1. Give DFAs that recognize the following languages

(a) \( \{w \in \{0, 1\}^*|w \text{ starts with a } 1 \text{ and has even length}\}. \)

\[ \text{Solution:} \]

\begin{center}
\begin{tikzpicture}
\node[state, initial] (q) at (0, 0) {$q$};
\node[state] (r) at (1, 0) {$r$};
\node[state, accepting] (s) at (2, 0) {$s$};
\node[state] (t) at (1, -1) {$t$};
\path[->]
(q) edge [above] node {$1$} (r)
(q) edge [loop below] node {$0$} (q)
(r) edge [above] node {$0, 1$} (s)
(r) edge [loop below] node {$0, 1$} (r)
(s) edge [loop below] node {$0, 1$} (s)
(t) edge [loop below] node {$0, 1$} (t);
\end{tikzpicture}
\end{center}

(b) \( \{w \in \{0, 1\}^*|w \text{ ends with } 011\}. \)

\[ \text{Solution:} \]

\begin{center}
\begin{tikzpicture}
\node[state, initial] (q) at (0, 0) {$q$};
\node[state] (r) at (1, 0) {$r$};
\node[state, accepting] (s) at (2, 0) {$s$};
\node[state] (t) at (2, -1) {$t$};
\path[->]
(q) edge [above] node {$1$} (r)
(q) edge [below] node {$0$} (r)
(r) edge [below] node {$0$} (s)
(s) edge [above] node {$1$} (t)
(s) edge [below] node {$0$} (t)
(t) edge [loop below] node {$1$} (t);
\end{tikzpicture}
\end{center}
(c) \( \{01, 0100\}^* \).

2. Using the complementation construction and one of the DFAs from Exercise 1, give a DFA that recognizes the language

\[ \{ w \in \{0, 1\}^* | w \text{ does not end with } 011 \} \]

Solution: