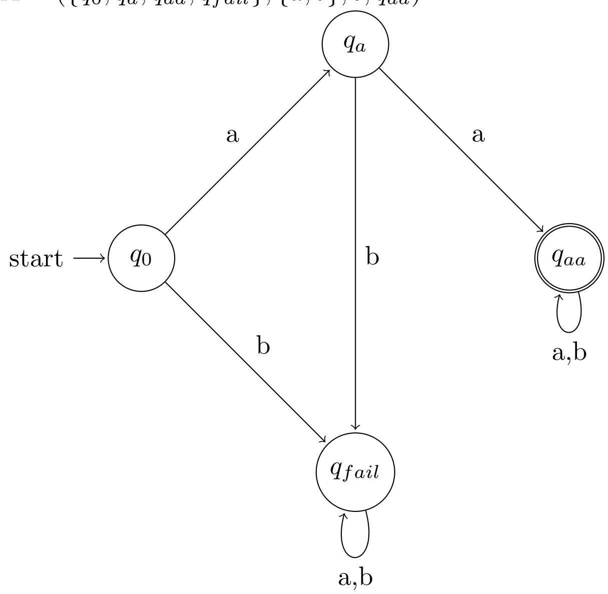
1 Automatas:

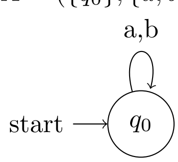
1.1 Accept words starting with two consecutive a's:

$A = (\{q_0, q_a, q_{aa}, q_{fail}\}, \{a, b\}, \delta, q_{aa})$



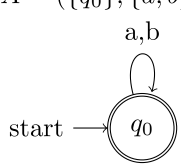
1.2 Accept no words:

$A = (\{q_0\}, \{a, b\}, \delta, \emptyset)$



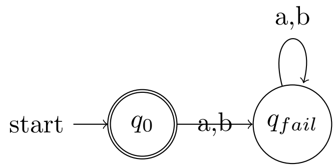
1.3 Accept all words:

$A = (\{q_0\}, \{a, b\}, \delta, \Sigma^*)$



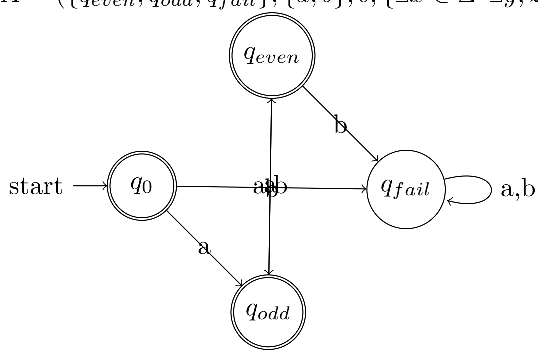
1.4 Only accept empty words (ϵ):

$A = (\{q_0, q_{fail}\}, \{a, b\}, \delta, \{\epsilon\})$



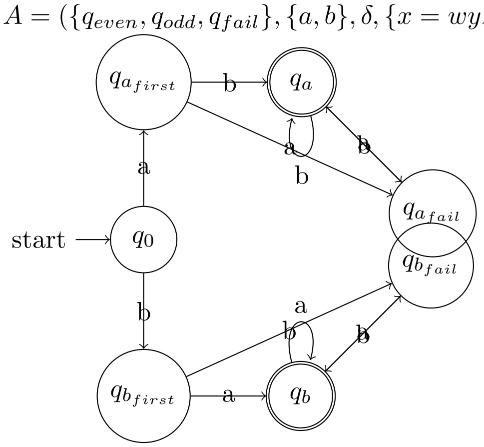
1.5 Only accept words which have their odd characters set to a:

$A = (\{q_{even}, q_{odd}, q_{fail}\}, \{a, b\}, \delta, \{\exists x \in \Sigma^* \exists y, z \in \Sigma \mid x = yz \land z = a\})$

