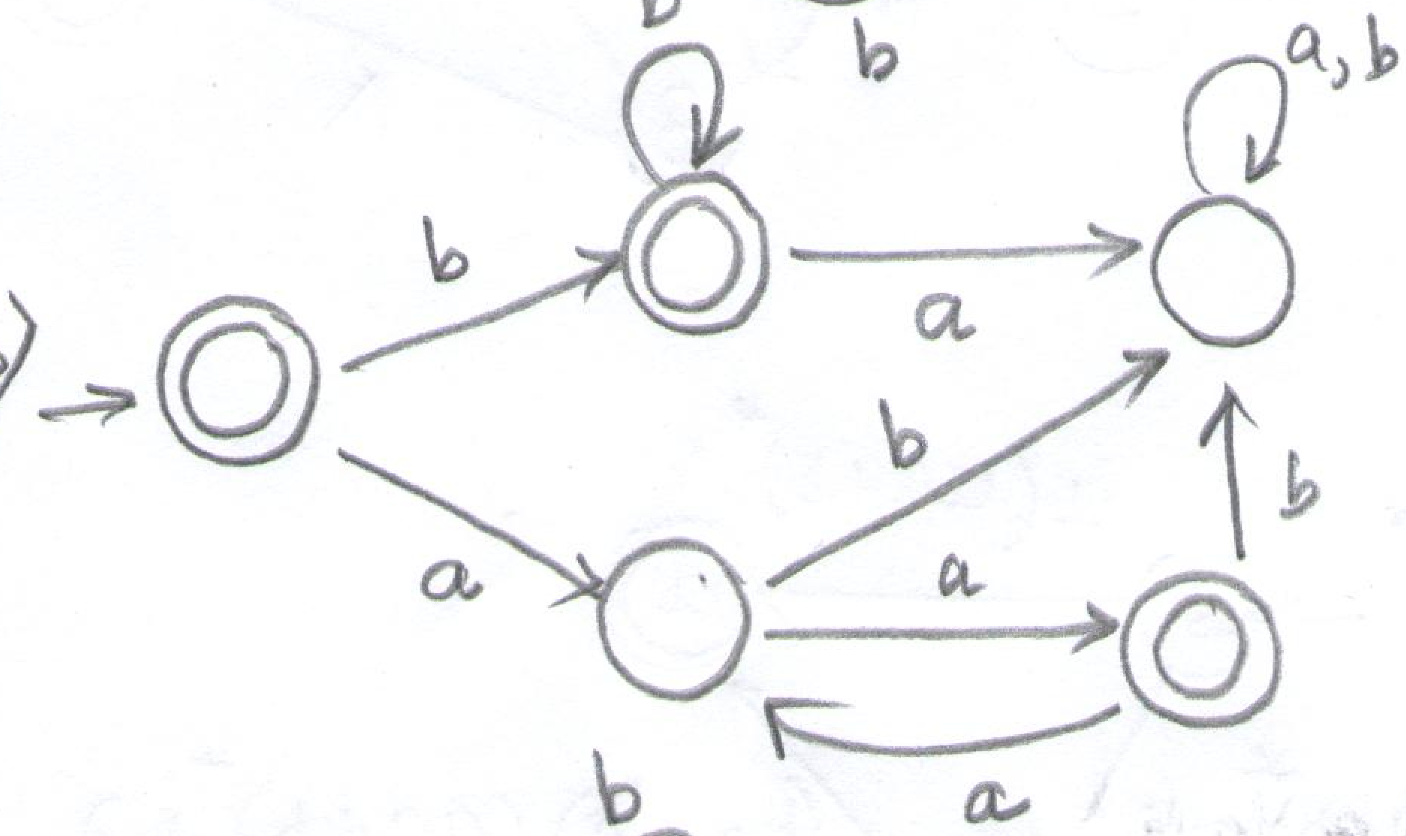
3.



