CS449/549 Computational Learning Quiz 3 (take-home) Fall 2023.
Due: Tuesday 10/31/2023 at 14:00 (submit hardcopy).
Note: Class materials may be consulted but submitted work must be your own.

Learning Finite Automata

Alice (the Oracle) holds a deterministic finite automata (DFA) $M = (S, A, \delta, s_0, F)$ where $S = \{s_0, s_1, s_2, s_3\}$ is the set of states, $A = \{0, 1\}$ is the set of alphabet symbols, s_0 is the start state, $F = \{s_3\}$ is the set of accept states, and the deterministic transition function δ is given by
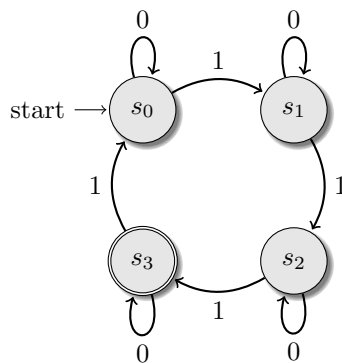

Figure 1: A 4-state Deterministic Finite Automata M.

Bob (the Learner) uses ANGLUIN's $L^\star$ algorithm to learn M using *equivalence* and *membership* queries. Alice always returns the **shortest** counterexample for each equivalence query.

True/False: Circle one. Explain your answers by showing the full trace of $L^\star$.

1. (T/F) When Bob asked the first equivalence query, Alice's counterexample was the string "111".

2. (T/F) When Bob asked the last equivalence query, he had asked a total of 4 equivalence queries.

3. (T/F) All counterexamples from Alice are the same: "111."

4. (T/F) When Bob asked the last equivalence query, the classification tree T that he maintained has exactly 4 leaf nodes and 3 internal nodes.

5. (T/F) When Bob asked the last equivalence query, the classification tree T that he maintained has all of its leaf nodes labeled with prefixes of the first counterexample.