1. Construct a deterministic finite automaton which accepts each of the following languages. (Give a transition diagram for each.):

(a) \( \{aa, bb, cc\}^* \)
(b) \( \{ s \in \{a, b\}^* : s \text{ does not contain more than four } b's. \} \)
(c) \( \{ s \in \{a, b, c\}^* : s \text{ does not contain } abc \text{ as a substring.} \} \)
(d) \( \{ s \in \{a, b\}^* : \text{the number of } b's \text{ in } s \text{ is divisible by } 3. \} \)
(e) \( \{ a^i b^j : i + j \text{ is odd and } i \geq 1, j \geq 1. \} \)

2. Let \( M_1 \) be the deterministic finite automaton \( \langle P, \Sigma, \delta, p_0, F_1 \rangle \) where:

\[
\begin{align*}
P &= \{p_0, p_1\} \\
\Sigma &= \{0, 1\} \\
F_1 &= \{p_1\} \\
\delta(p_0, 0) &= p_0 \\
\delta(p_0, 1) &= p_1 \\
\delta(p_1, 0) &= p_1 \\
\delta(p_1, 1) &= p_0
\end{align*}
\]

Let \( M_2 \) be the deterministic finite automaton \( \langle Q, \Sigma, \delta, q_0, F_2 \rangle \) where:

\[
\begin{align*}
Q &= \{q_0, q_1, q_2\} \\
\Sigma &= \{0, 1\} \\
F_2 &= \{q_0, q_2\} \\
\delta(q_0, 0) &= q_0 \\
\delta(q_0, 1) &= q_2 \\
\delta(q_1, 0) &= q_2 \\
\delta(q_1, 1) &= q_0 \\
\delta(q_2, 0) &= q_1 \\
\delta(q_2, 1) &= q_0
\end{align*}
\]

Let \( L_1 \) and \( L_2 \) be the languages accepted by \( M_1 \) and \( M_2 \), respectively.

(a) Construct a deterministic finite automaton which accepts \( \overline{L_2} \), the complement of language \( L_2 \). (Give a transition diagram.)

(b) Construct a deterministic finite automaton which accepts \( L_1 \cap L_2. \) (Give a transition diagram.)

(c) Construct a deterministic finite automaton which accepts \( L_1 - L_2. \) (Give a transition diagram.)