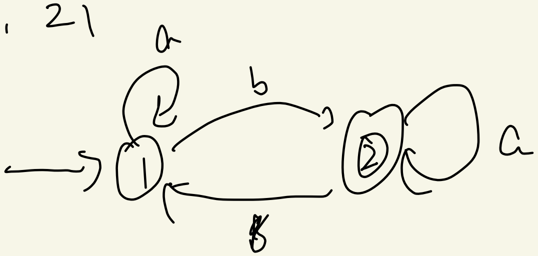
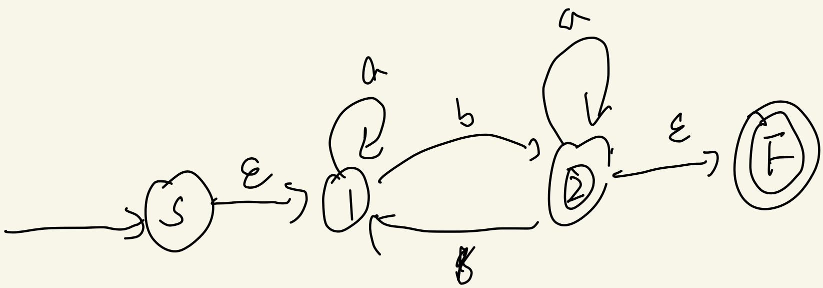
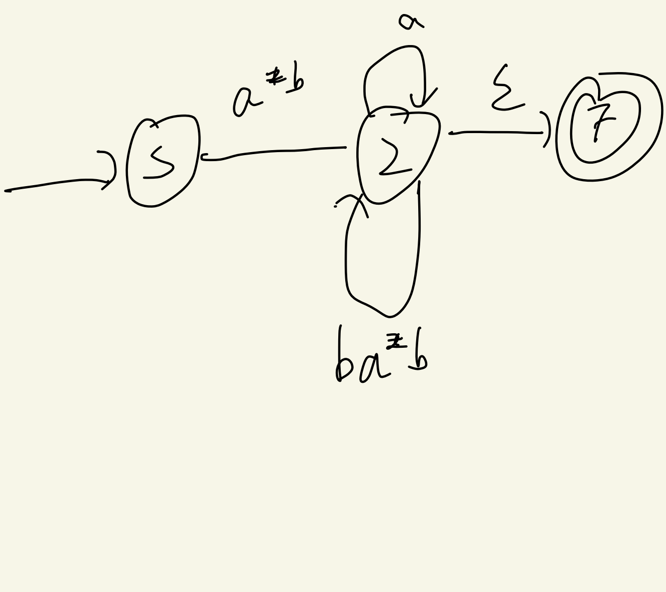
1. 21



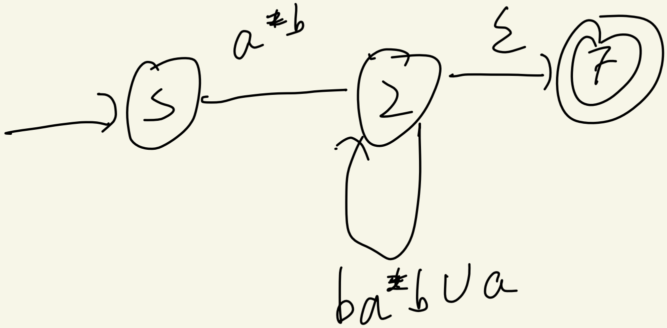
1. First add start state and final state.