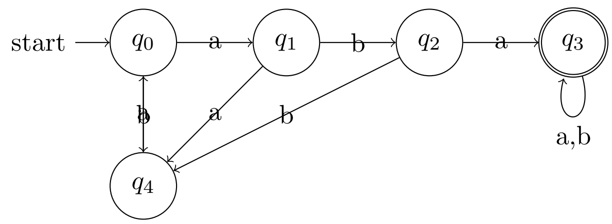


1.6 Only accept words which have their first character set differently than the last:

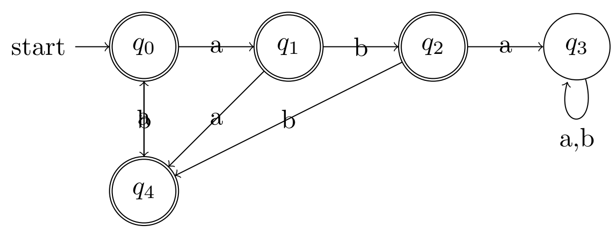
$A = (\{q_{even}, q_{odd}, q_{fail}\}, \{a, b\}, \delta, \{x = wyz \mid w, z \in \Sigma \land y \in \Sigma^* \land w \neq z\})$



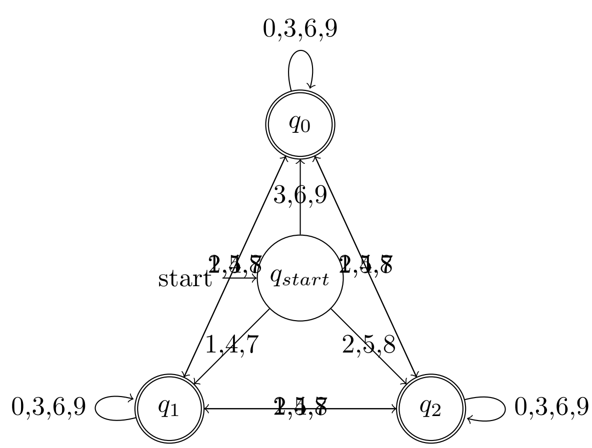
1.7 Only accept words which contain the string aba:



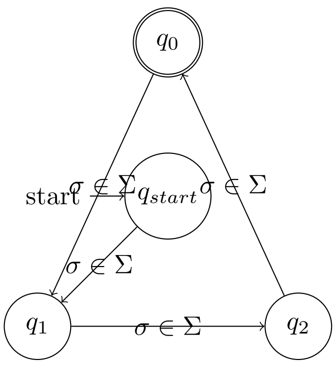
1.8 Only accept words which do not contain the string aba:



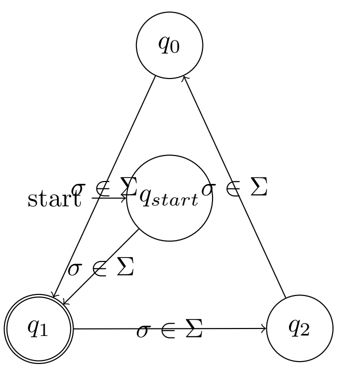
1.9 Only accept words which are numbers divisible by 3:



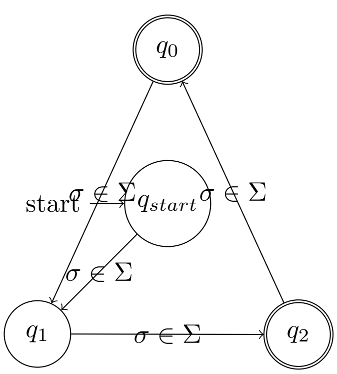
1.10 Only accept words which's length is divisible by 3:



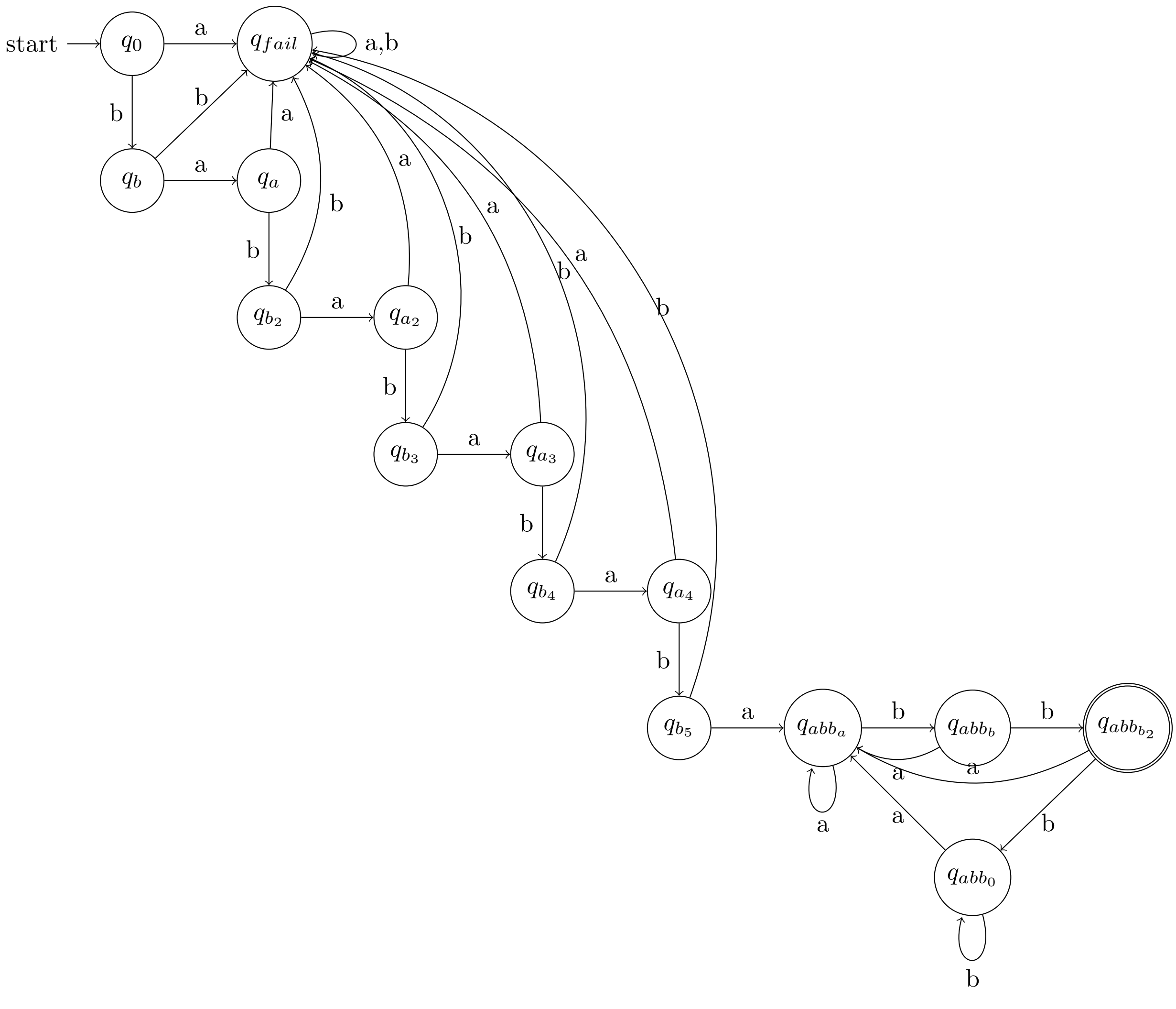
1.11 Only accept words which have a length such that it returns 1 when paired with modulu 3:



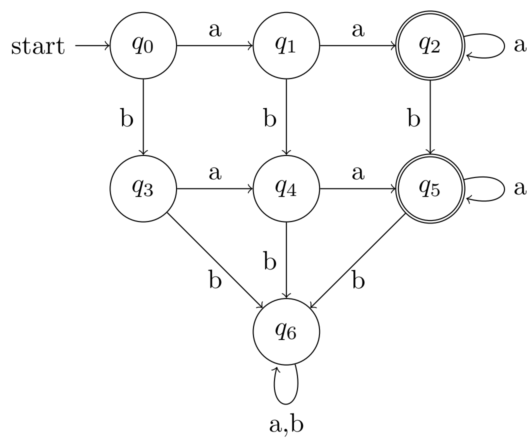
1.12 Only accept words which have a length such that it does not return 1 when paired with modulu 3:



1.13 Only accept words which begin with 5 consecutive ba's and end with an abb:

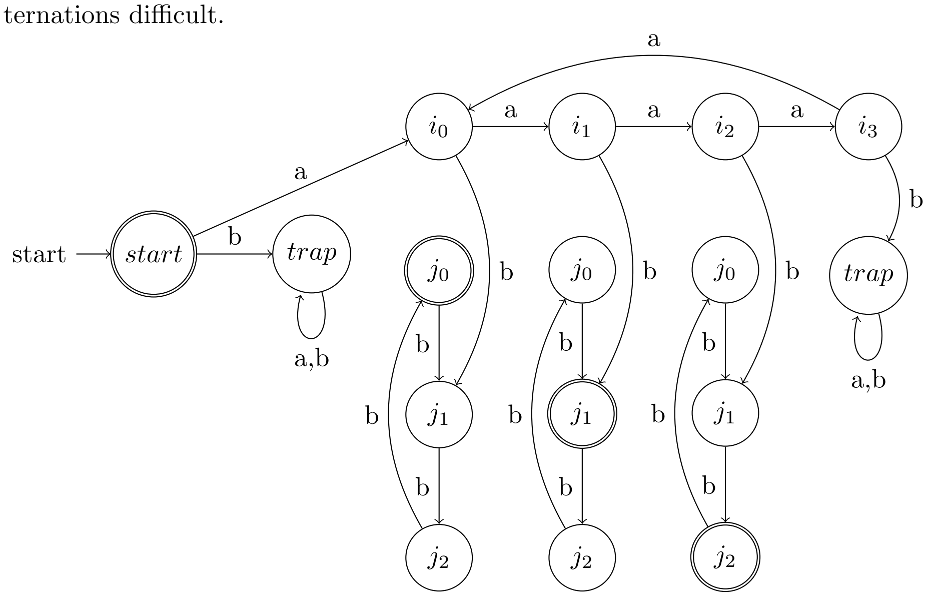


1.14 Only accept words which contain the letter a at least twice and no more than 1 of the letter b:



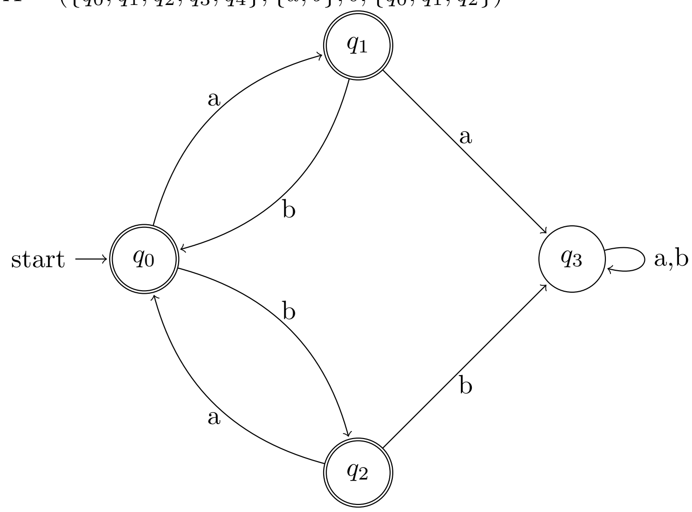
1.15 Only accept words of the following form: $a^i b^j \mid i \bmod 4 = j \bmod 3$

Additional traps should be set in case 'a' is received as input after moving to the j section, though I had already built a structure that would make such alternations difficult.



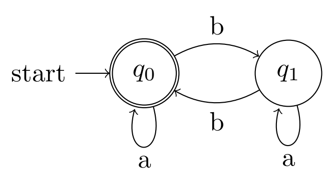
1.16 Accept words which have all their prefixes include a similar (+-1 divergence) rate of a's and b's:

