

Finite Automata

Part Two

Recap from Last Time

Old MacDonald Had a Symbol,

♪ Σ -eye- ϵ -ey \in , Oh! ♪

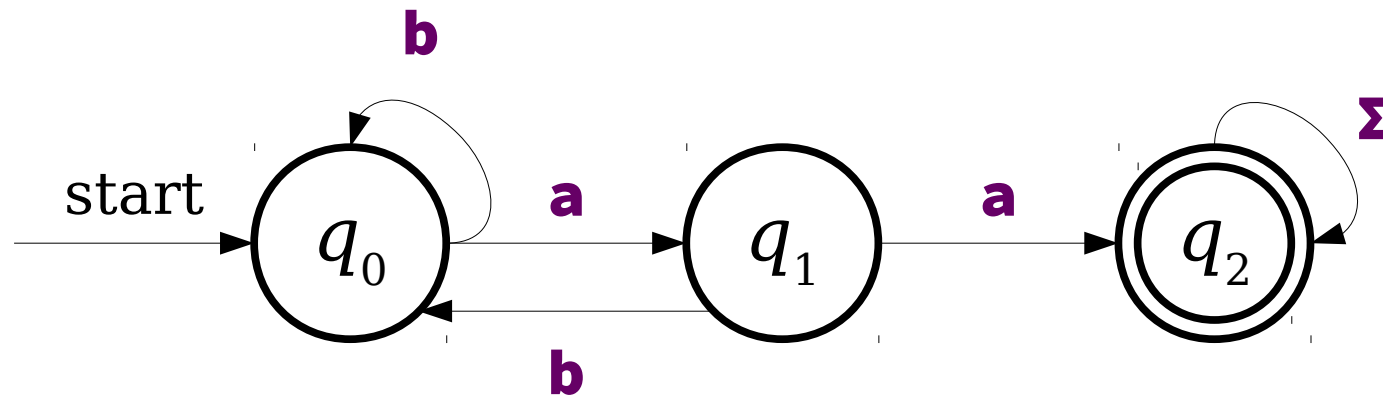
- You may have noticed that we have several letter-E-ish symbols in CS103, which can get confusing!
- Here's a quick guide to remembering which is which:
 - In automata theory, Σ refers to an ***alphabet***.
 - In automata theory, ϵ is the ***empty string***, which is length 0.
 - In set theory, use \in to say “is an ***element of***.”
 - In set theory, use \subseteq to say “is a ***subset of***.”

DFAs

- A ***DFA*** is a
 - ***D***eterministic
 - ***F***inite
 - ***A***utomaton
- DFAs are the simplest type of automaton that we will see in this course.

