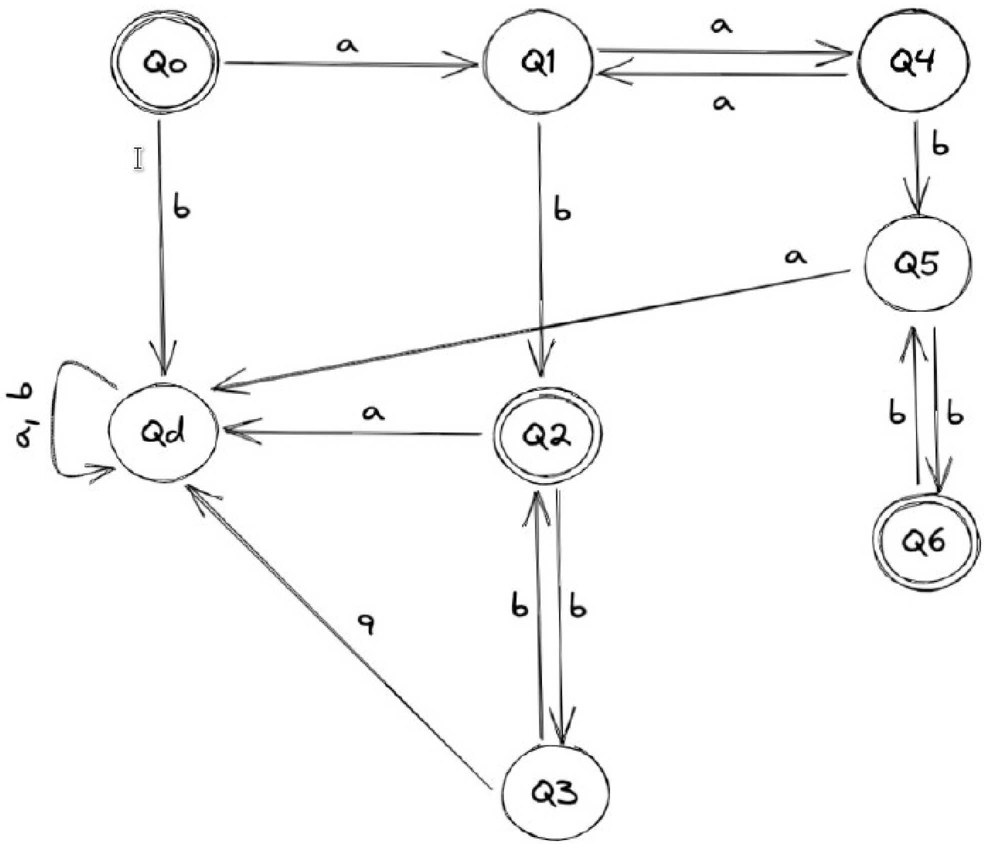
Theory Of Automata

Assignment # 1

Saad Bin Khalid 20K-0161 26 February 2022

$$L_1 = \{ a^n b^m : (n+m) \text{ is even} \}$$

$$(a^2)^*(b^2)^* + \ a^*b^*$$



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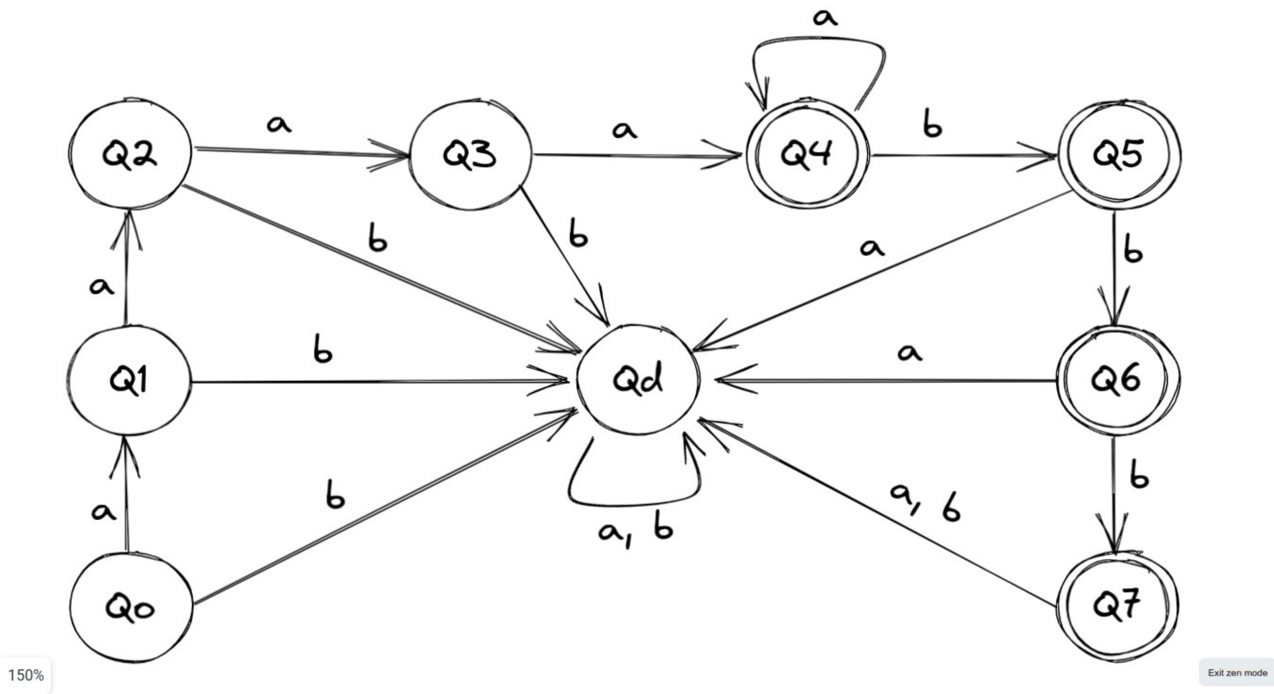
$$L_2 = \{\ a^n b^m\ ,\ n \geq 4,\ m \leq 3\ \}$$

$$a^4 a^* (b^3 + b^2 + b + \lambda)$$



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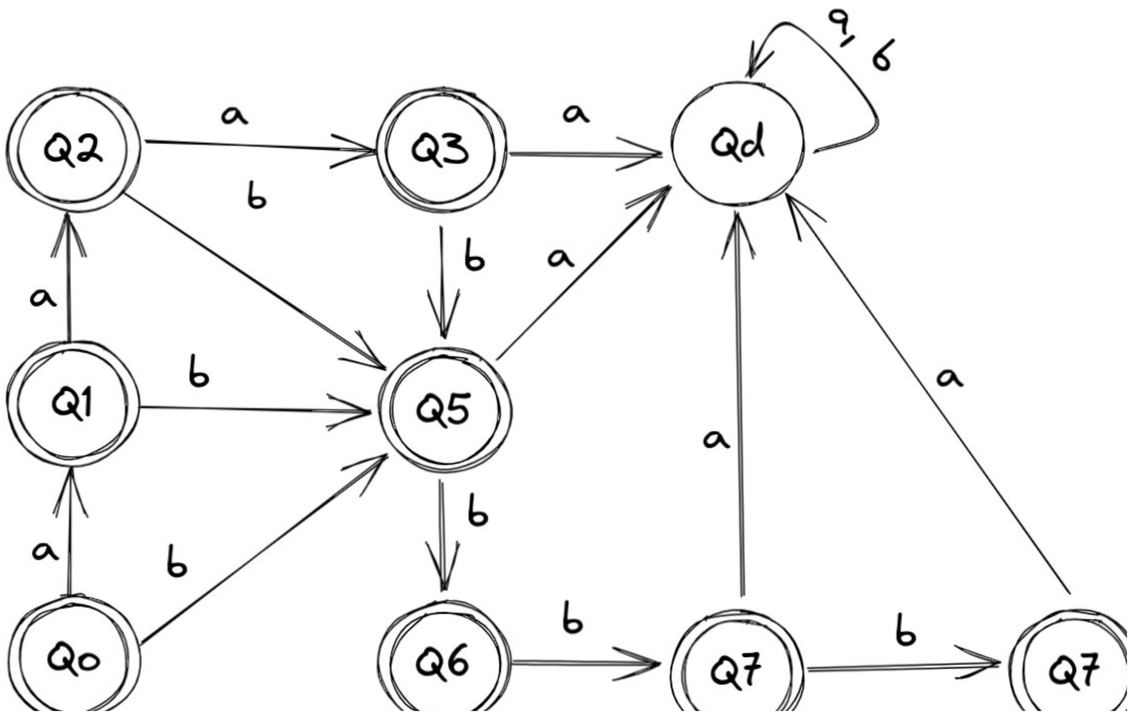
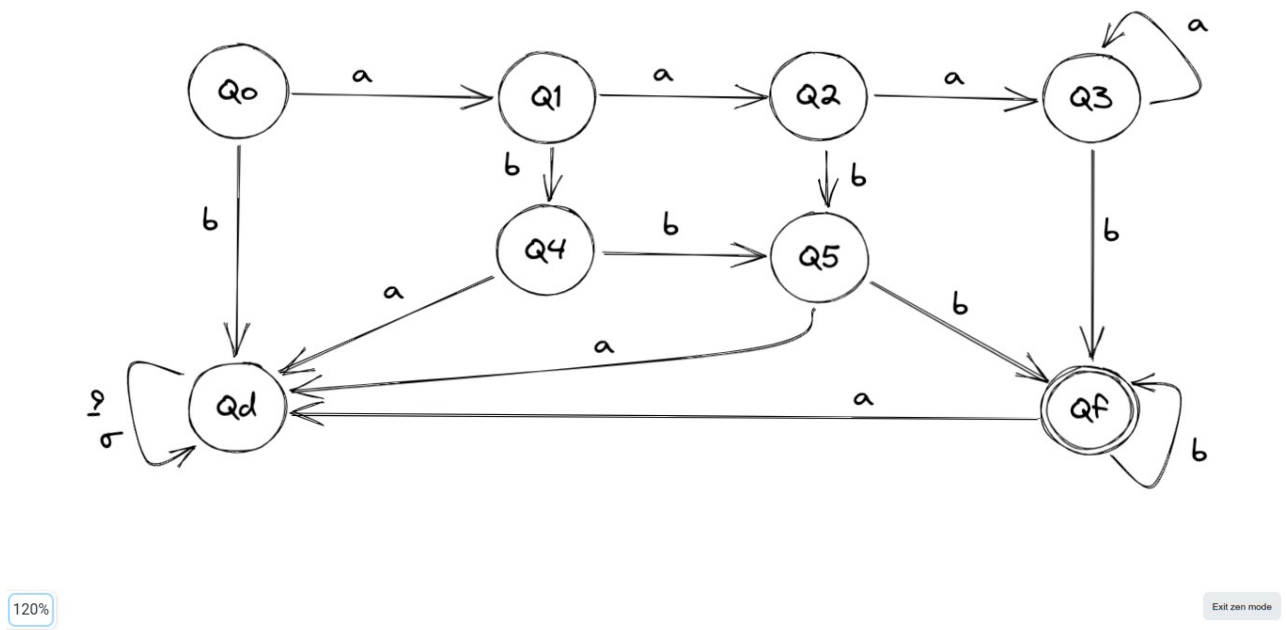
$$L_3 = \{\ a^n b^m\ ,\ n < 4,\ m \leq 4\ \}$$

$$(a^3+a^2+a+\lambda)(b^4+b^3+b^2+b+\lambda)$$



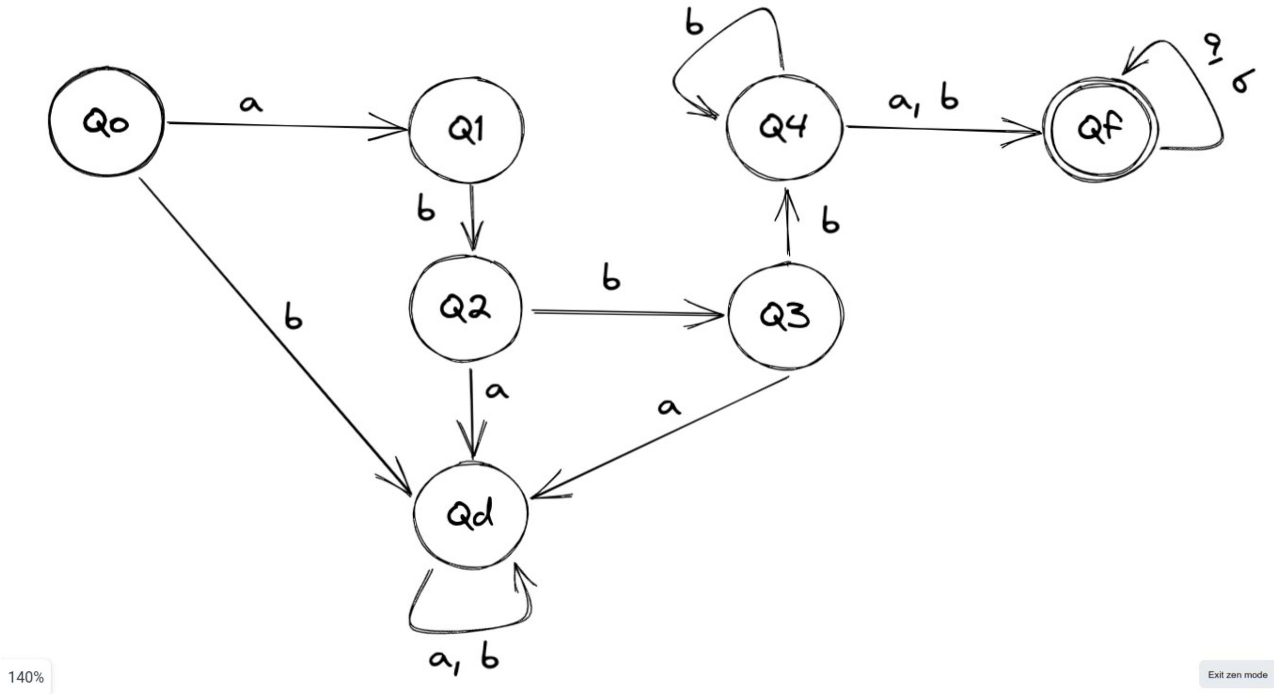
$$L_4 = \{ a^n b^m , n \geq 1, m \geq 1, nm \geq 3 \}$$

$$ab^3b^* + a^2b^2b^* + a^3a^*bb^*$$



$$L_5 = \{\ ab^n w : n \geq 3,\ w \in \{a,b\}^+\ \}$$

$$ab^3b^*(a+b)^+$$



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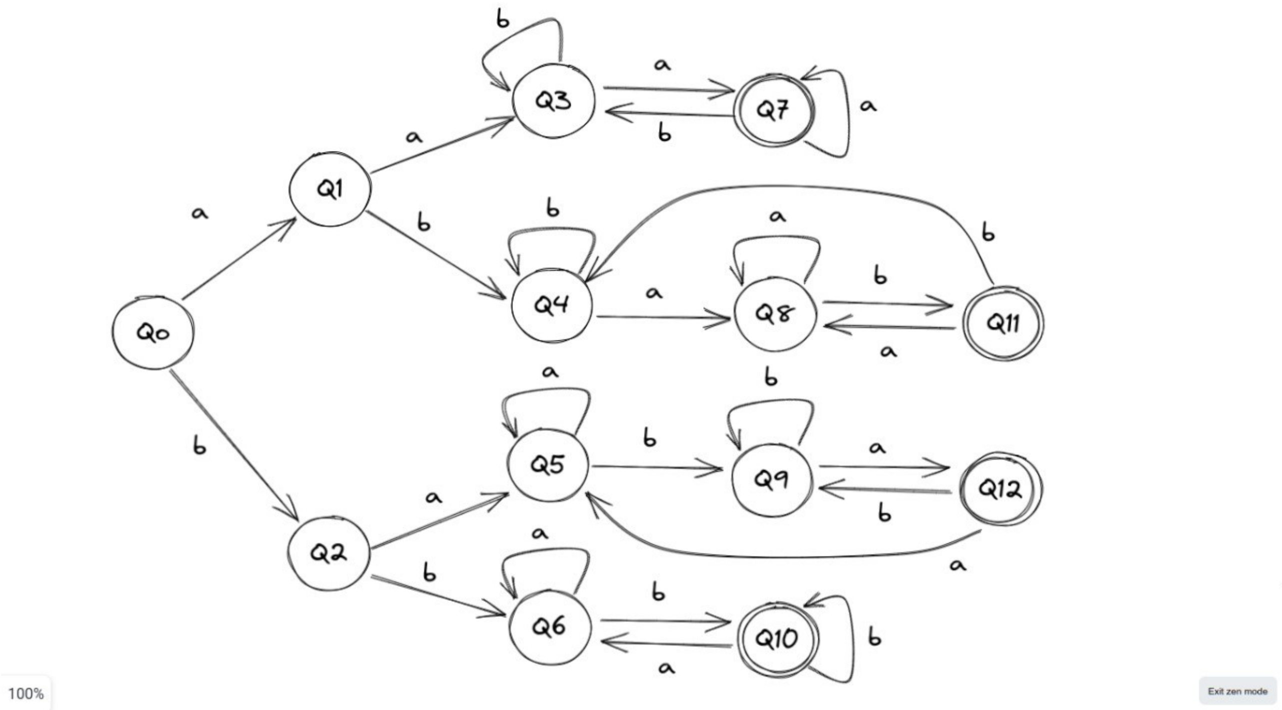
$L_6 = \{\ vwv\colon v, w \in \{a, b\}^*, |v| = 2\}$

