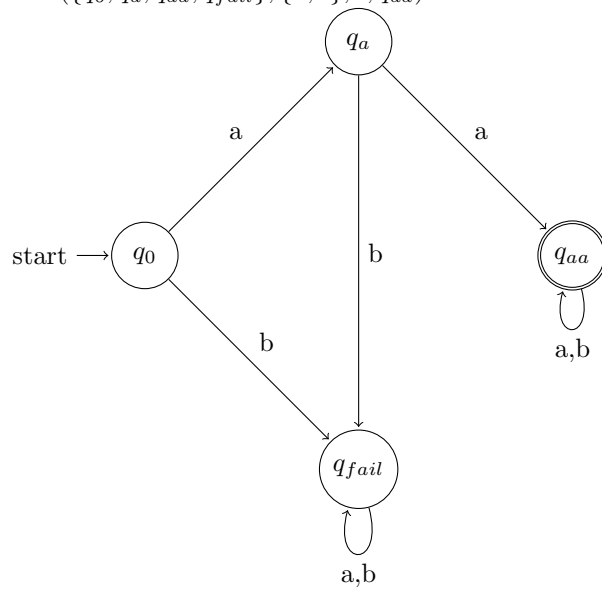


1 Automatas:

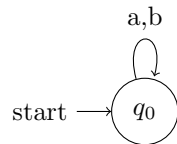
1.1 Accept words starting with two consecutive a's:

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



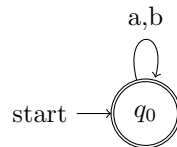
1.2 Accept no words:

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



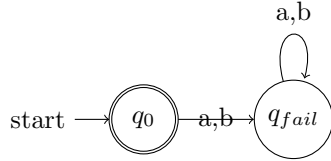
1.3 Accept all words:

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



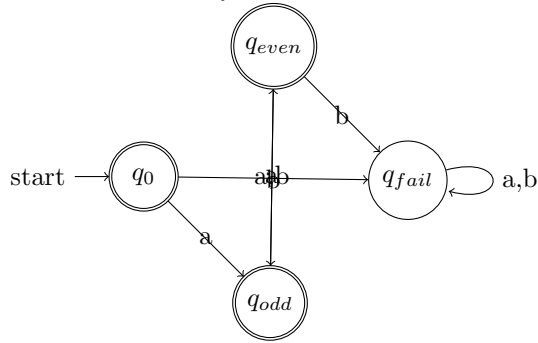
1.4 Only accept empty words (ϵ):

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



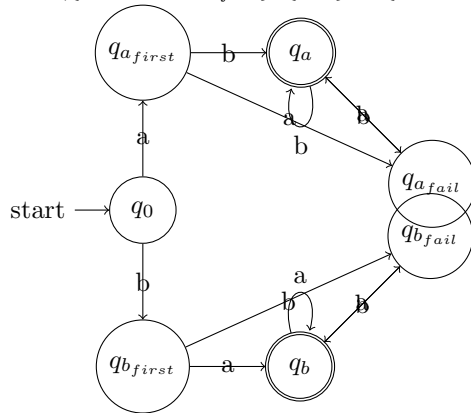
1.5 Only accept words which have their odd characters set to a:

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

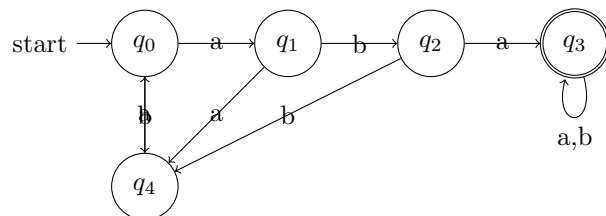


1.6 Only accept words which have their first character set differently than the last:

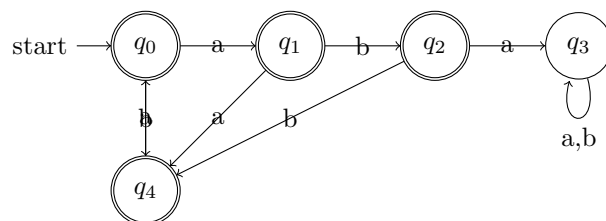
$$A = (\{q_{a_first}, q_{a_fail}, q_{b_first}, q_{b_fail}, q_a, q_b\}, \{a, b\}, \delta, \{x = wyz \mid w, z \in \Sigma \wedge y \in \Sigma^* \wedge w \neq z\})$$