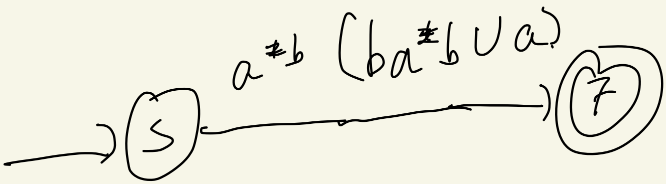
2. eliminate state 1



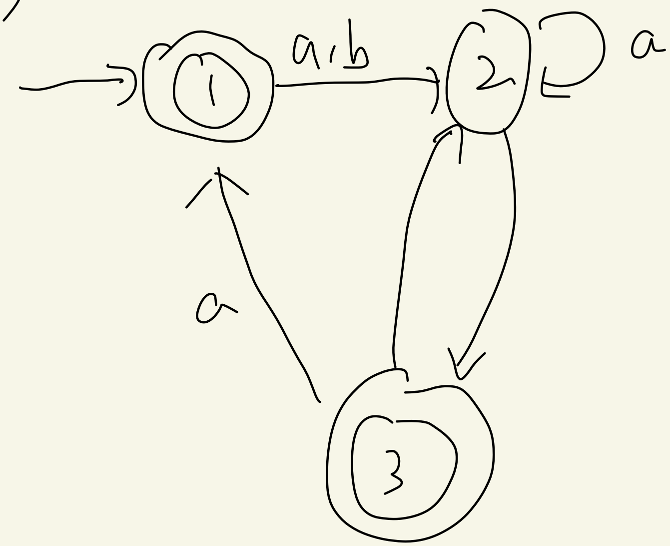
3, merge 2 conditions on state 2



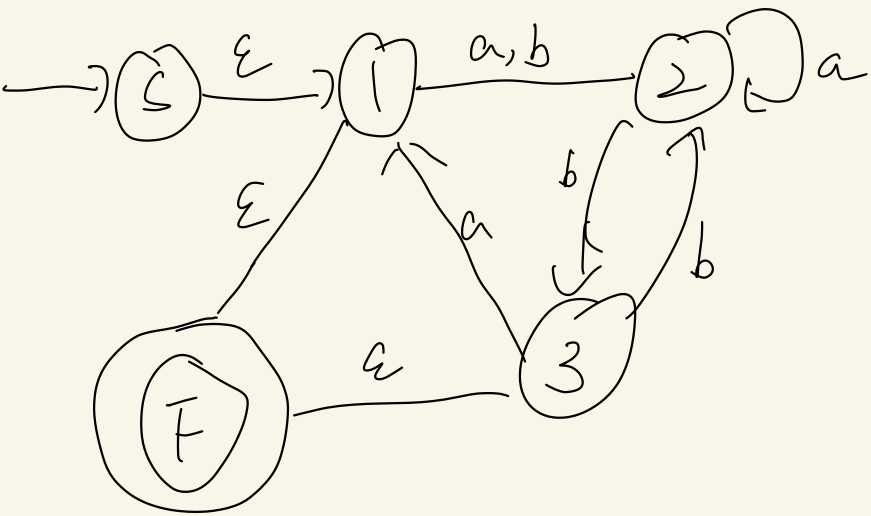
4, remove state 2



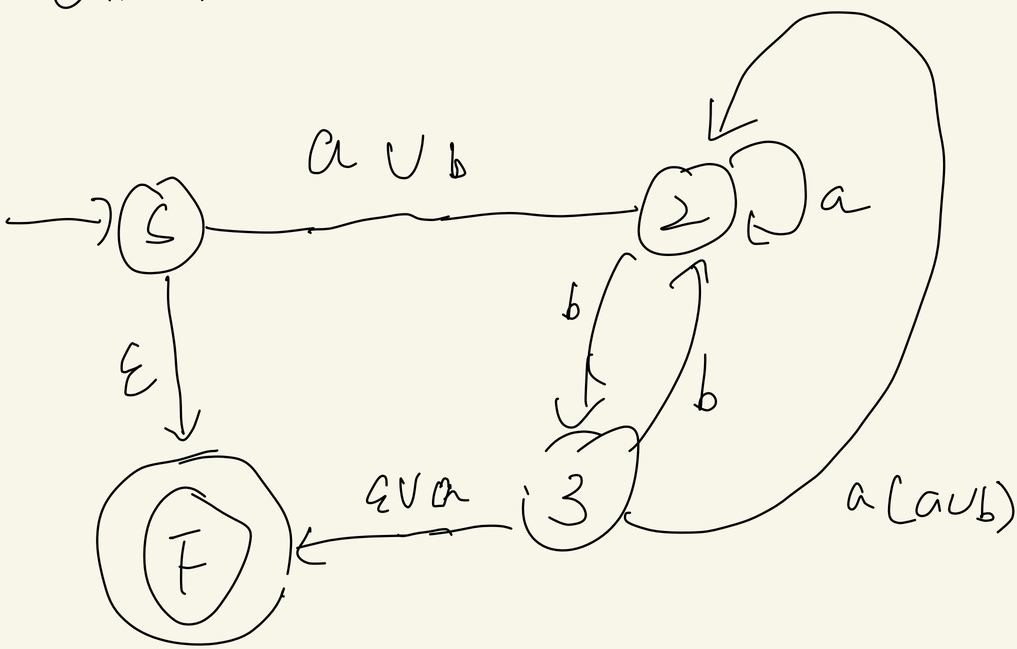
b)