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



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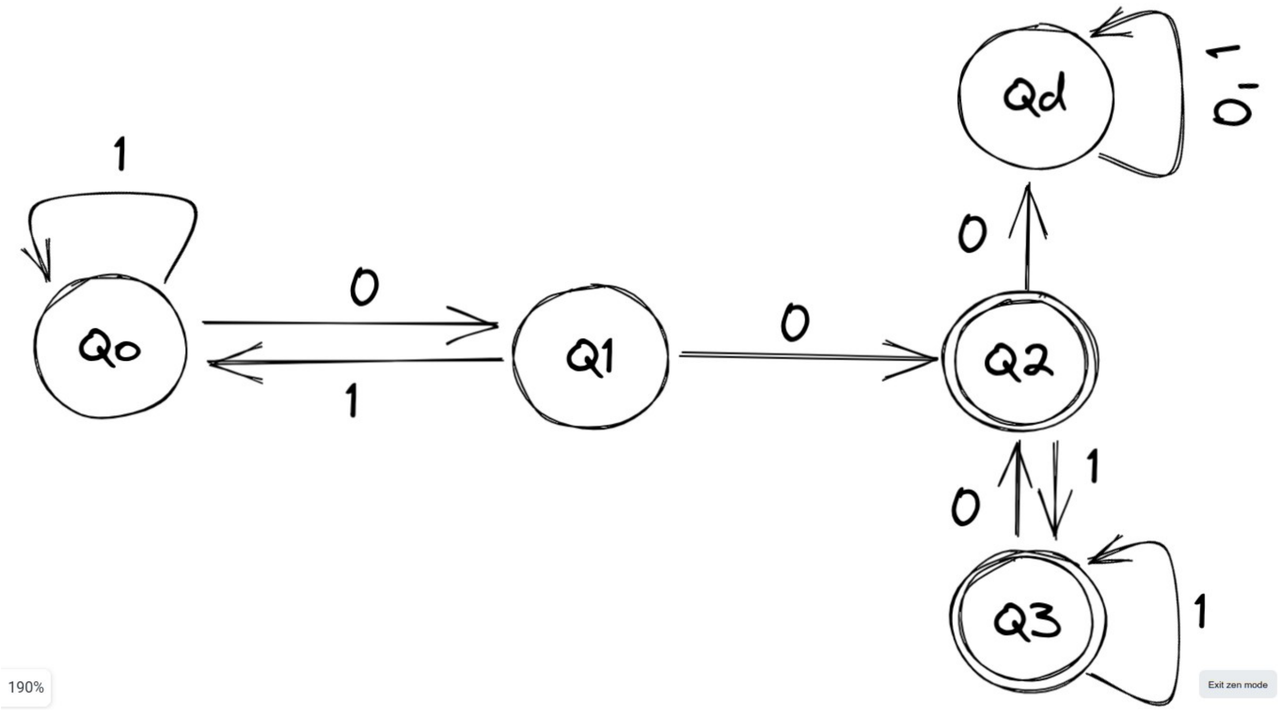
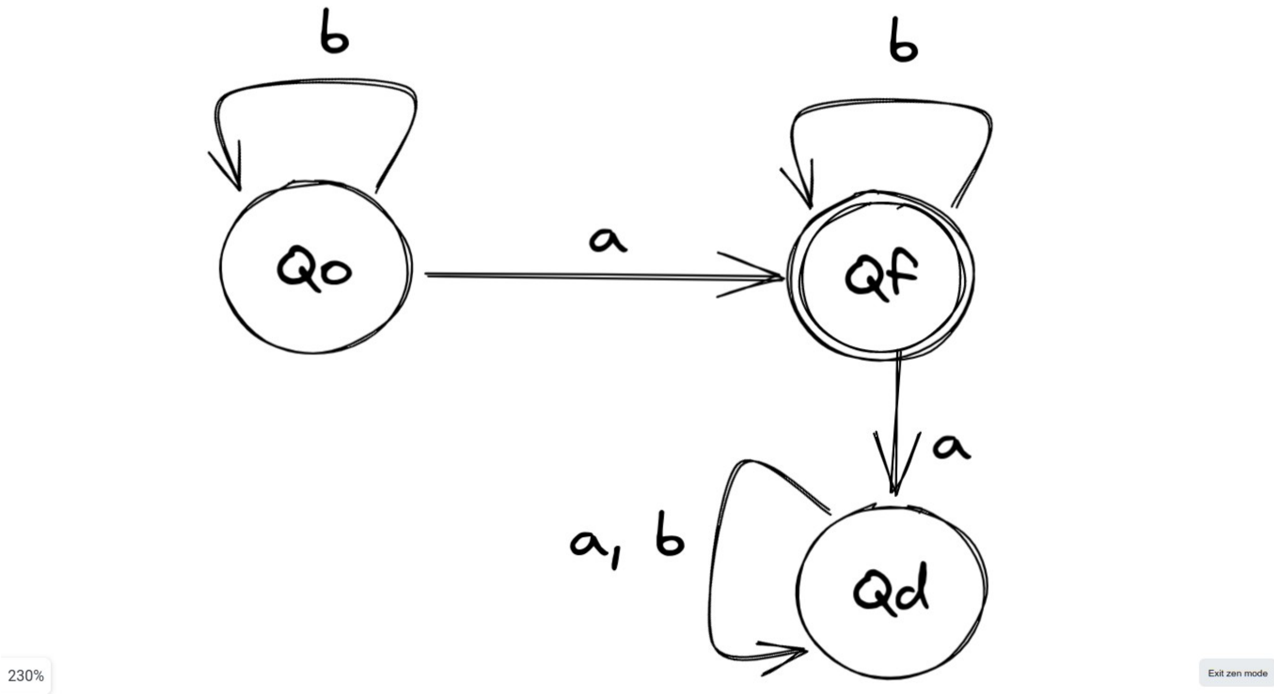
$L_7 =$ having exactly one pair of consecutive zeros

$$(1+01)^*00(1+10)^*$$



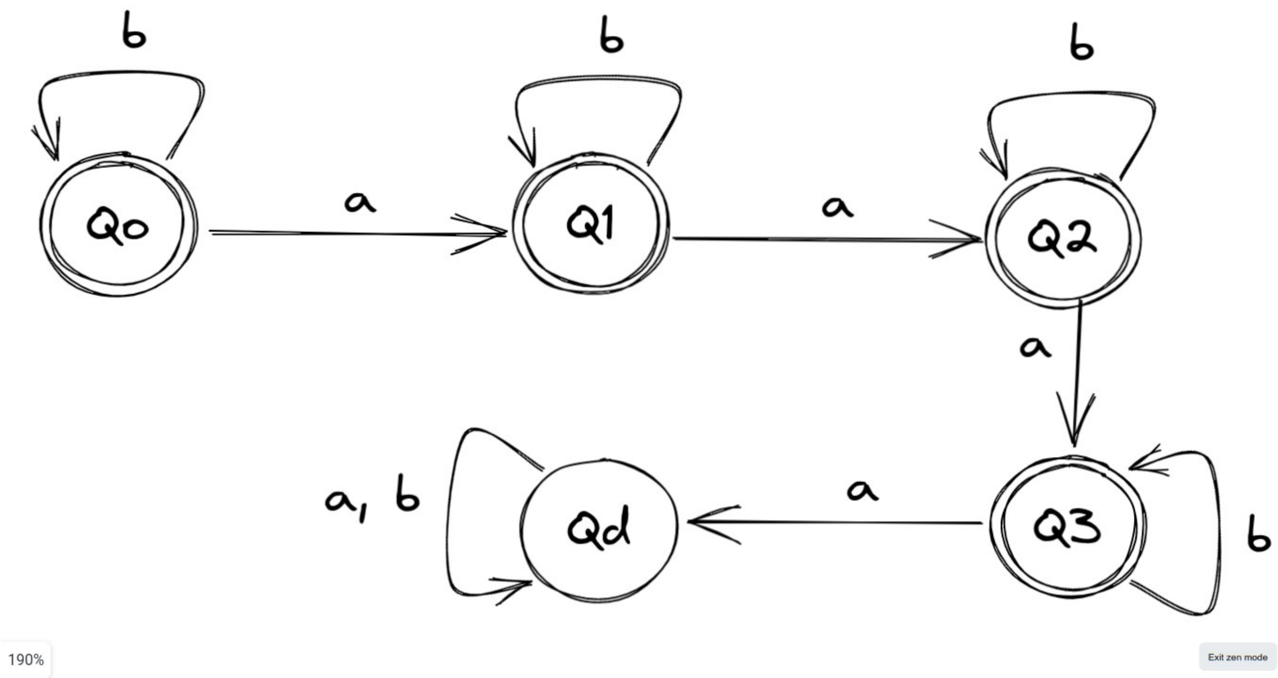
$L_8 =$ having exactly one a

b^*ab^*



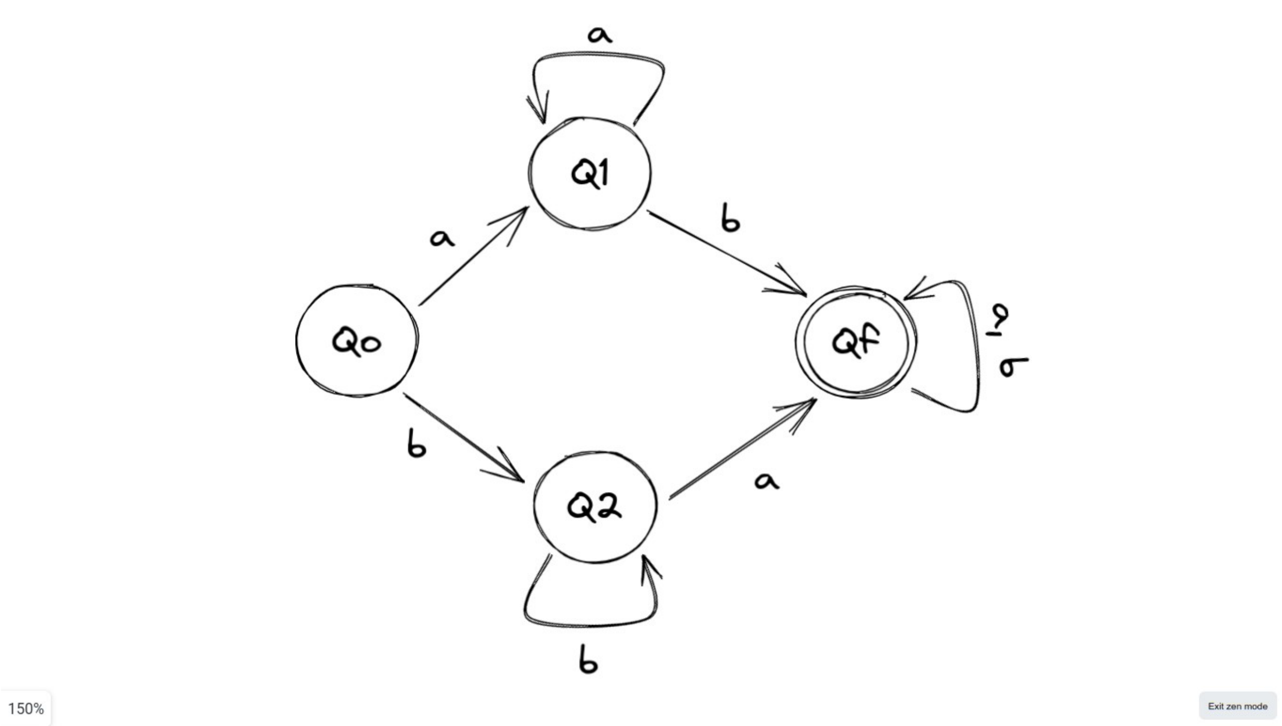
$L_9 =$ strings containing no more than three a's

$$b^*ab^*ab^*ab^* + b^*ab^*ab^* + b^*ab^* + b^*$$



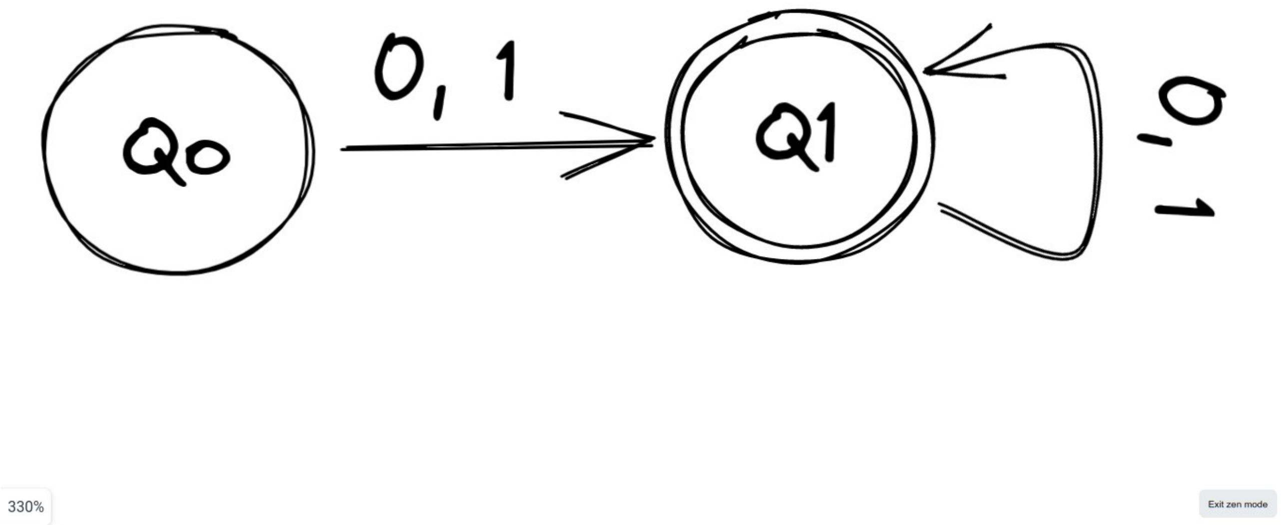
L_{10}= all strings that contain at least one occurrence of each symbol in alphabet

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



$$L_{11} = \text{all strings ending in } 0{,}1$$

$$(0+1)^*(0+1) \text{ or } (0+1)^+$$



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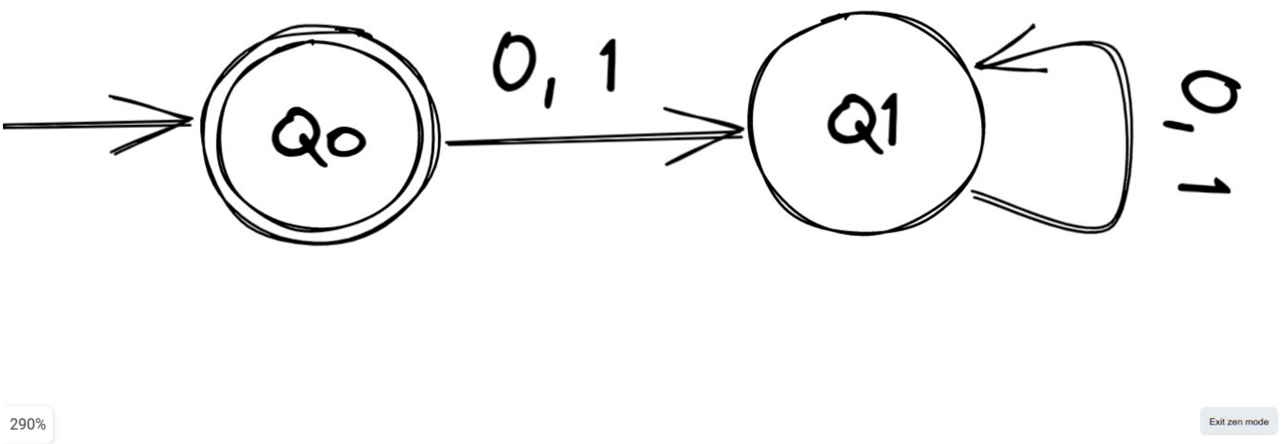
L_{12} = all strings not ending in 0 or 1

λ



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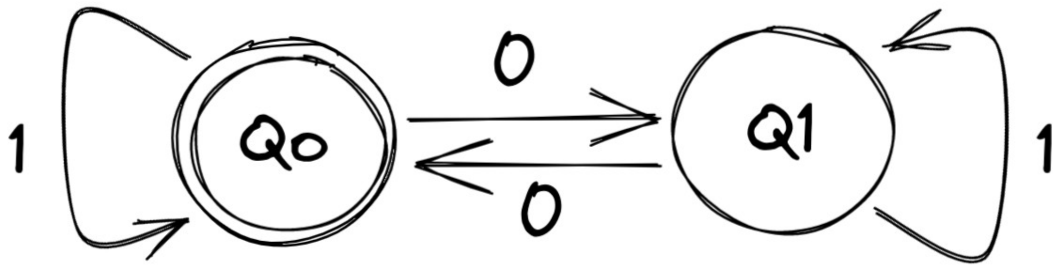
L_{13} = all strings containing even number of zeros

(1*01*01*)*

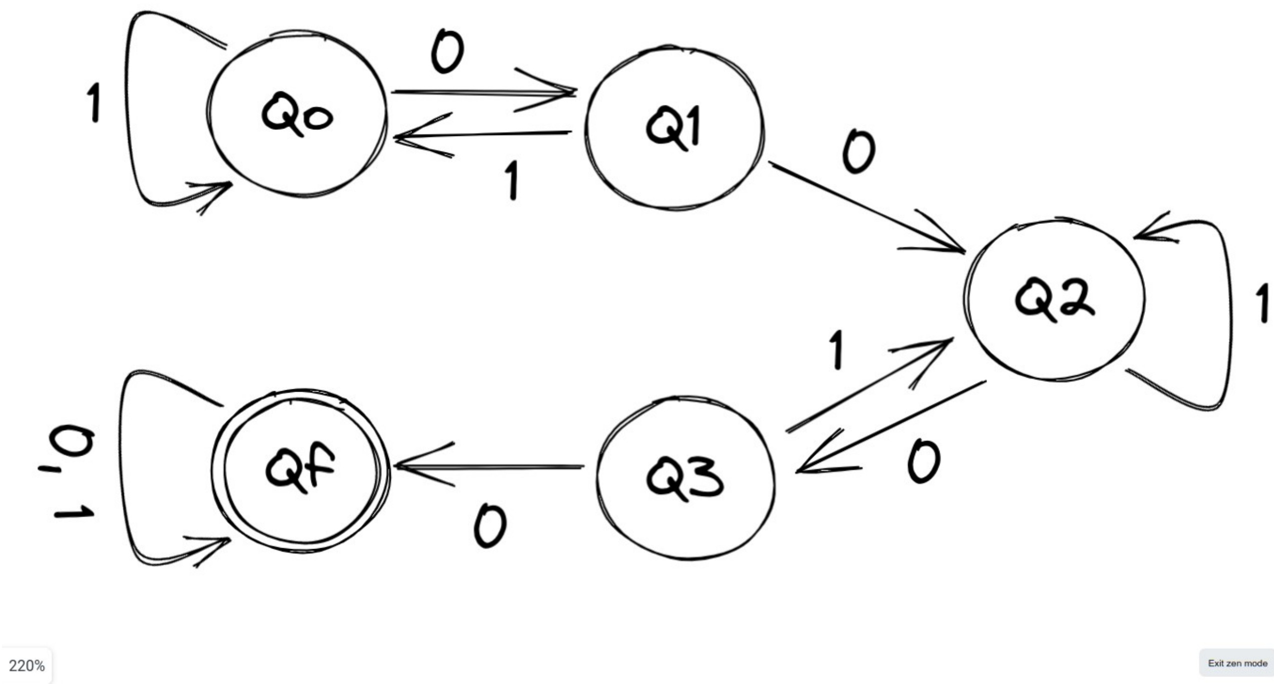


270%

Exit zen mode

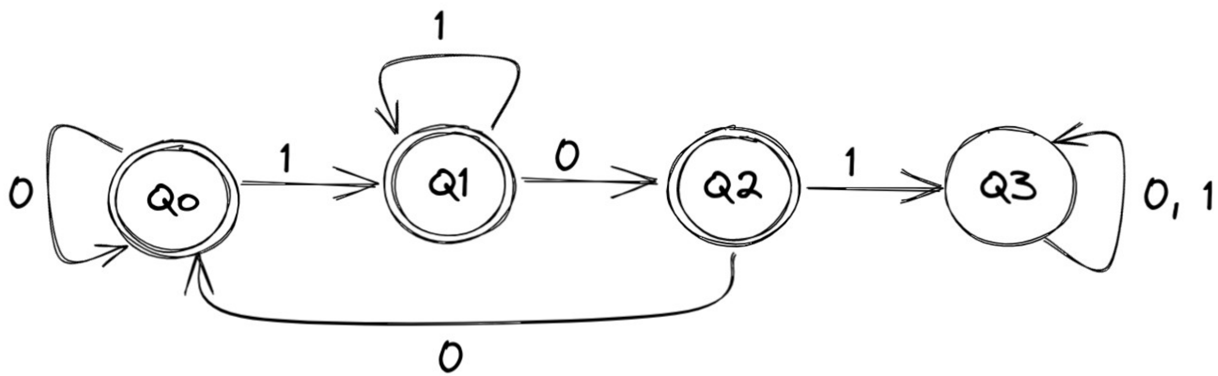
L_{14} = all string having at least two occurrences of substring 00

$$(0+1)^*00(0+1)^*00(0+1)^*$$



$L_{15} =$ all string not containing 101

$(0+\lambda)(00+1)^*(0+\lambda)$

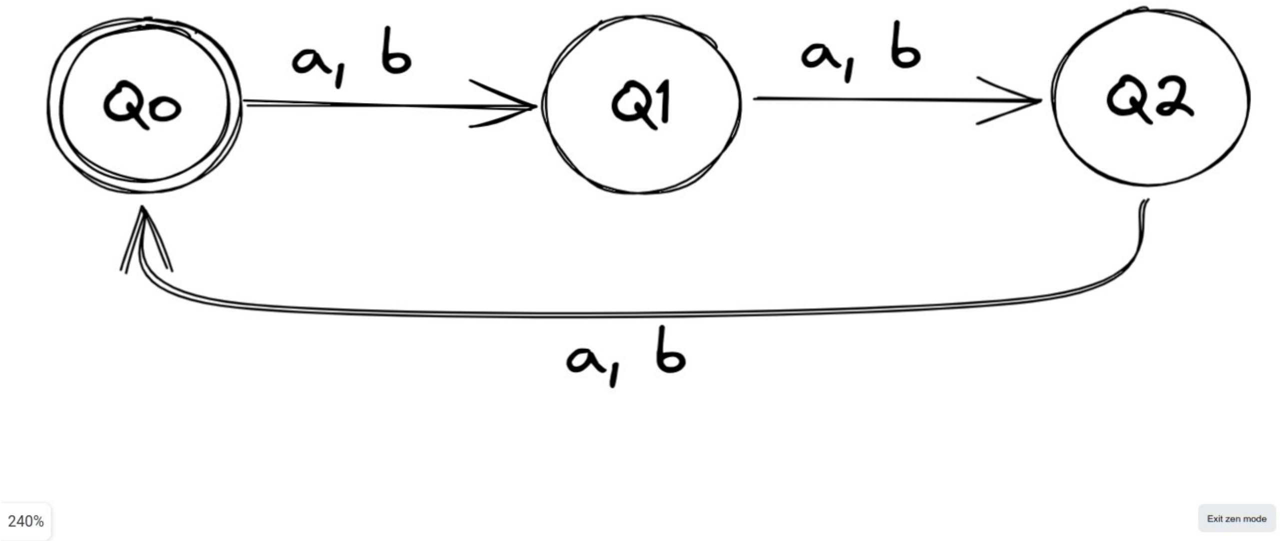


160%

Exit zen mode

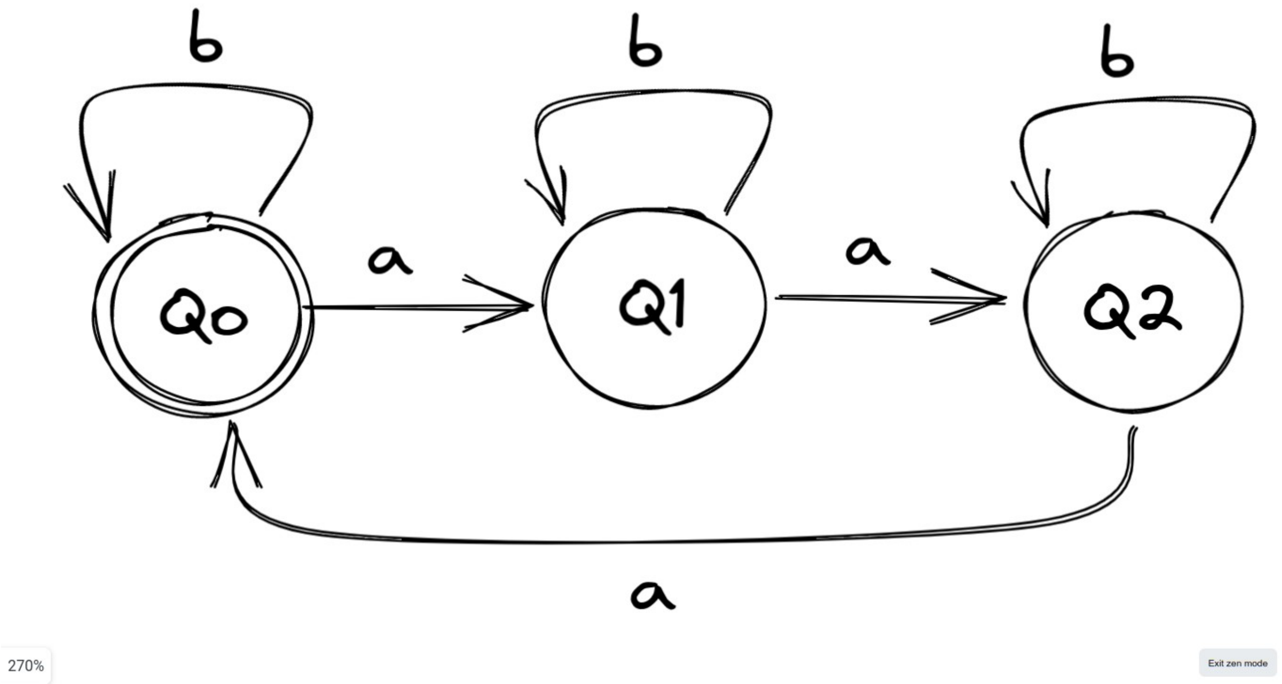
$$L_{16} = \{\ w : |w| \bmod 3 = 0\ \}$$

$$((a+b)^3)^*$$



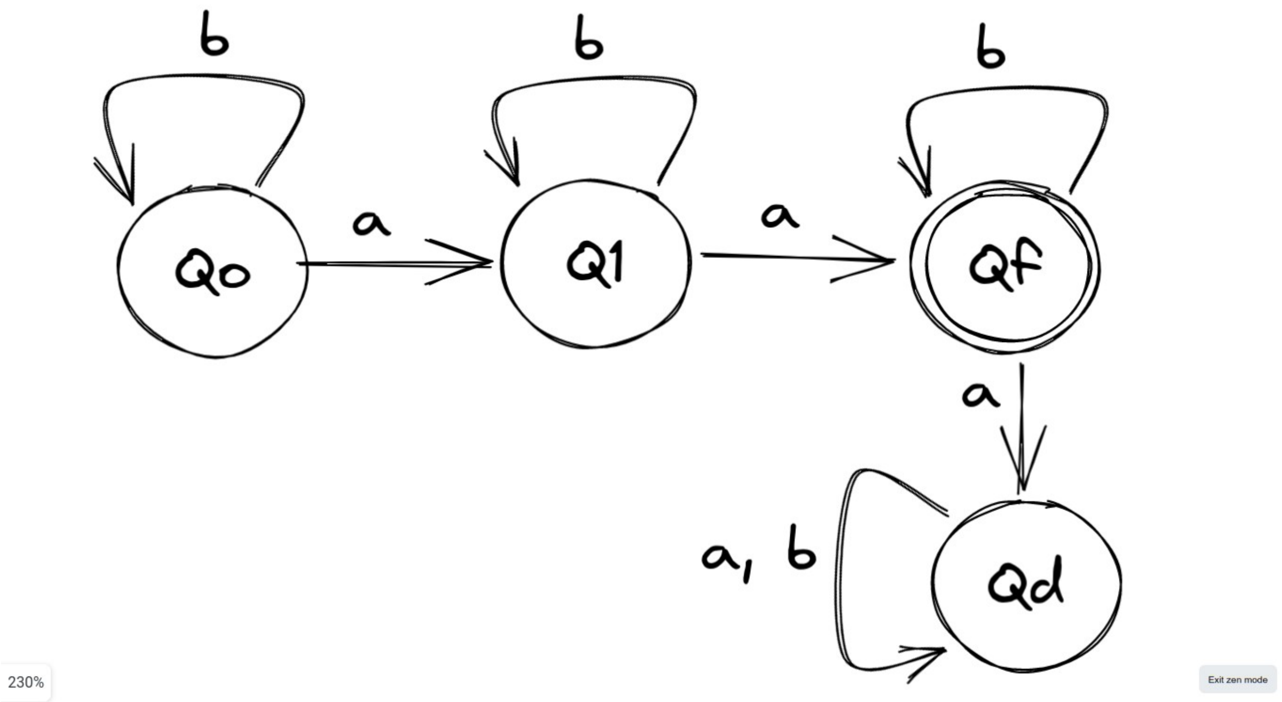
$$L_{17} = \{\ w : n_a(w) \bmod 3 = 0\ \}$$

$$(b^*ab^*ab^*ab^*)^*$$



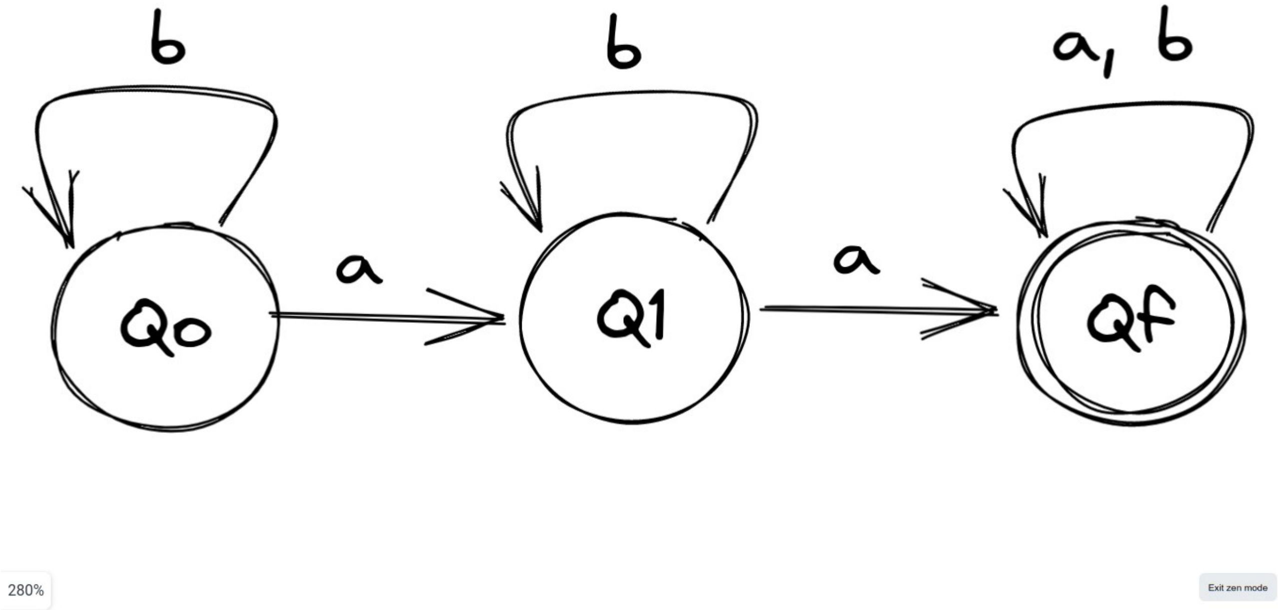
L_{18} = The language of all strings containing exactly two a's

$b^*ab^*ab^*$



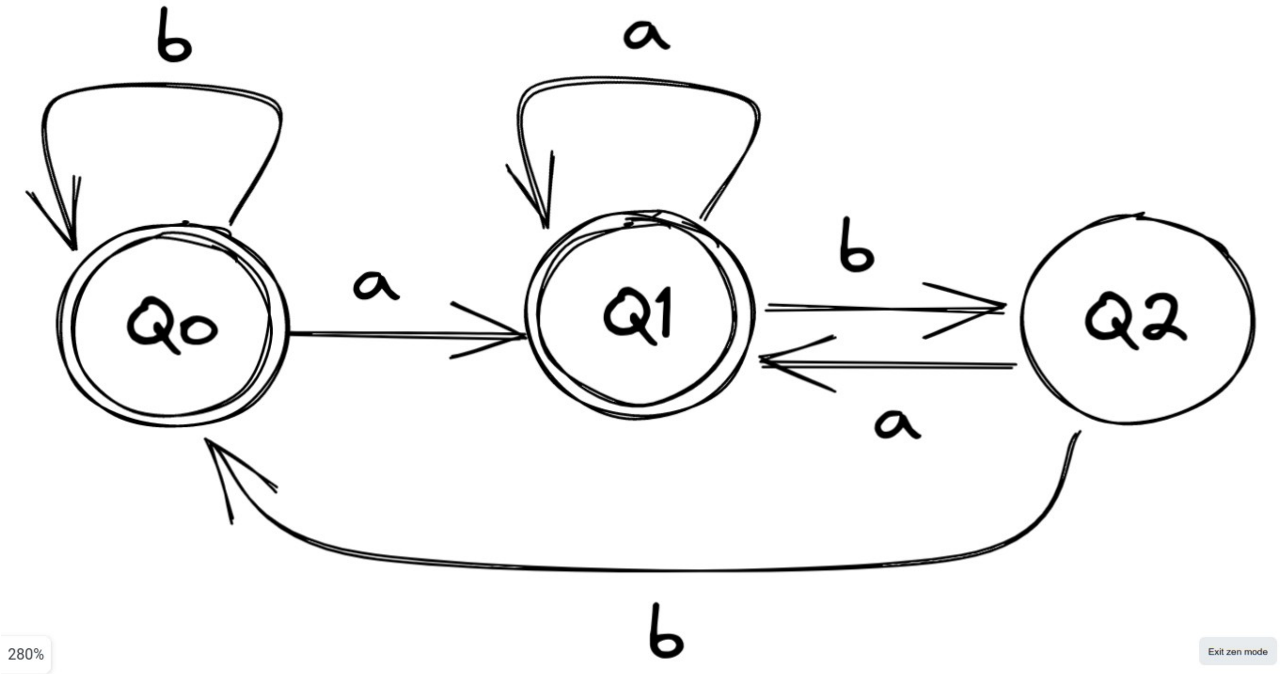
L_{19} = The language of all strings containing atleast two a's

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



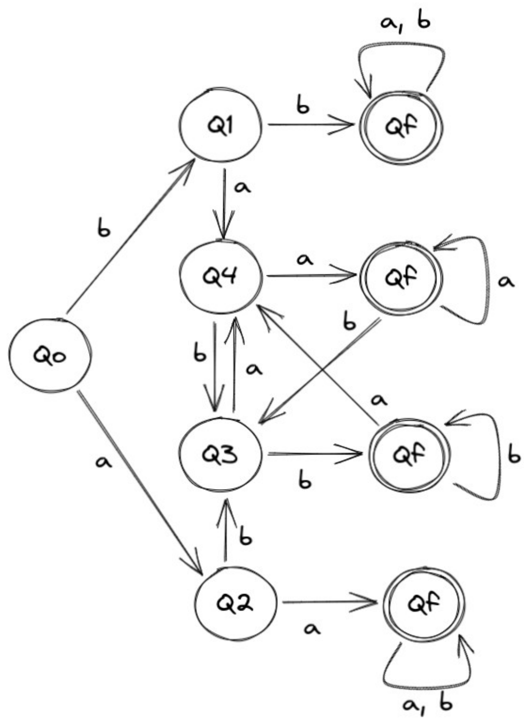
L_{21} = The language of all strings that do not end with ab

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



L_{21} = The language of all strings that begin or end with aa or bb

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

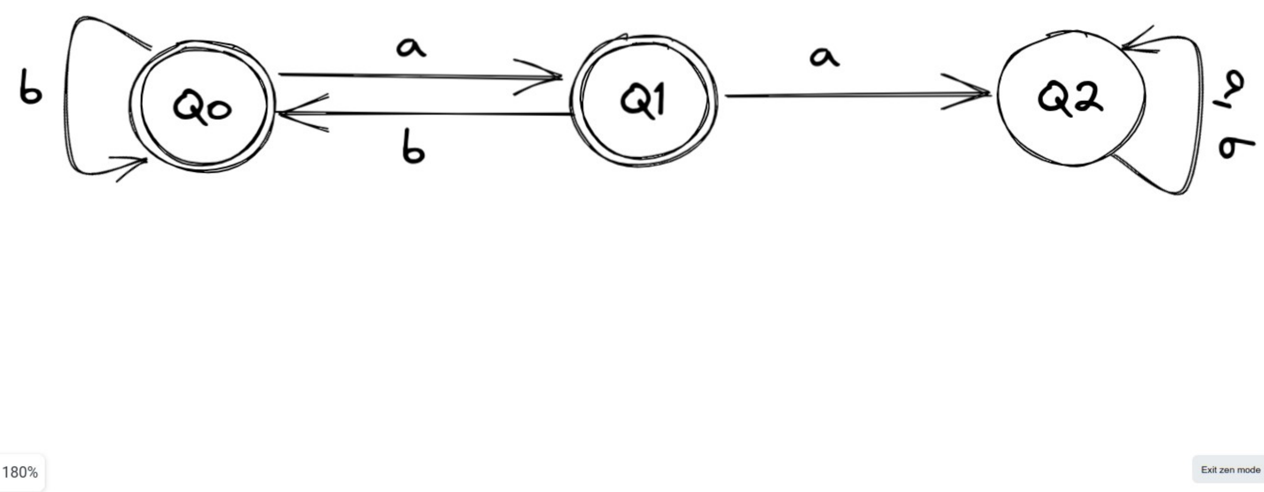


100%

Exit zen mode

L_{22} = The language of all strings not containing the substring aa

$(ab+b)^*$



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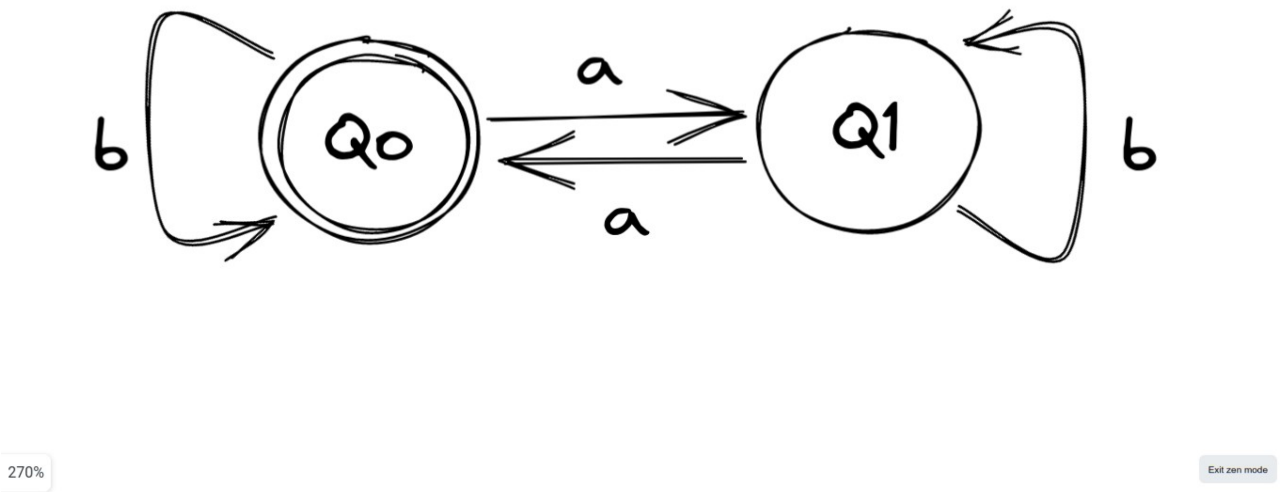
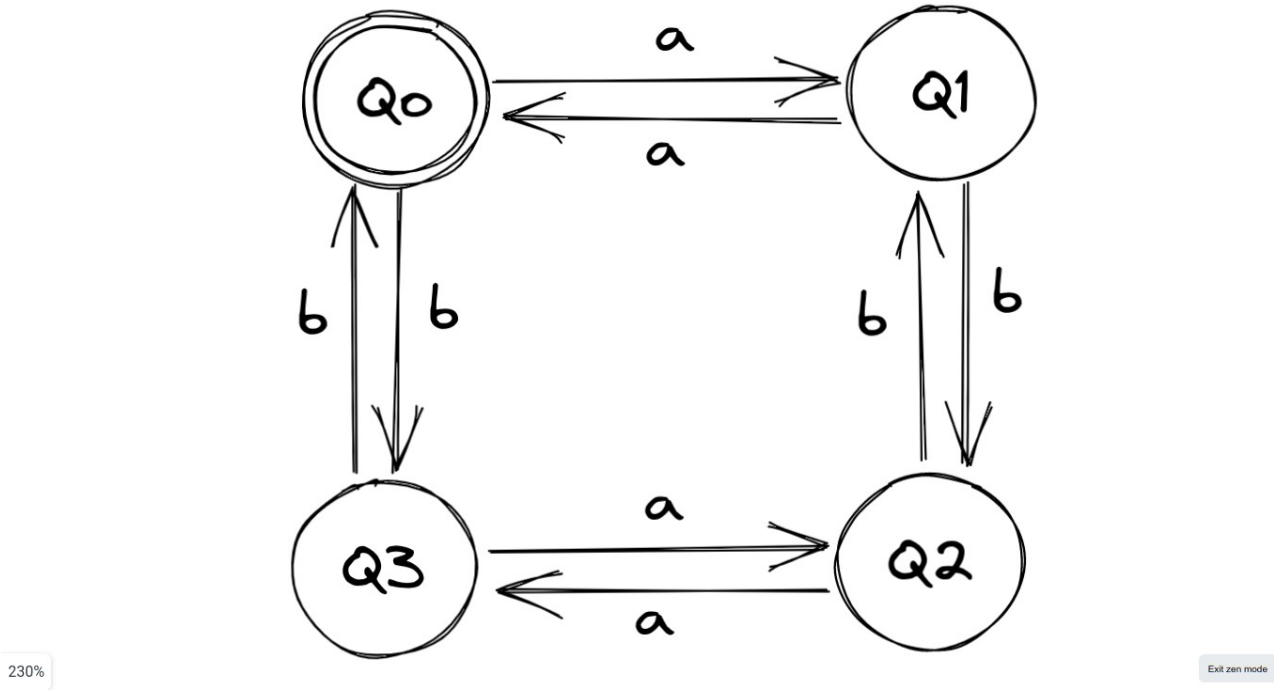
L_{23} = The language of all strings in which number of a's is even

(b*ab*ab*)*



L_{24} = The language of all strings in which both number of a's and number of b's are even

$((ab+ba+aa+bb)^2)^*$



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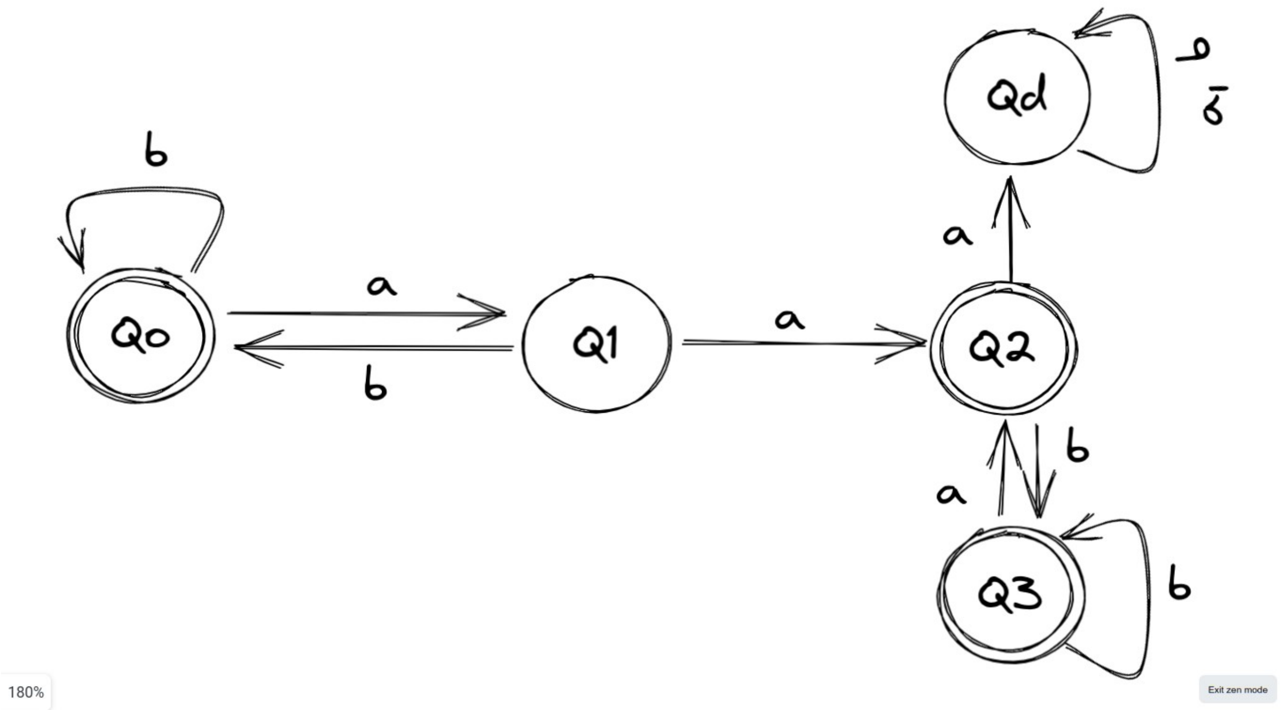
L_{25} = The language of all strings containing no more than one occurrence of the string aa.

