There are a total of seven parts in problem 1. You have to solve all of them.

## Problem 1 (CO1): Deterministic Finite Automata (20 points)

Let $\Sigma = \{0, 1\}$. Consider the following languages over $\Sigma$.

$$L_1 = \{w \text{ contains at least three } 1\text{s}\}$$
$$L_2 = \{w \text{ starts and ends with different symbols}\}$$
$$L_3 = \{w \text{ doesn't contain } 01 \text{ as a subsequence}\}$$
$$L_4 = \{w \text{ ends with at least one } 0\}$$

Now solve the following problems.

(a) **Design** a DFA for the language $L_1$. (4 points)

(b) **Design** a DFA for the language $L_2$. (4 points)

(c) **Design** a DFAn for the language $L_3$. (4 points)

(d) **Write** all four-letter strings in $L_1 \cap L_4$. (1 point)

(e) **Design** a DFA for the language $L_1 \cap L_4$. (3 points)

(f) **Write** all four-letter strings in $L_2 \cap L_4$. (1 point)

(g) **Design** a DFA for the language $L_2 \cap L_4$. (3 points)