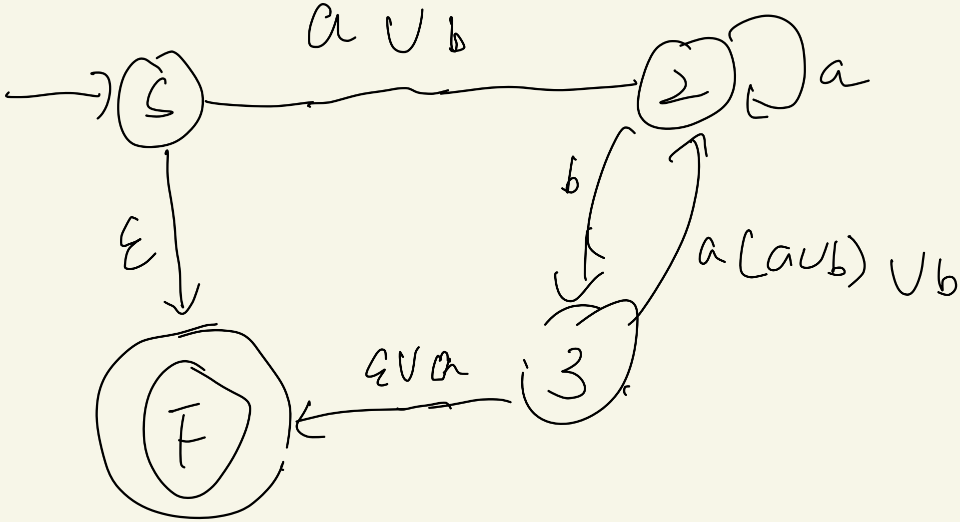
1, Add start state and final state.



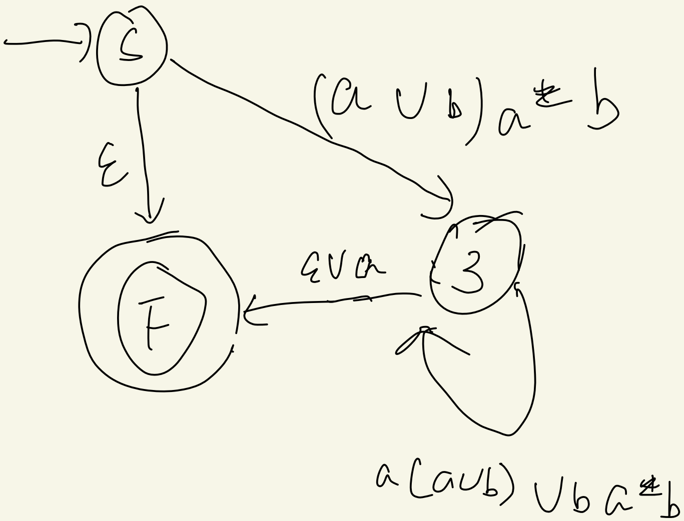
3, eliminate state 1



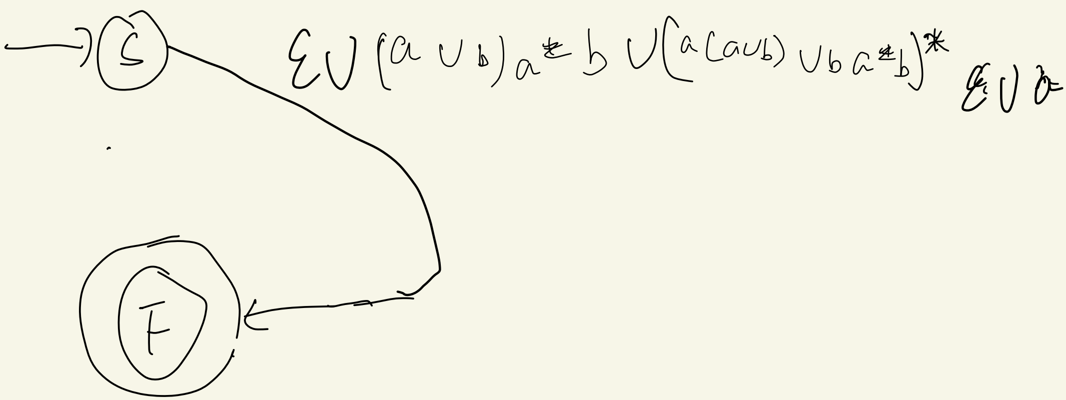
4, merge conditions on 3 2.



