

# AUTOMATA TERM PROJECT

## DETERMINISTIC FINITE AUTOMATA


### What is DFA?

In DFA, for each input symbol, one can determine the state to which the machine will move. Hence, it is called Deterministic Automaton. As it has a finite number of states, the machine is called Deterministic Finite Machine or Deterministic Finite Automaton.

In the theory of computation, a branch of theoretical computer science, a deterministic finite automaton (DFA)—also known as deterministic finite acceptor (DFA), deterministic finite state machine (DFSM), or deterministic finite state automaton (DFSFA)—is a finite-state machine that accepts or rejects strings of symbols and only produces a unique computation (or run) of the automaton for each input string. Deterministic refers to the uniqueness of the computation. In search of the simplest models to capture finite-state machines, Warren McCulloch and Walter Pitts were among the first researchers to introduce a concept similar to finite automata in 1943.

### Code

First I wrote the css code to set the indentation of the text from the right and left. Then I wrote the css code to create the header to scroll down the page to show the continuation of the photo. After adding the necessary libraries for the code, I started to create the table structure. I've added a library for the font. According to the structure, I added the texts and pictures. I did example part by using one of the classworks we used in the lesson and I added the diagram.



**Deterministic Finite Automata**

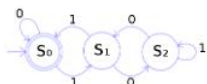
Merve YAVUZ GitHub

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**State Diagram Example**

The figure illustrates a deterministic finite automaton using a state diagram. In this example automaton, there are three states:  $S_0$ ,  $S_1$ , and  $S_2$  (denoted graphically by circles). The automaton takes a finite sequence of 0s and 1s as input. For each state, there is a transition arrow leading out to a next state for both 0 and 1. Upon reading a symbol, a DFA jumps deterministically from one state to another by following the transition arrow. For example, if the automaton is currently in state  $S_0$  and the current input symbol is 1, then it deterministically jumps to state  $S_1$ . A DFA has a start state (denoted graphically by an arrow coming in from nowhere) where computations begin, and a set of accept states (denoted graphically by a double circle) which help define when a computation is successful.



An example of a deterministic finite automaton that accepts only binary numbers that are multiples of 3. The state  $S_0$  is both the start state and an accept state.

#### Formal Definition of a DFA

A DFA can be represented by a 5-tuple  $(Q, \Sigma, \delta, q_0, F)$  where

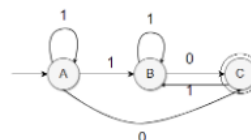
- $\rightarrow Q$  is a finite set of states.
- $\rightarrow \Sigma$  is a finite set of symbols called the alphabet.
- $\rightarrow \delta$  is the transition function where  $\delta: Q \times \Sigma \rightarrow Q$
- $\rightarrow q_0$  is the initial state from where any input is processed ( $q_0 \in Q$ ).
- $\rightarrow F$  is a set of final state/states of  $Q$  ( $F \subseteq Q$ ).

#### EXAMPLE

$\rightarrow$  Write an input (01001010 etc.)

$w =$    $F =$

A Reject



#### Graphical Representation of a DFA

A DFA is represented by digraphs called state diagram.

The vertices represent the states.

The arcs labeled with an input alphabet show the transitions.

The initial state is denoted by an empty single incoming arc.

The final state is indicated by double circles.

	0	1
→A	A	B
B	C	B
*C	A	B

$\rightarrow$  : Start state

\* : Finish state