Recognizing Languages with DFAs

$L = \{ w \in \{a, b\}^* \mid w \text{ contains } aa \text{ as a substring} \}$

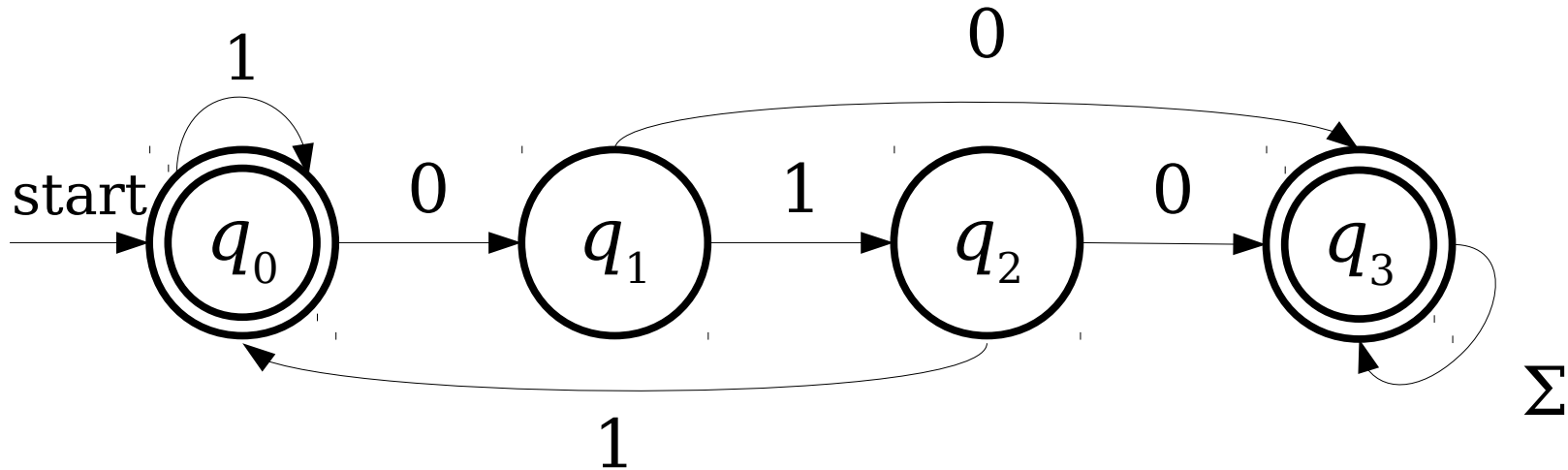


DFAs

- A DFA is defined relative to some alphabet Σ .
- For each state in the DFA, there must be *exactly one* transition defined for each symbol in Σ .
 - This is the “deterministic” part of DFA.
- There is a unique start state.
- There are zero or more accepting states.

New Stuff!

Which table best represents the transitions for the DFA shown below?



(A)

	0	1
q_0	q_1	q_0
q_1	q_3	q_2
q_2	q_3	q_0
q_3	q_3	q_3

(B)

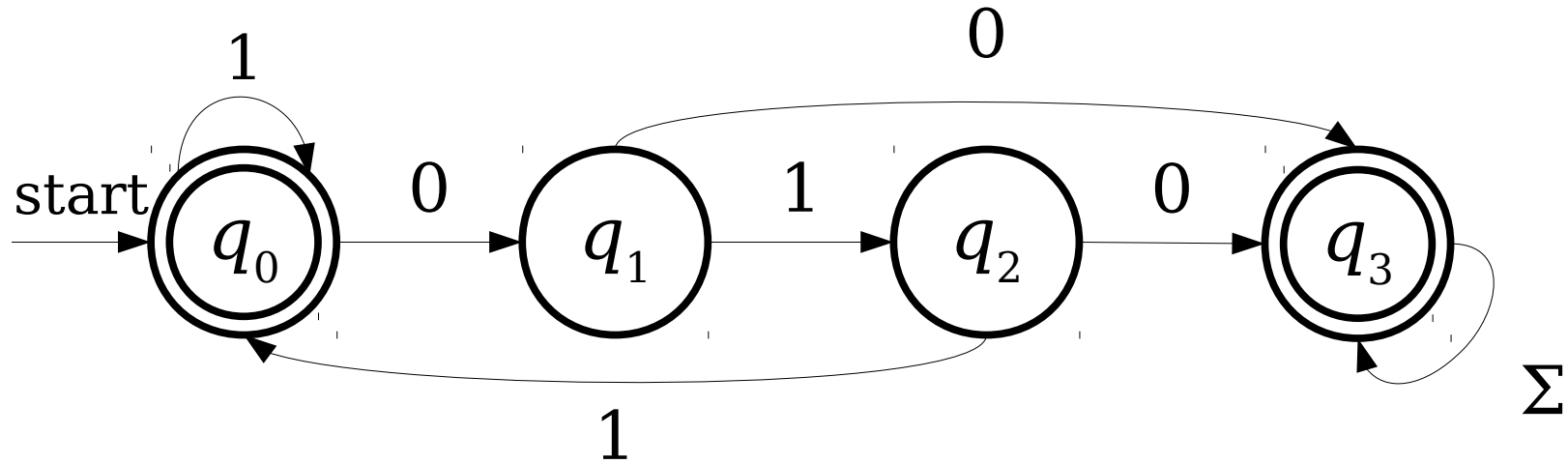
	0	1
q_0	q_0	q_1
q_1	q_2	q_3
q_2	q_0	q_3
q_3	q_3	q_3

(C)