5 eliminate state 2



6 Eliminate state 3



1.29

b) Let's consider a string

$S = a^p b a^p b a a b^p a b^p$

if it satisfy Pumping lemma

$S = x y^i j$

$x = a \quad y = a \quad z = a^p b a a b^p a b^p$

The loop here is a^* But zt also

Contains $a^p b a a b^p a b^p$ which cannot

be explained by xyz, So this

language is not regular

1.31

we can build a DFA that regcognize A

From this DFA, we can build an NFA M' for A^R by reversing all the arrows and change q_{accept} as q_0', q_0 to q_{accept}'

In this way, there is always a path from w_n to w_1 in M' ~~from~~ the new q_0' to q_{accept}'. which says as $w \in A$ there must be $w^R \in A^R$

So A^R has the same property as regular language.

1.38

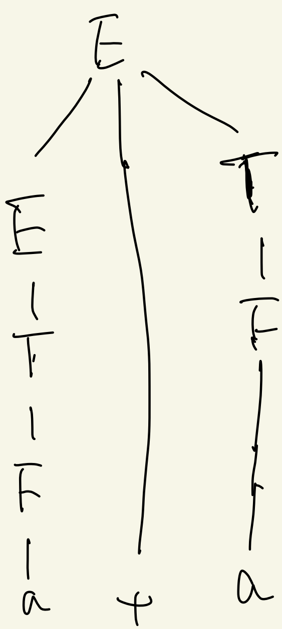
2.1

a) parse tree for a is

$$E \to T \to F \to a$$

$$E \Rightarrow T \quad E \Rightarrow F \quad E \Rightarrow a$$

b) parse tree is

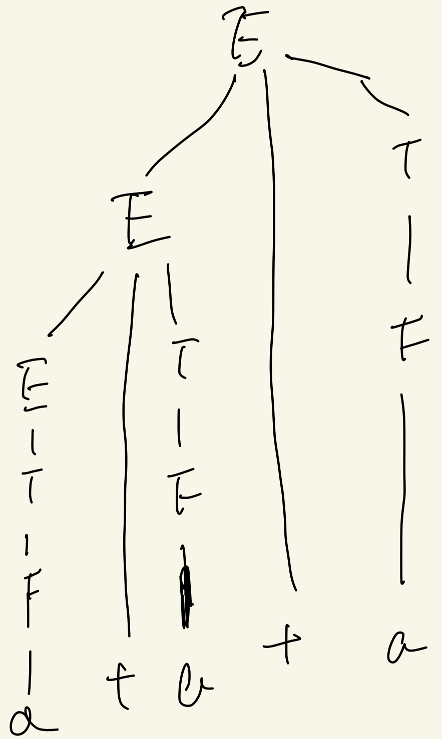


$$E \Rightarrow E+T \quad E \Rightarrow T+T$$

$$E \Rightarrow F+T \quad E \Rightarrow a+T$$

$$E \Rightarrow a+F \quad E \Rightarrow a+a$$

c) Parse tree is



$$E \Rightarrow E + T$$

$$E \Rightarrow E + T + T$$

$$E \Rightarrow T + T + T$$

$$E \Rightarrow F + T + T$$

$$E \Rightarrow a + T + T$$

$$E \Rightarrow a + F + T$$

$$E \Rightarrow a + a + T$$

$$E \Rightarrow a + a + F$$

$$E \Rightarrow a + a + a$$

d) Parse tree is

$$
\begin{array}{c}
E \\ | \\ T \\ | \\ F \\ | \\ (E) \\ | \\ (T) \\ | \\ (F) \\ | \\ ((E)) \\ | \\ ((T)) \\ | \\ ((F)) \\ | \\ ((a))
\end{array}
$$

$E \Rightarrow T$

$E \Rightarrow F$

$E \Rightarrow (E)$

$E \Rightarrow (T)$

$E \Rightarrow (F)$

$E \Rightarrow ((E))$

$E \Rightarrow ((T))$

$E \Rightarrow ((F))$

$E \Rightarrow ((a))$

2.4

b) $\{w \mid w$ starts and ends with the same symbol$\}$

$S \to 0P0 \mid 1P1 \mid 0 \mid 1$

$P \to 0P \mid 1P \mid \varepsilon$

c) $\{w \mid$ the length of w is odd$\}$

$S \to 0 \mid 1 \mid 00S \mid 01S \mid 10S \mid 11S$

or

$S \to 0 \mid 1 \mid 0S0 \mid 0S1 \mid 1S0 \mid 1S1$

e) $\{w \mid w = w^R$, that is, w is a palindrome$\}$

$S \to 0 \mid 1 \mid 0S0 \mid 1S1 \mid \varepsilon$

f) It is empty!

$S \to S$