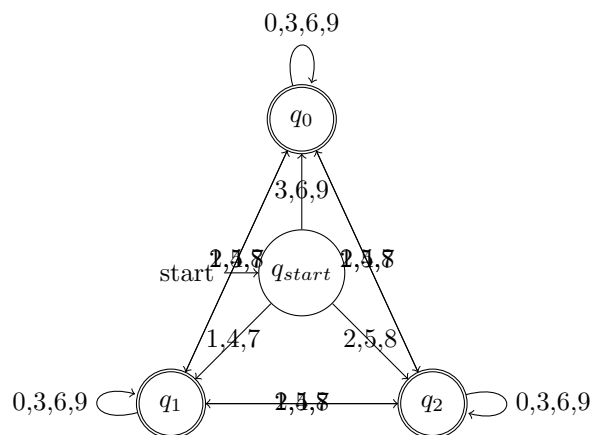
1.7 Only accept words which contain the string aba:



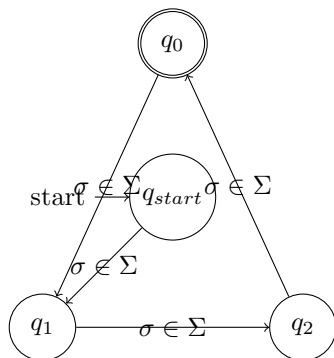
1.8 Only accept words which do not contain the string aba:



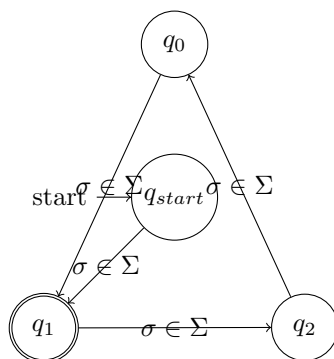
1.9 Only accept words which are numbers divisible by 3:



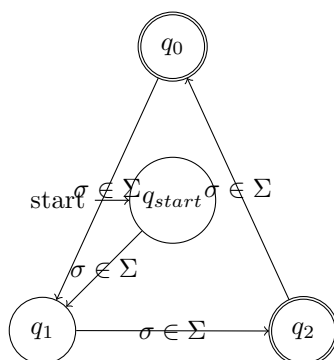
1.10 Only accept words which's length is divisible by 3:



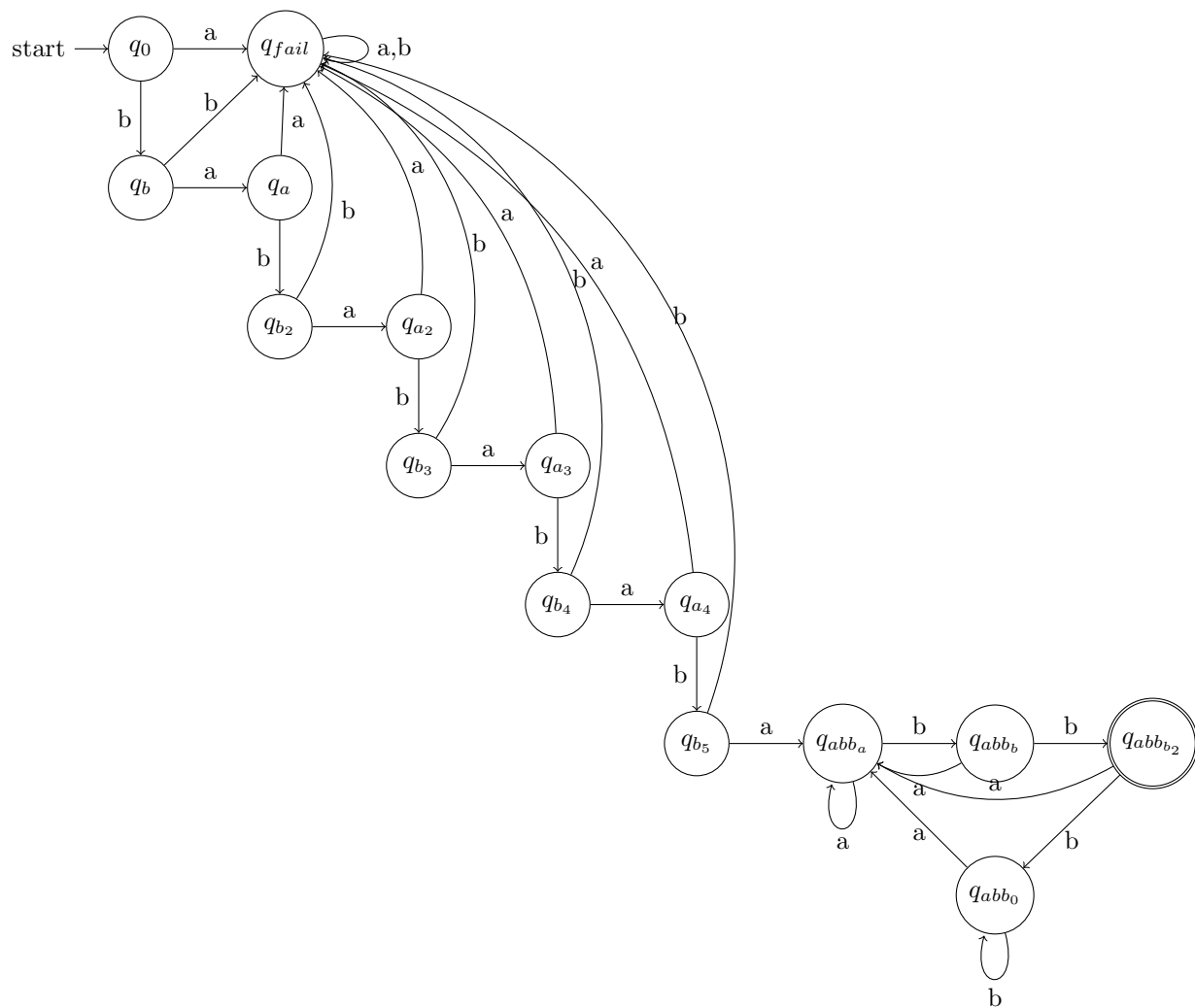
1.11 Only accept words which have a length such that it returns 1 when paired with modulu 3:



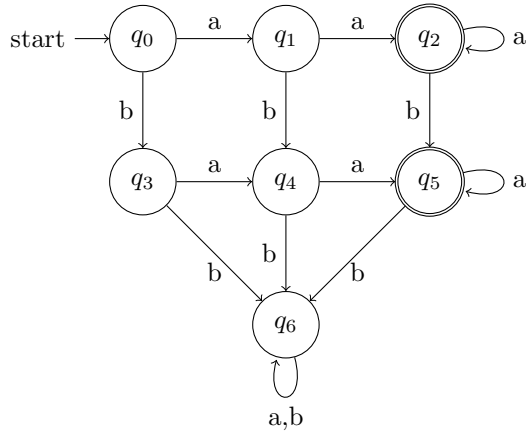
1.12 Only accept words which have a length such that it does not return 1 when paired with modulu 3:



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

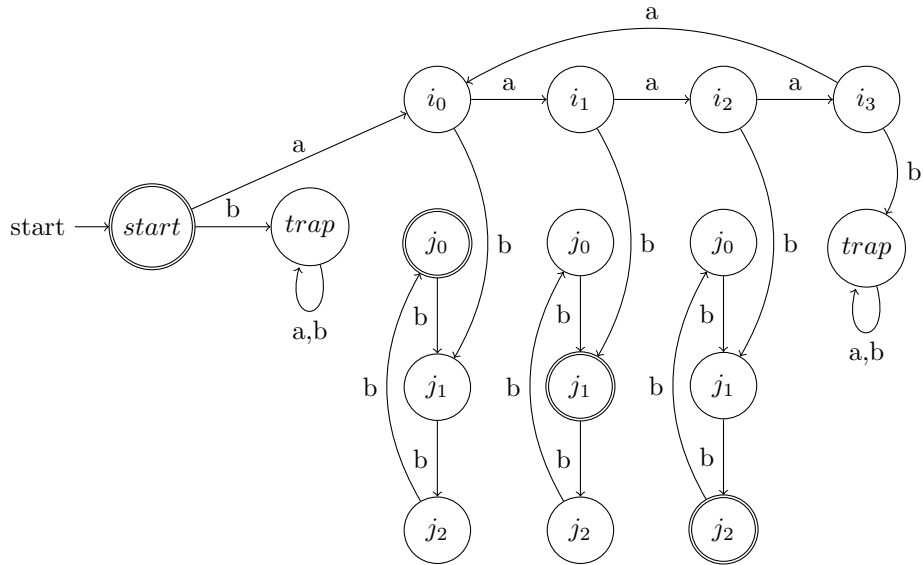


1.14 Only accept words which contain the letter a at least twice and no more than 1 of the letter b:



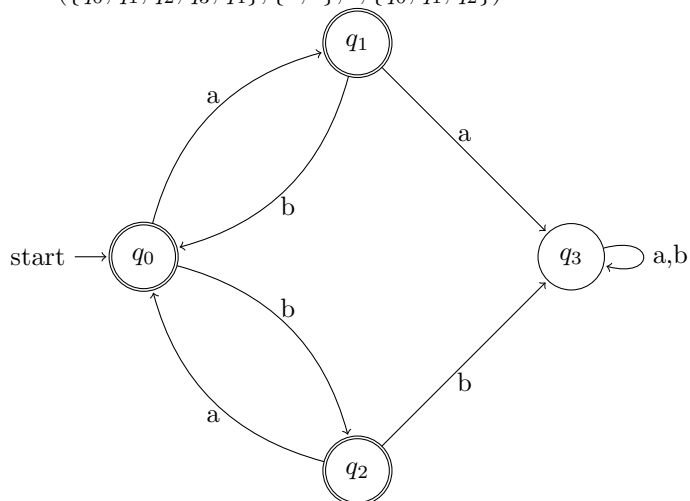
1.15 Only accept words of the following form: $a^i b^j \mid i \bmod 4 = j \bmod 3$

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.



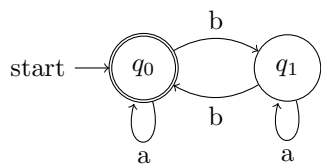
1.16 Accept words which have all their prefixes include a similar (+-1 divergence) rate of a's and b's:

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

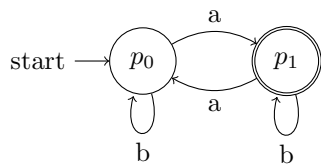


1.17 Given A,B automatas above abc $\{a, b\}$ build an automata C which accepts the language $L(A) \cap L(B)$

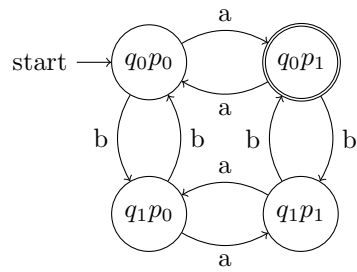
Automata A:



Automata B:

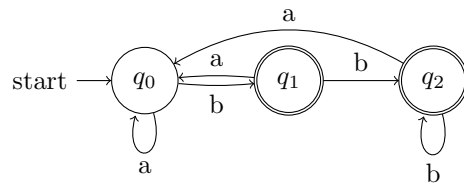


Automata C:

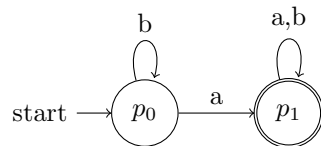


1.18 Given A,B automatas above abc $\{a,b\}$ build an automata C which accepts the language $L(A) \cup L(B)$

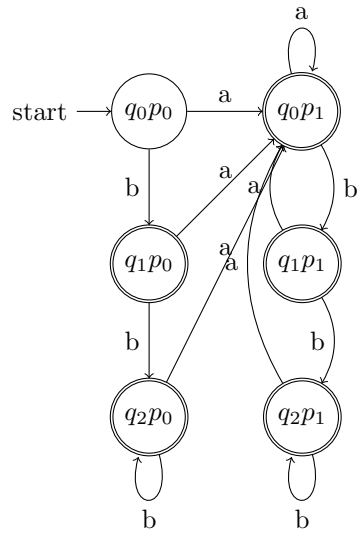
Automata A:



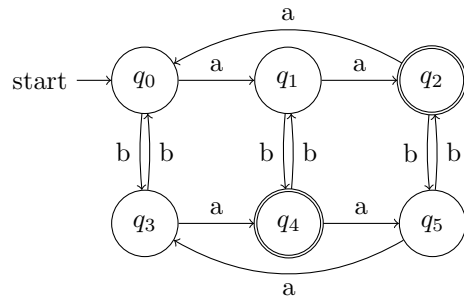
Automata B:



Automata C:



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



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