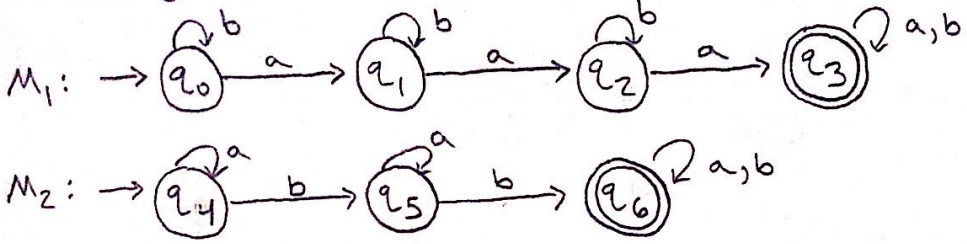
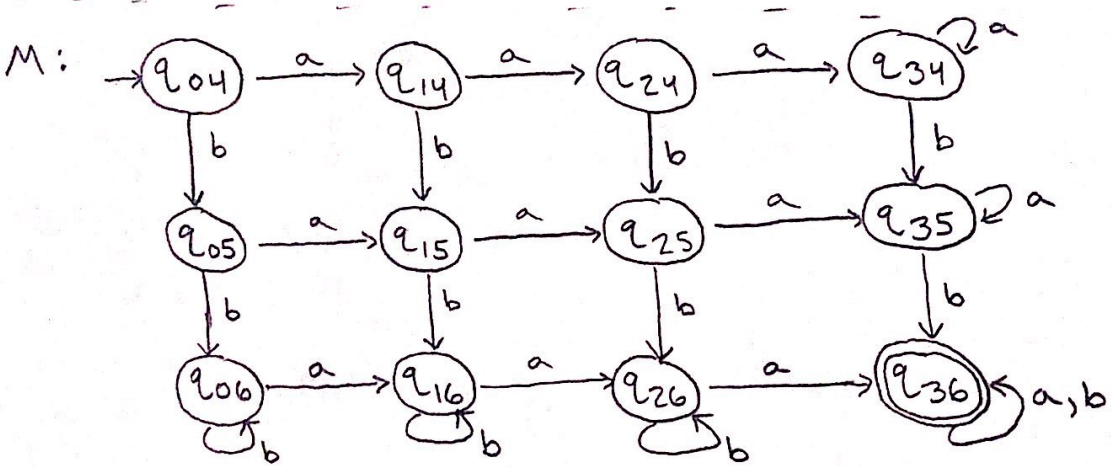
1 - Assume the alphabet $\Sigma = \{a, b\}$