4. a)

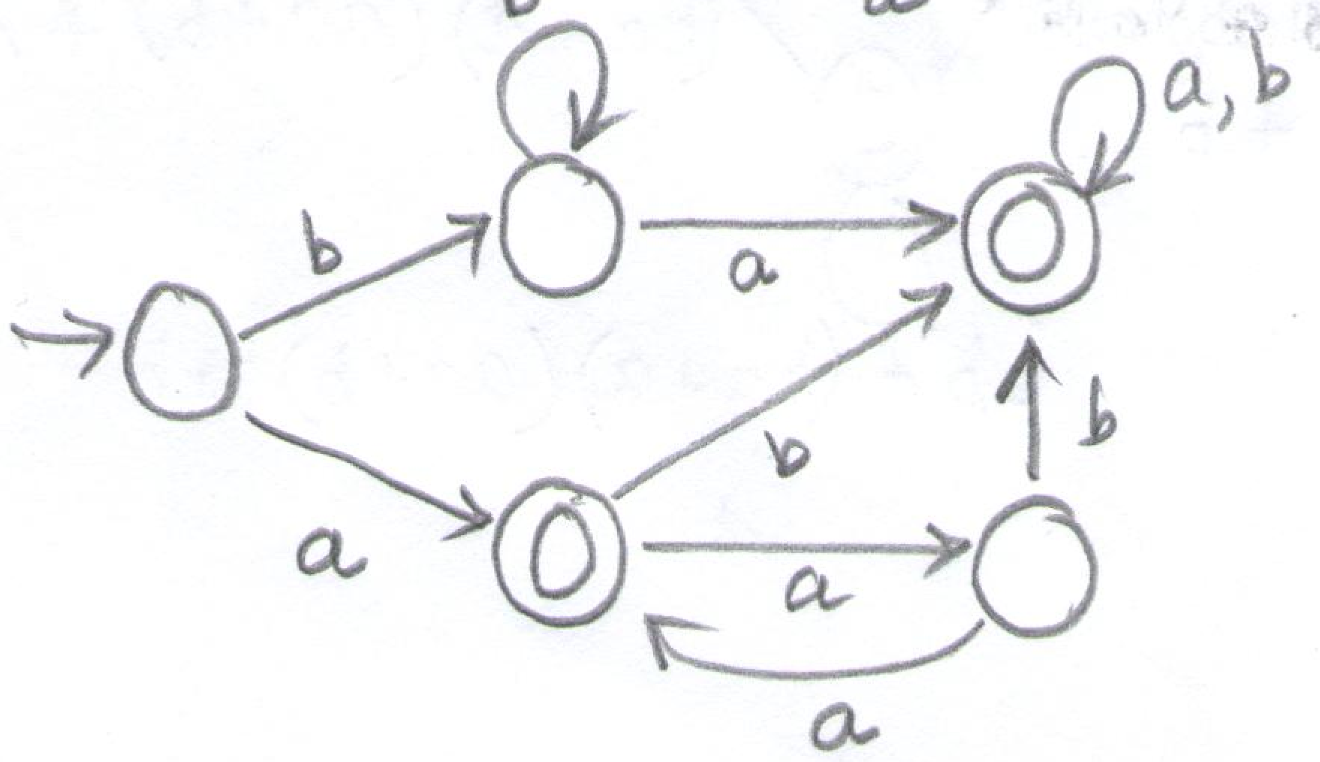


b)



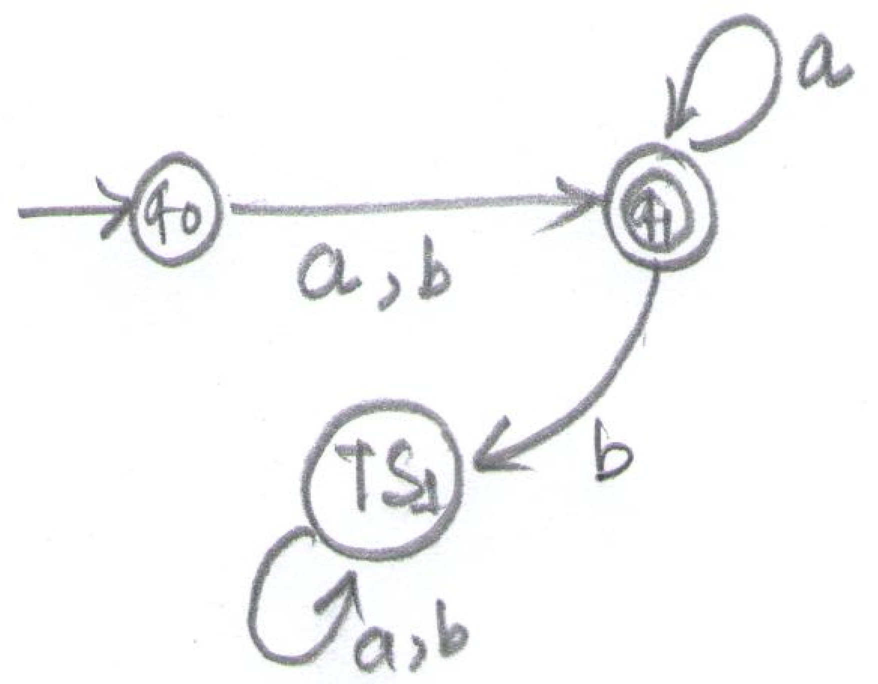
DFA accepting R

c)

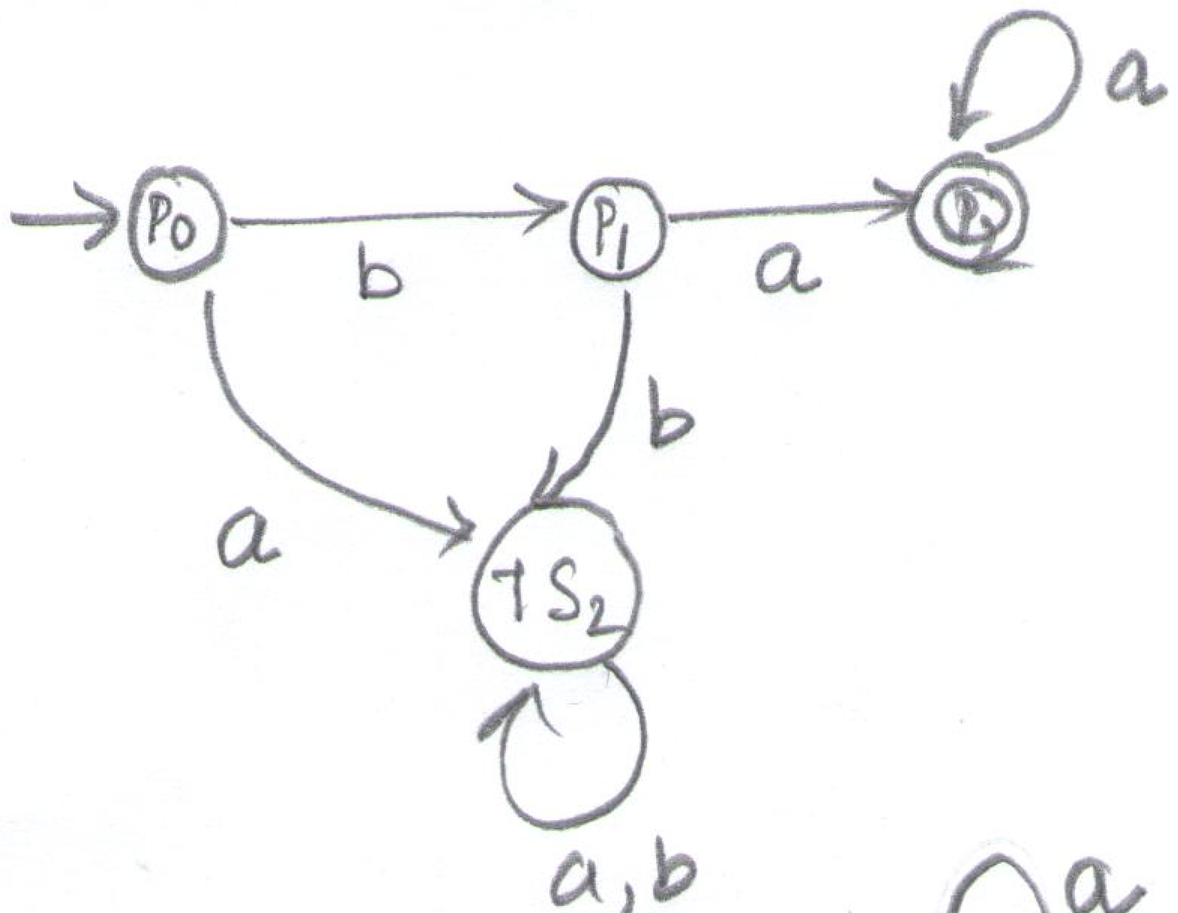


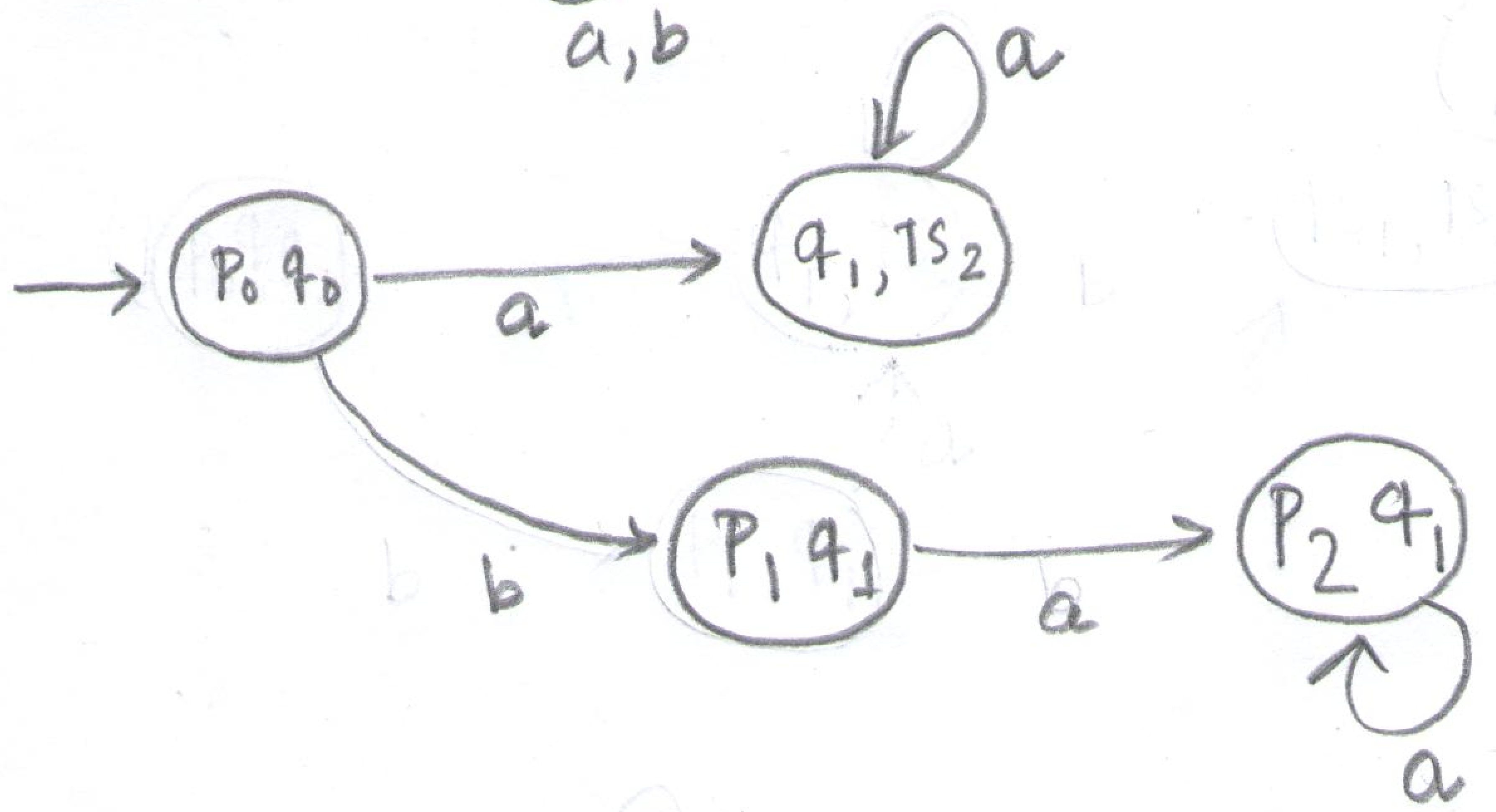
$$a(aa)^* + (bb^+a + a(aa)^*(b+ab))(a+b)^*$$

5. DFA for $((a+b)a^*)$



DFA for baa^*





The resulting NFA

Ans 6.

We take the string(s) $1^p \# 1^{p+1} \# \ldots 1^{2p}$, i.e. $k = p+1$
given p as pumping length

For any breakup xyz such that $|xy| \leq p$
and $|y| \neq \varepsilon$
$|xy^2z|$ will clash with one of the existing string lengths.

Ans 7
(a) A regular language is closed under complementation

So it will suffice to prove that the language of all palindromes is not regular

For that we can use the string

$$0^p 1 0^p$$

7(b) is a regular language