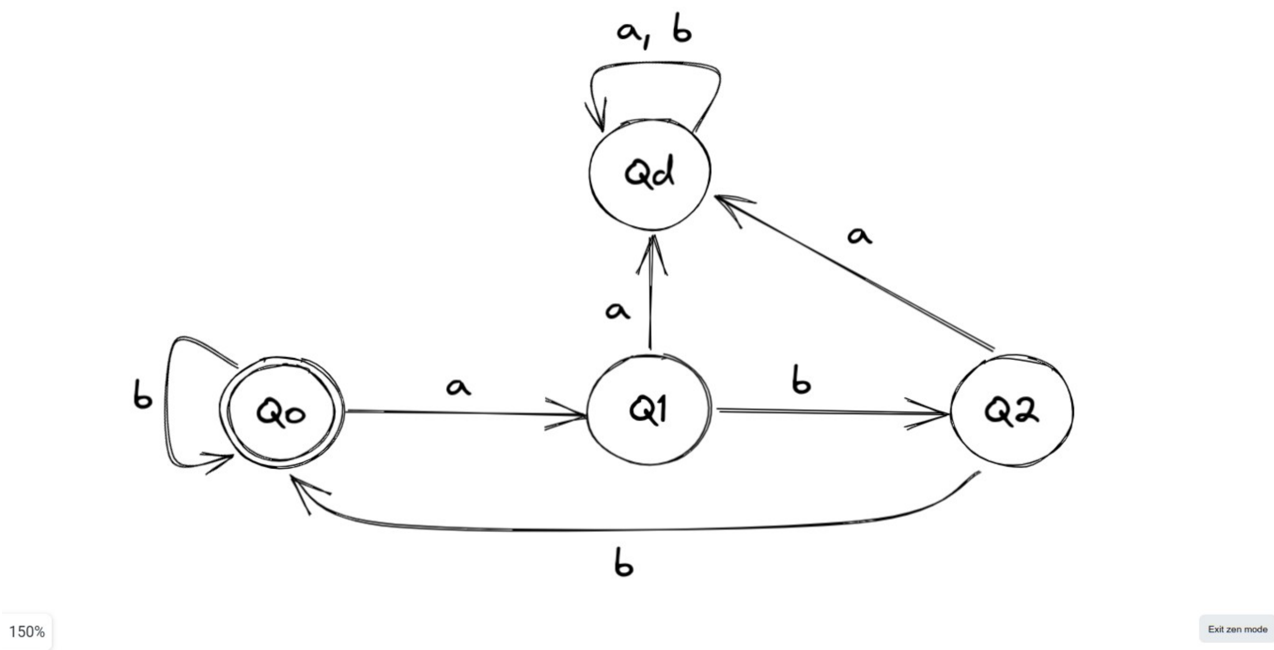
(The aaa string contains two occurrences of aa.)

(b+ab)*aa(b+ba)* + (b+ab)*



L_{26} = The language of all strings in which every a (if there are any) is followed immediately by bb

$(abb + b)^*$



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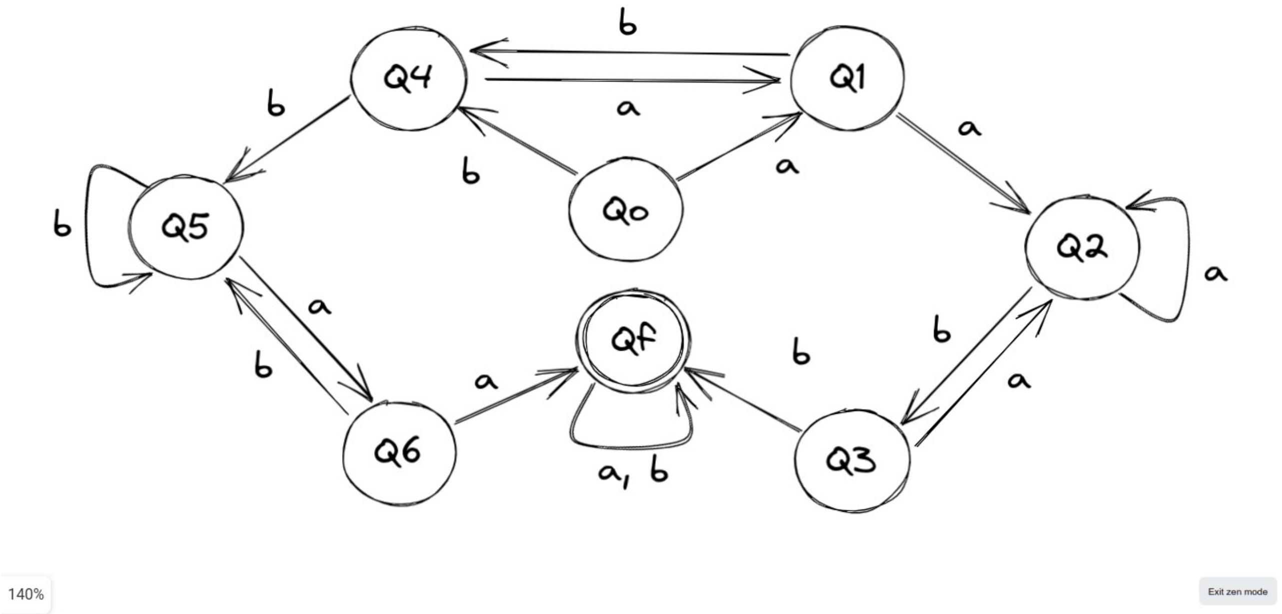
L_{27} = The language of all strings containing both bb and aa as substrings

(a+b)*aa(a+b)*bb(a+b)*



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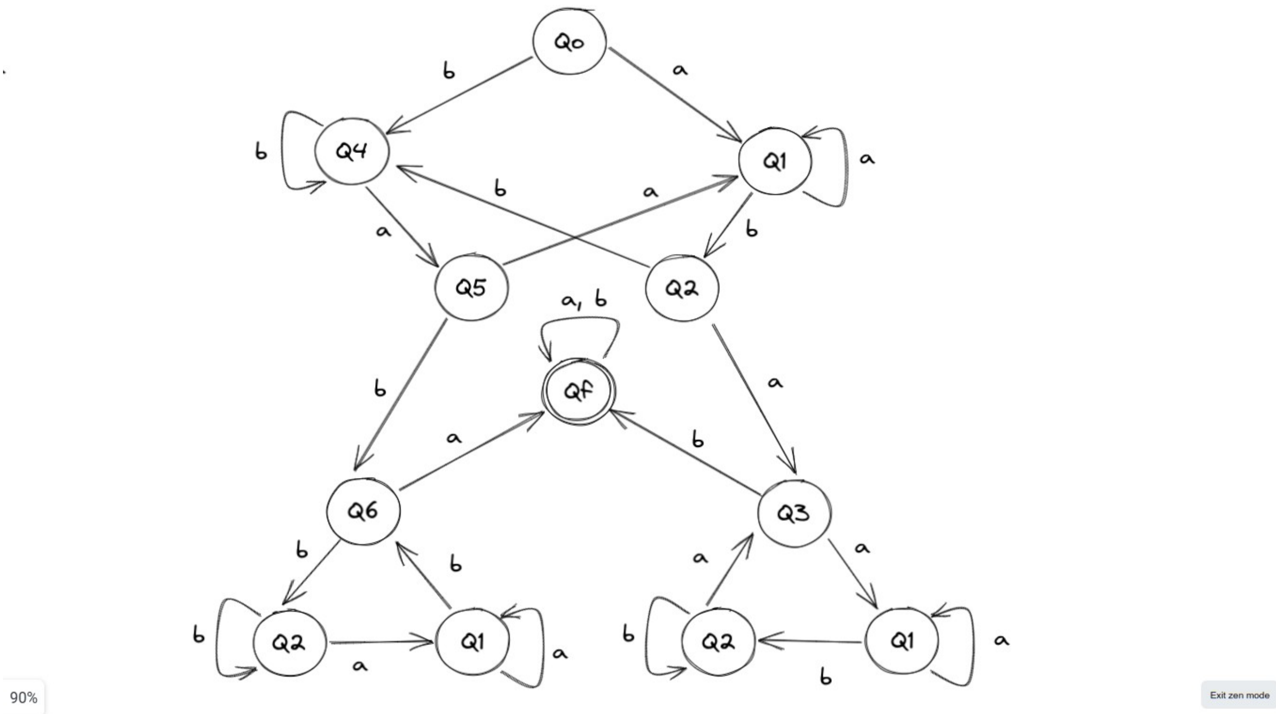
L_{28} = The language of all strings containing both bab and aba as substrings

(a+b)*aba(a+b)*bab(a+b)* + (a+b)*bab(a+b)*aba(a+b)* + (a+b)*(abab + baba)(a+b)*



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