$A = (\{q_0, q_1, q_2, q_3, q_4\}, \{a, b\}, \delta, \{q_0, q_1, q_2\})$

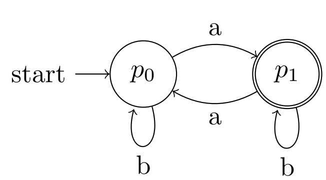


1.17 Given A,B automatas above abc $\{a, b\}$ build an automata C which accepts the language $L(A) \cap L(B)$

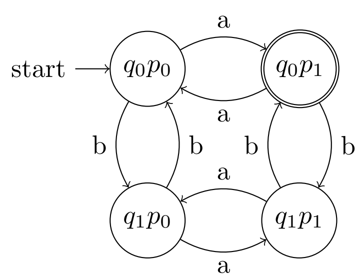
Automata A:



Automata B:

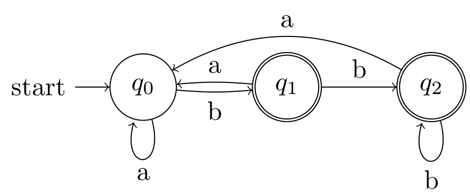


Automata C:

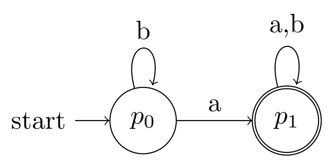


1.18 Given A,B automatas above abc $\{a, b\}$ build an automata C which accepts the language $L(A) \cup L(B)$

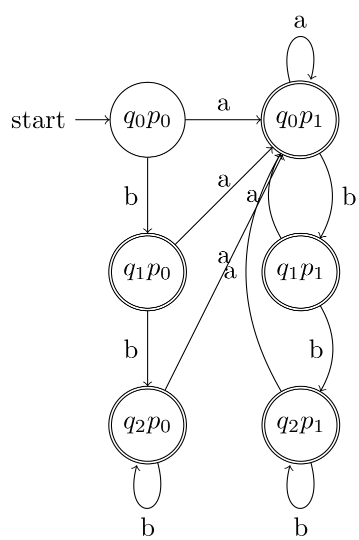
Automata A:



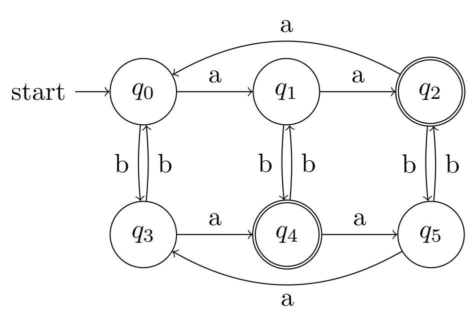
Automata B:



Automata C:



1.19 Given a finite deterministic automata A defined the following way:



1.19.1 Propose a possible formal automata to match the diagram

My supposition of L(A) to match the automata at hand:
$L(A) = \{w \in \{a, b\}^* \mid (\#a_w \text{ mod } 3) + (\#b_w \text{ mod } 2) = 2\}$

1.19.2 What alternation to the diagram must one perform in order for the automata at hand to be the following:

1.19.2.1 $\{w \in \{a, b\}^* \mid (\#a_w \text{ mod } 3) = (\#b_w \text{ mod } 2)\}$:

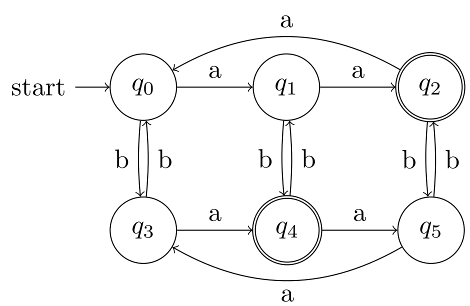
The set of accepted states must be altered to the following:
$F^C = \{q_0, q_4\}$

1.19.2.2 $\{w \in \{a,b\}^* \mid ((\#a_w - 1) \bmod 3) + (\#b_w \bmod 2) = 2\}$:

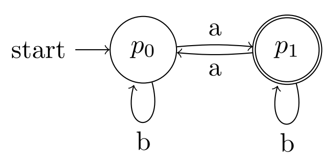
The set of accepted states must be altered to the following:
$F^C = \{q_0, q_5\}$

1.20 Given the following finite deterministic automatas A, B, C defined the following way:

1.20.1 Diagram A:



1.20.2 Diagram B:



1.20.3 Diagram C: