

## Problem

Let  $ALL_{DFA} = \{\langle A \rangle \mid A \text{ is a DFA and } L(A) = \Sigma^*\}$ . Show that  $ALL_{DFA}$  is decidable.

## Step-by-step solution

### Step 1 of 4

A DFA (Deterministic Finite Automaton) starts travelling, via arrows of the DFA, from the start state to the accept state and when it reaches an accept state, it accepts some string.

[Comment](#)

### Step 2 of 4

Consider the following details:

$$ALL_{DFA} = \{\langle A \rangle \mid A \text{ is a DFA and } L(A) = \Sigma^*\}$$

Prove that  $ALL_{DFA}$  is decidable.

[Comment](#)

### Step 3 of 4

A is a DFA that accepts every possible permutation and combination of its input string. Thus, its DFA has only a single state  $q^0$ , which is both initial and final state.

[Comments \(3\)](#)

### Step 4 of 4

**So, on executing the Turing machine 'T' on INPUT( A ):**

- Mark the initial state of A.
- Repeat until no new states gets marked:
- The state that has any transition coming into it from any other already marked state will be marked.
- **ACCEPT**: when all the accept states are marked, otherwise **REJECT**.

[Comments \(4\)](#)