Lecture #4: DFA Design and Verification — Part Two
Lecture Presentation

Main Points

Problem To Be Solved

Let $\Sigma = \{\mathtt{a}, \mathtt{b}\}$ and let $L \subseteq \Sigma^\star$ be the following language:

$$L = \{w \in \Sigma^\star \mid \omega \text{ ends with } \mathtt{abb}\}.$$

The problem to be solved — which was also considered in the previous lecture presentation — is to design a ***deterministic finite automaton*** with alphabet Σ, whose language is L, and to prove that this DFA is correct.

A First Attempt

We first tried to design a DFA for this language, under the assumption that the only information that the DFA would need to remember, about the string that has been processed so far, is ***whether it belongs to the above language*** L.

This would correspond to a deterministic finite automaton with two states, q_0 and q_1, corresponding to the set

$$S_0 = \{\omega \in \Sigma^\star \mid \omega \textit{ does not } \text{end with “}\mathtt{abb}\text{”}\}$$

— which corresponds to the state q_0 — and the set

$$S_1 = \{\omega \in \Sigma^\star \mid \omega \textit{ does } \text{end with “}\mathtt{abb}\text{”}\}$$

— which corresponds to the state q_1. Since $\lambda \in S_0$, q_0 is the start state. Since $S_1 = L$ (so that $S_1 \subseteq L$) and $S_0 = \Sigma^\star \setminus L$ (so that $S_0 \cap L = \emptyset$) q_1 should be the only accepting state. That is, $F = \{q_1\}$.

This *first* attempt to design a deterministic finite automaton, for L, ***failed***.

How This Failed:

What Could Be Learned From This:

A Second Attempt

What Must the DFA Remember?

Representation Using Subsets of $\Sigma^\star$

Initial Sanity Checks

Identifying Transitions

A Third Attempt

What Went Wrong — Which Transition was not Well Defined? Why?

What Must the DFA Remember?

Representation Using Subsets of $\Sigma^\star$

Initial Sanity Checks

Identifying Transitions

What We Have Now:

Writing a Proof Correctness

What Result, from the Lecture Notes, is Useful?

What Things Must Be Established?

A detailed list of the properties that should be established is as follows.

Other Things to Think About, or To Do

Verification vs. Testing