1a) $\{w \mid w$ has at least 3 a's and at least 2 b's$\}$

$L(M_1) = \{w \mid w$ has at least 3 a's$\}$ $\Rightarrow$ $M = M_1 \cap M_2$

$L(M_2) = \{w \mid w$ hat at least 2 b's$\}$ $L(M) = L(M_1) \times L(M_2)$

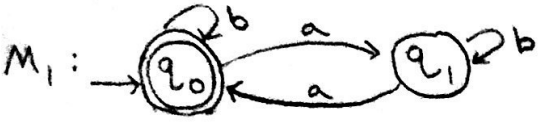


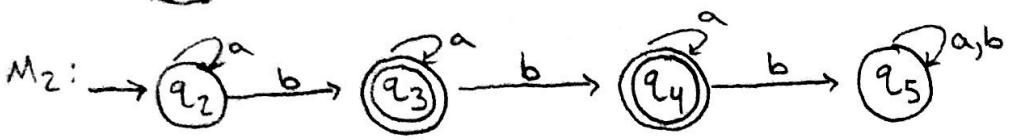


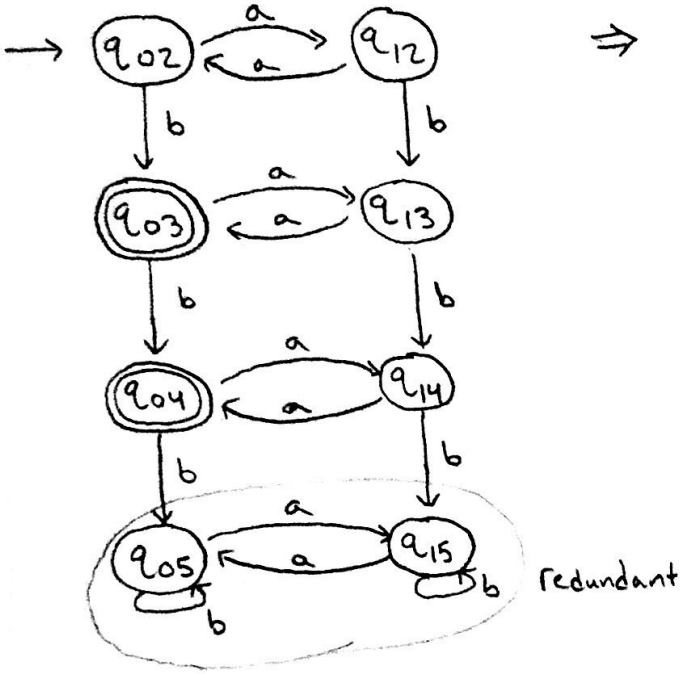
1b) {w|w has an even number of a's and 1 or 2 b's}

$L(M_1)$ = {w|w has an even number of a's} $\Rightarrow$ $M = M_1 \cap M_2$

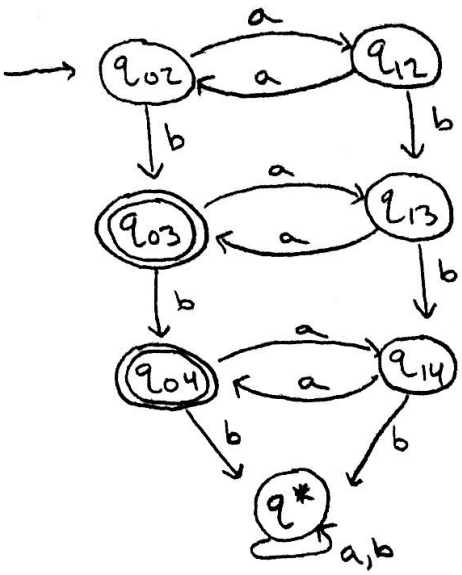
$L(M_2)$ = {w|w has 1 or 2 b's} $L(M) = L(M_1) \times L(M_2)$







$\Rightarrow$ M:



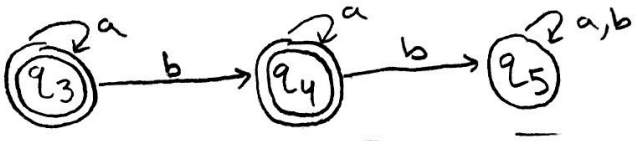
1c) $\{w \mid w$ starts with an a and has at most 1 b$\}$

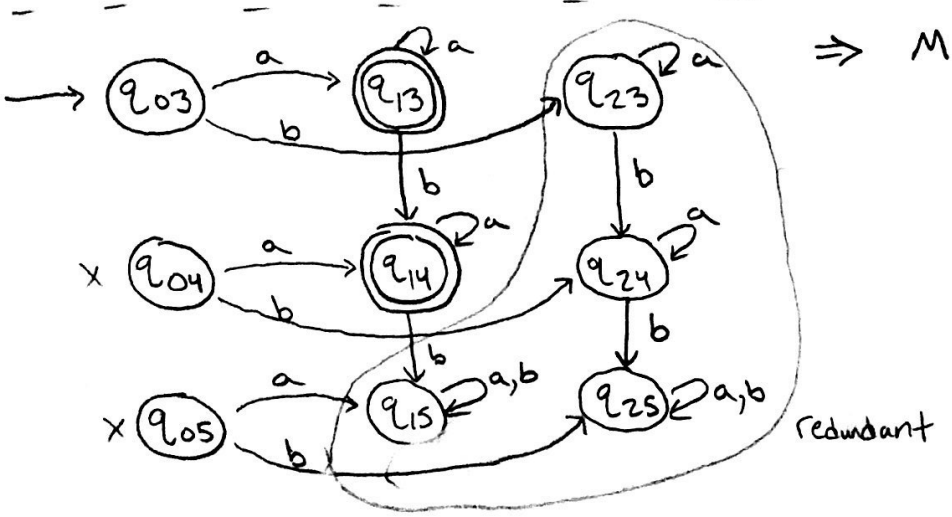
$L(M_1) = \{w \mid w$ starts with an a$\}$ $\Rightarrow$ $M = M_1 \cap M_2$

$L(M_2) = \{w \mid w$ has at most 1 b$\}$ $L(M) = L(M_1) \times L(M_2)$

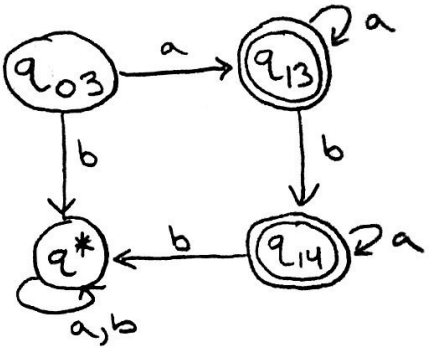
M_1:

M_2:





$\Rightarrow$ M:

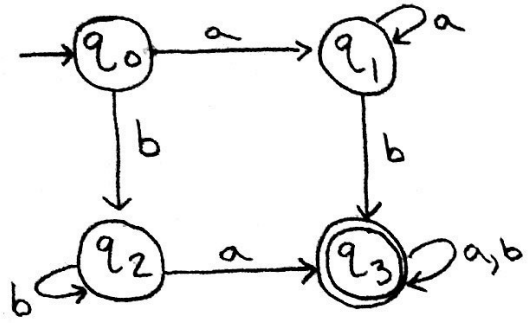


2 - Assume the alphabet $\Sigma = \{a, b\}$

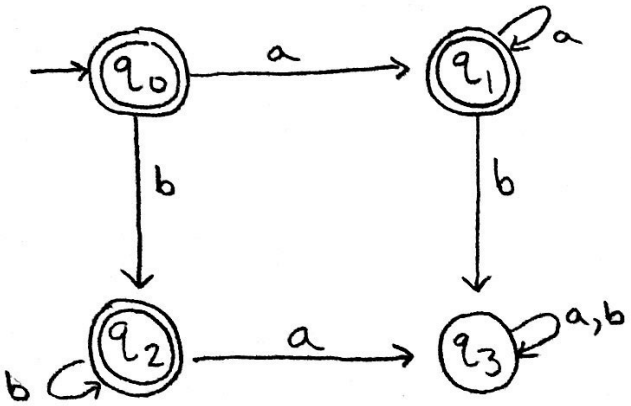
2a) $\{w \mid$ contains neither the substrings ab nor ba$\}$

$\bar{L} = \{w \mid$ contains either the substring ab or ba$\} \Rightarrow L(\bar{M}) = \bar{L}$

$\bar{M}$:



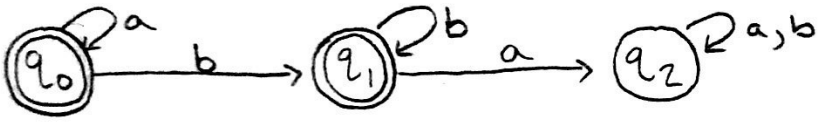
M :



2b) $\{w \mid w$ is any string not in $a^*b^*\}$

$\bar{L} = \{w \mid w$ is a string in $a^*b^*\} \Rightarrow L(\bar{M}) = \bar{L}, L(M) = \bar{\bar{L}} = L$

$\bar{M}$:

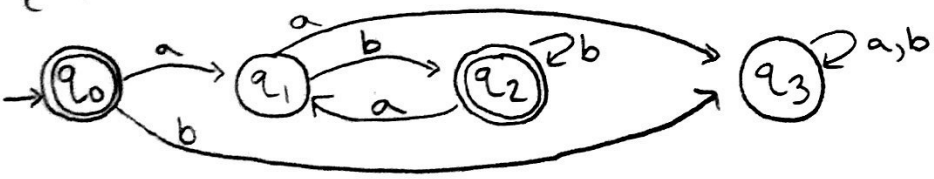


M :

2c) $\{w \mid w$ is any string not in $(ab^+)^*\}$

$\bar{L} = \{w \mid w$ is a string in $(ab^+)^*\} \Rightarrow L(\bar{M}) = \bar{L}$.

$\bar{M}$:



M :