

# Deterministic Finite Automaton (DFA)

machine = automaton

↳ one = automaton (tekil)

↳ two = automata (gugul)

Example! Did a heatwave occur?

Input: String of weather data

\* Heatwave: temperature  $\geq 45^\circ\text{C}$  for 2 consecutive days



## LANGUAGE OF THE MACHINE

$L_M = \{ \text{all strings containing 11} \}$

M accepts 11.

Also M accepts 110, 0110, 1011, 1010110.

WHY we call deterministic?

↳ Because the next steps are all determined.

Formal Definition of  $M = (Q, \Sigma, \delta, q_0, F)$

is the set of states

$(q_0, q_1, q_2)$

is the alphabet

$\Sigma = \{1, 0\}$

is the transition function

	1	0
$q_0$	$q_1$	$q_0$
$q_1$	$q_2$	$q_1$
$q_2$	$q_2$	$q_2$

↳  $q_0$ : Start State

↳  $F$ : set of accept/final states =  $\{q_2\}$

## Regular Language

A language recognized by some finite automaton

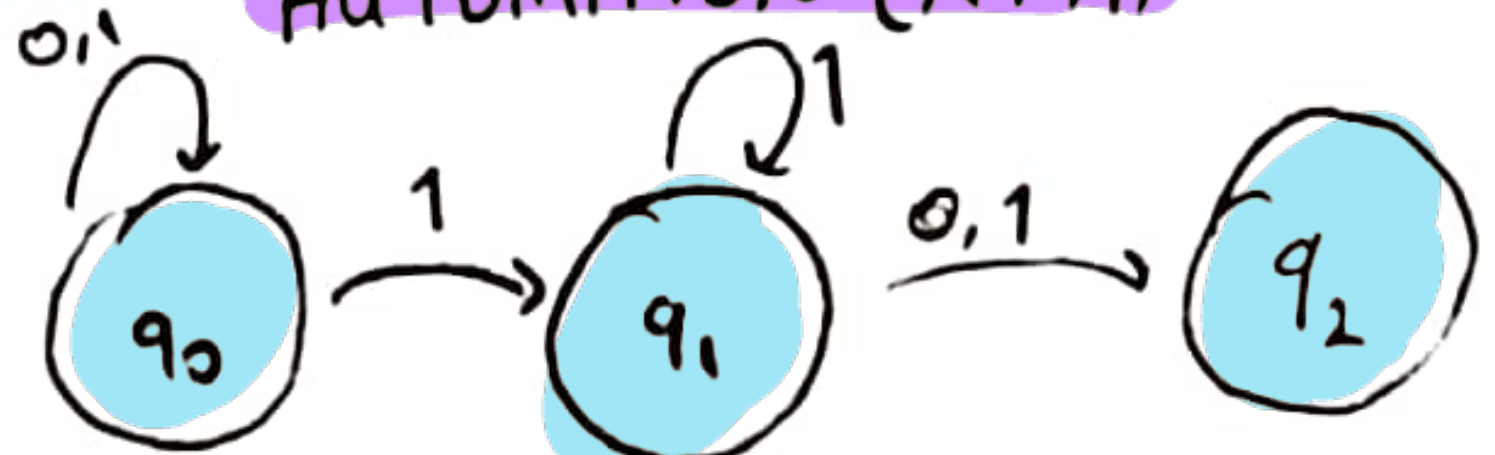
## SUMMARY

DFA's are 5-tuples  $(Q, \Sigma, \delta, q_0, F)$

⊙ = This means accept state

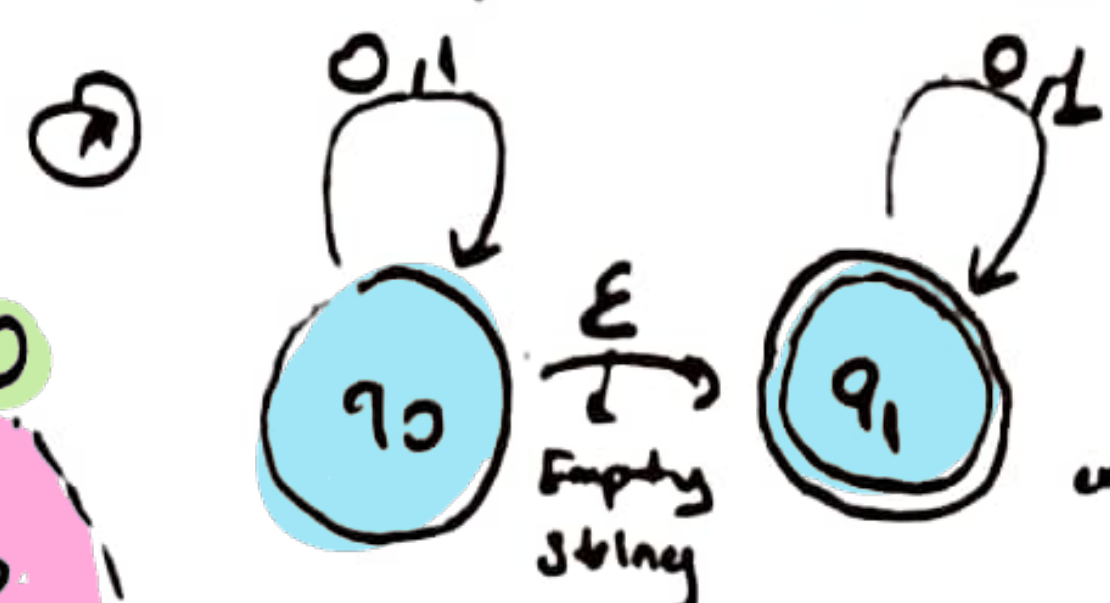
$L_M$  is set of all accepted strings

# NONDETERMINISTIC FINITE AUTOMATON (NFA)



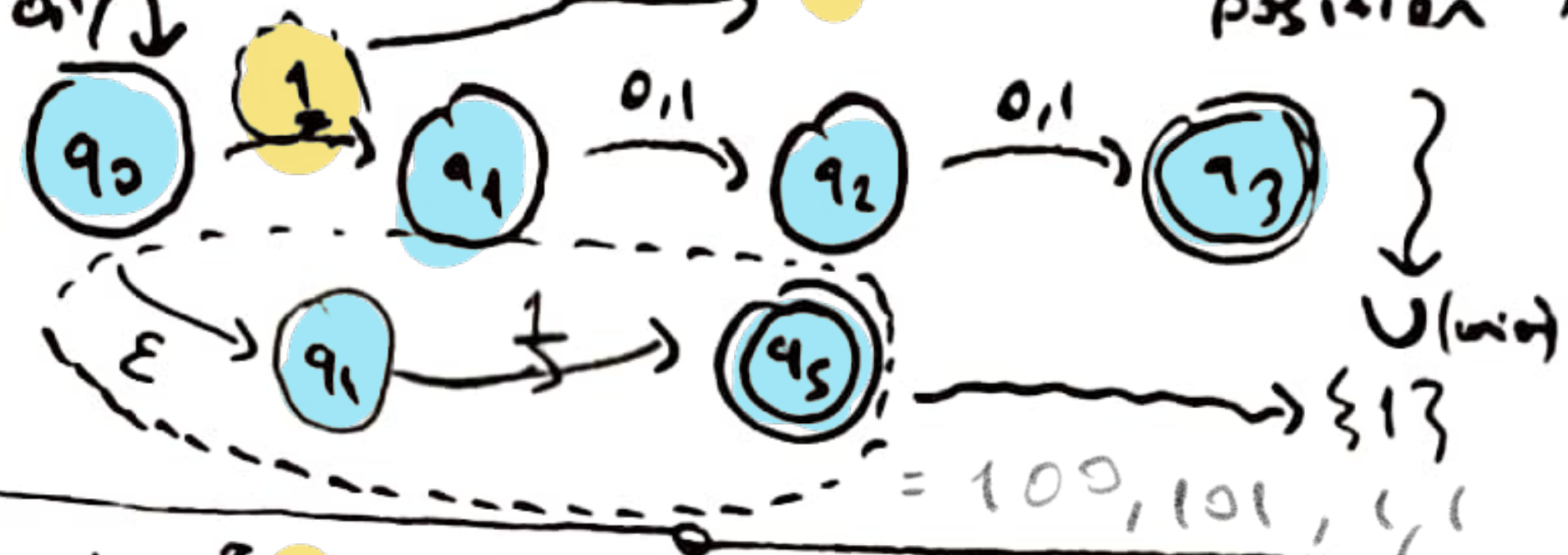
INPUT: 11 = goes two different paths.

The NFA still accepts the string, because there is a path to an accept state.



Input: 01  
Notice there is an empty string in here

\*  $L_M = \{ x \mid x \text{ contains a 1 in the third final position} \}$



$M = (Q, \Sigma, \delta, q_0, F)$  delta

$\{q_0, q_1, q_2, q_3, q_4, q_5\}$

$\Sigma = \{1, 0\}$

$q_0$ : start

$F: \{q_3, q_4\}$

$\delta: Q \times \Sigma \rightarrow P(Q)$

$\Sigma \cup \{\epsilon\}$

\*  $\delta$  gives a set of possible states, instead of just 1

$\delta:$	0	1	$\epsilon$
$q_0$	$\{q_0\}$	$\{q_0, q_1\}$	$\{q_4\}$

NFA can only do as much as DFA can so DFA is more powerful

## SUMMARY

NFA's are 5-tuples  $(Q, \Sigma, \delta, q_0, F)$



That means set of possible states

• Languages recognized by an NFA regular languages