1) a)

i) Set of accepted states = $\{q2\}$

states ii) $q1 \xrightarrow{a} q2 \xrightarrow{b} q3 \xrightarrow{a} q3 \xrightarrow{b} q2 \xrightarrow{b} q3 \xrightarrow{a} q3$

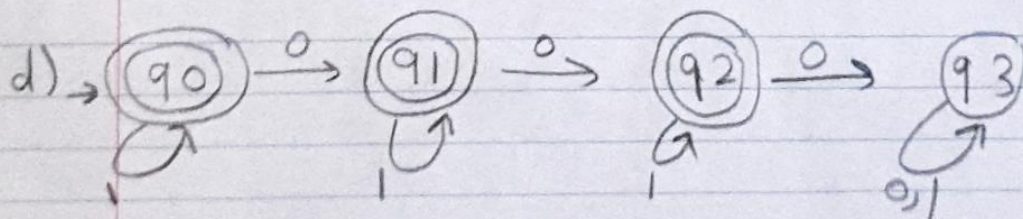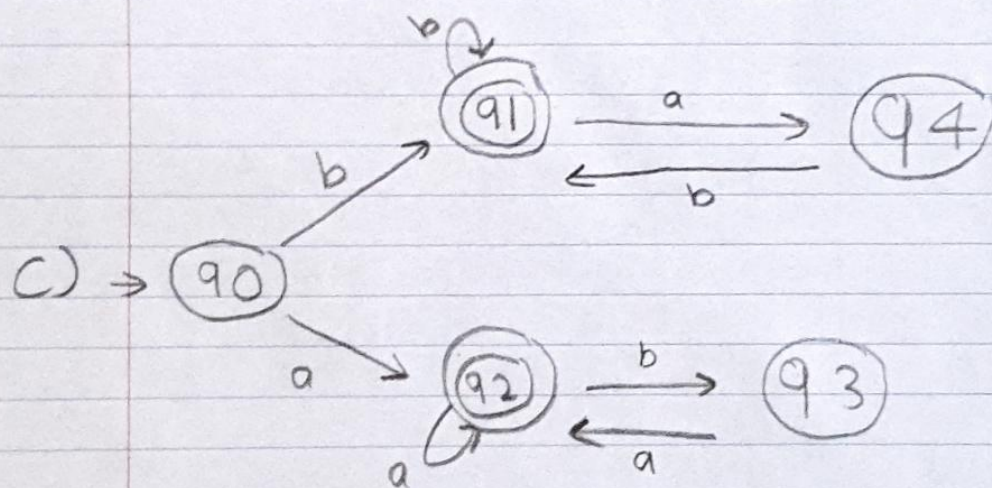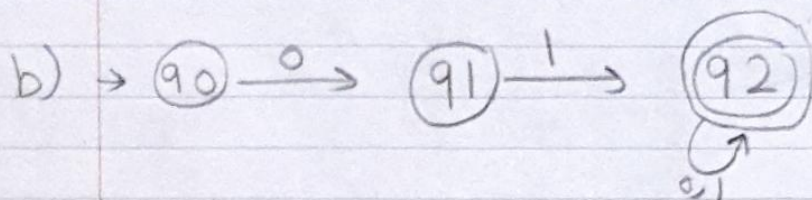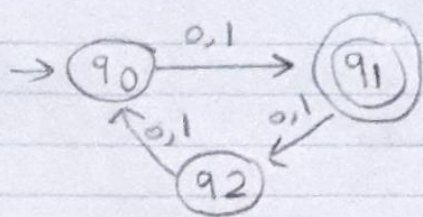iii) The strings accepted must have at least 1 a and must have an even number of b's.

b) i) Accepted states set = $\{q0, q1, q2\}$

ababba ii) $q0 \xrightarrow{a} q1 \xrightarrow{b} q2 \xrightarrow{a} q1 \xrightarrow{b} q2 \xrightarrow{b} q3 \xrightarrow{a} q3$
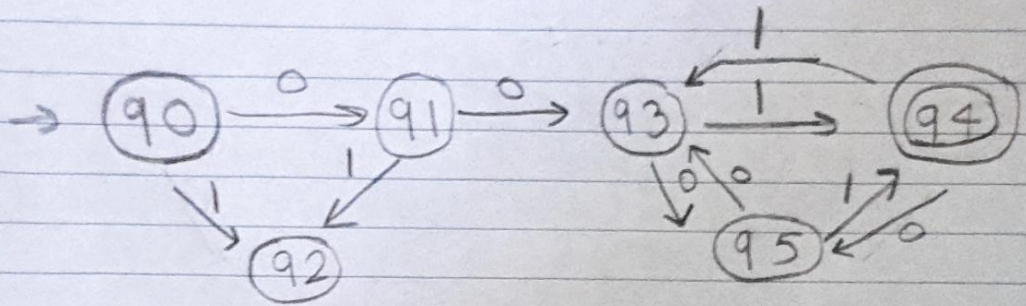
iii) The accepted string can be an empty one. If it's not an empty one, it can start with either a or b; doesn't matter. However, after starting with a or b, the next letter has to be the other (non-chosen) and it has to keep alternating between them. In short, if the string is not an empty one or a one-letter string, it can't have the same letter 2 times in a row.
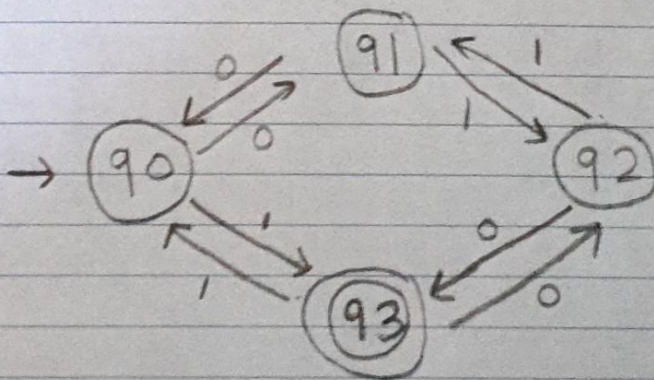
2) a)

3n+1

States: q_0 (start), q_1 (accepting), q_2. Transitions: $q_0 \xrightarrow{0,1} q_1$, $q_1 \xrightarrow{0,1} q_2$, $q_2 \xrightarrow{0,1} q_0$.

b)

$q_0 \xrightarrow{0} q_1 \xrightarrow{1} q_2$ (accepting), $q_2 \xrightarrow{0,1} q_2$.

c)

$q_0 \xrightarrow{b} q_1$, $q_1 \xrightarrow{b} q_1$, $q_1 \xrightarrow{a} q_4$, $q_4 \xrightarrow{b} q_1$, $q_0 \xrightarrow{a} q_2$, $q_2 \xrightarrow{a} q_2$, $q_2 \xrightarrow{b} q_3$, $q_3 \xrightarrow{a} q_2$.

d)

$q_0 \xrightarrow{0} q_1 \xrightarrow{0} q_2 \xrightarrow{0} q_3$, $q_0 \xrightarrow{1} q_0$, $q_1 \xrightarrow{1} q_1$, $q_2 \xrightarrow{1} q_2$, $q_3 \xrightarrow{0,1} q_3$.

e)

f)   odd 1's   even 0's

g)