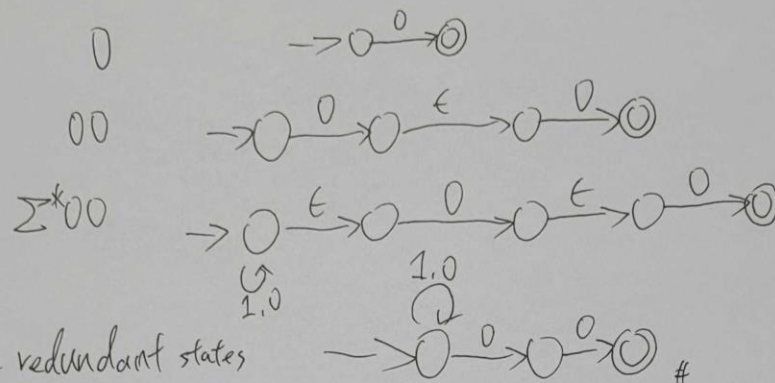Problem1.

(a) $\{w \mid w \text{ ends with } 00\}$ with three states

0　　　$\to \bigcirc \xrightarrow{0} \circledcirc$

00　　$\to \bigcirc \xrightarrow{0} \bigcirc \xrightarrow{\epsilon} \bigcirc \xrightarrow{0} \circledcirc$

$\Sigma^* 00$　$\to \bigcirc \xrightarrow{\epsilon} \bigcirc \xrightarrow{0} \bigcirc \xrightarrow{\epsilon} \bigcirc \xrightarrow{0} \circledcirc$
　　　　　　$\circlearrowleft 1,0$　　　　$\circlearrowleft 1,0$

remove redundant states　$\to \bigcirc \xrightarrow{0} \bigcirc \xrightarrow{0} \circledcirc$　#
　　　　　　　　　　　　　$\circlearrowleft 1,0$

(b) $0^* 1^* 0^+$ with three states

$\to \bigcirc \xrightarrow{\epsilon} \bigcirc \xrightarrow{0} \circledcirc$　#
　　$\circlearrowleft 0$　$\circlearrowleft 1$　$\circlearrowleft 0$

Problem 2.

$\to (q_s) \xrightarrow{\epsilon} \textcircled{1} \xrightarrow{a,b} \textcircled{2} \circlearrowleft a$　$\Longleftarrow$　$\to \textcircled{1} \xrightarrow{a,b} \textcircled{2} \circlearrowleft a$
（with ϵ, a, b transitions to/from $\textcircled{3}$ and (q_f)）
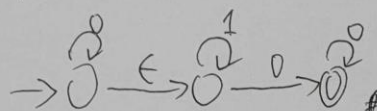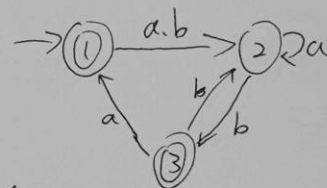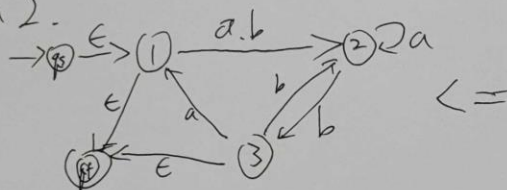
change q_0 from 1 to q_s, F from $\{1,3\}$ to $\{q_f\}$

(1) remove ②

$\textcircled{1} \xrightarrow{(a \cup b)a^* b (ba^* b)^*} \textcircled{3}$
　　$\xleftarrow{a}$
$\to (q_s) \xrightarrow{\epsilon} \dots \xrightarrow{\epsilon} ((q_f))$

(2) remove ③

$\to (q_s) \xrightarrow{\epsilon} \textcircled{1} \xrightarrow{(a \cup b)a^* b (ba^* b)^* (a (a \cup b) a^* b (ba^* b))^* \cup} ((q_f))$
　　　　　　　　　　$\xleftarrow{\emptyset}$

(3) remove ①

$\to (q_s) \xrightarrow{(a \cup b)a^* b (ba^* b)^* (a (a \cup b) a^* b (ba^* b))^* \cup \epsilon} ((q_f))$　#
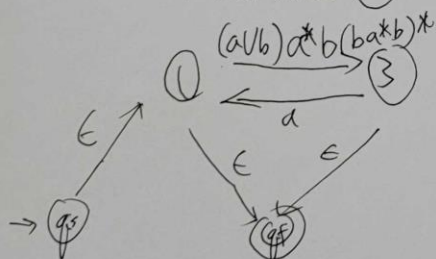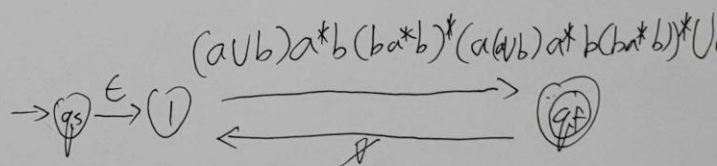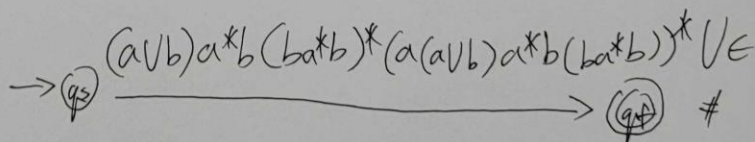
Problem 3.

Assume $\{0^n 1^m 0^n \mid m, n \geq 0\}$ is regular.

We choose $\qquad s = 0^P 1^P 0^P$

If $s = xyz$, $|xy| \leq P$, $|y| > 0$

then $\qquad y = 0 \cdots 0$ and thus $xy^2 z = 0 \cdots 0 1^P 0^P \longrightarrow \times$

Therefore $\{0^n 1^m 0^n \mid m, n \geq 0\}$ is _not_ regular