	0	1	Σ
q_0	q_1	q_0	/
q_1	q_3	q_2	/
q_2	q_3	q_0	/
q_3	/	/	q_3

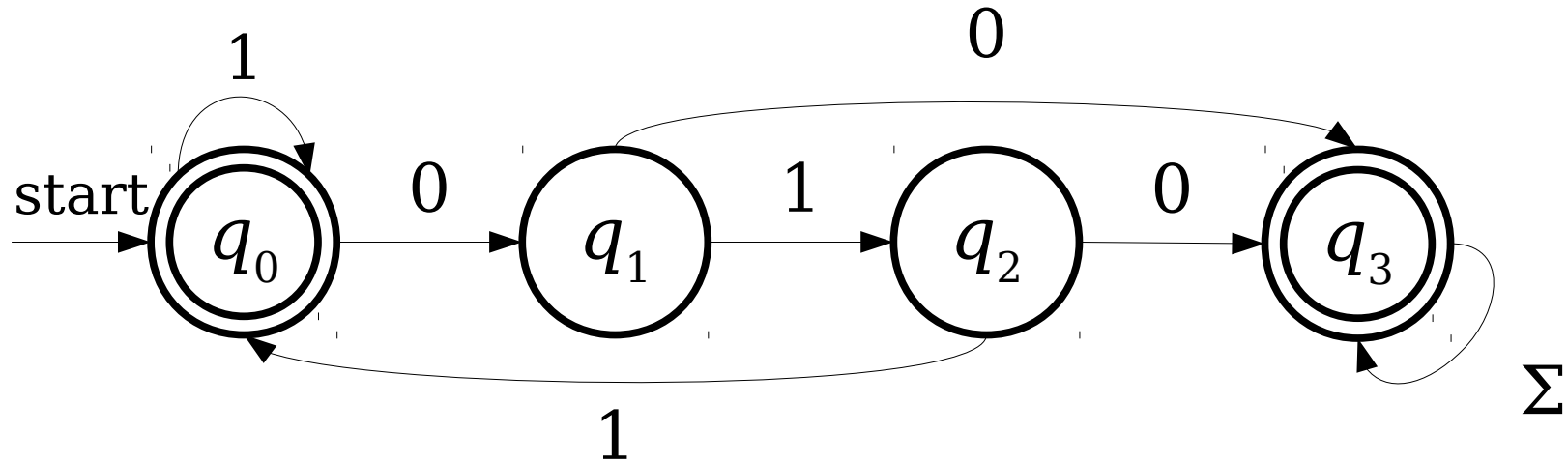
Answer at [PollEv.com/cs103](https://www.poll-ev.com/cs103) or text **CS103** to **22333** once to join, then **A, B, C, or D (none of the above)**.

Tabular DFAs



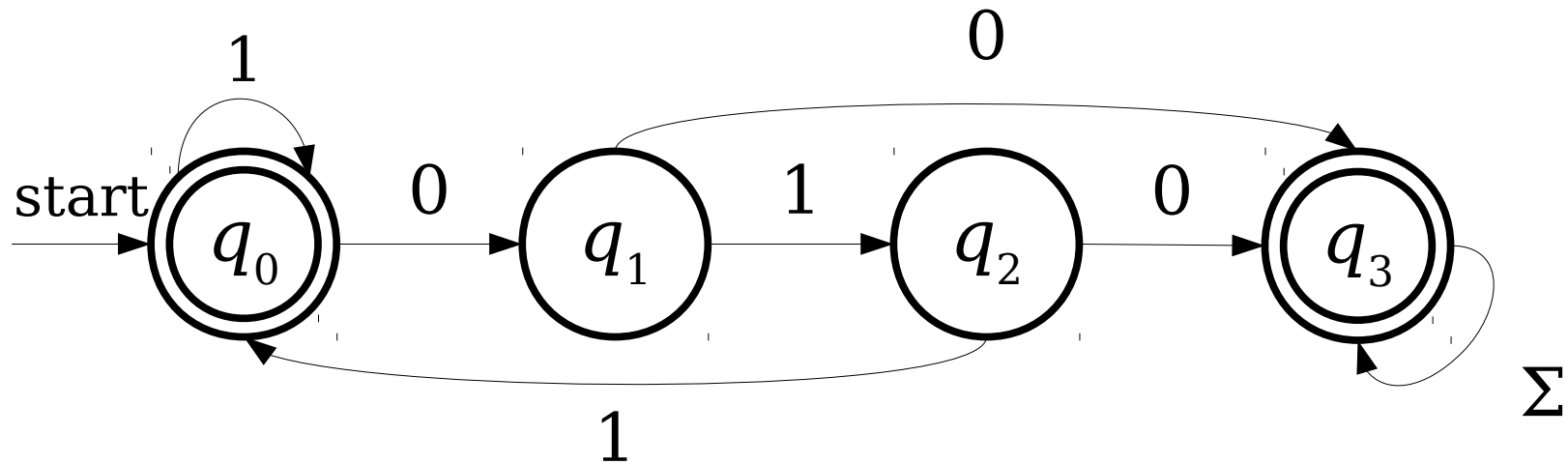
	0	1
q_0		
q_1		
q_2		
q_3		

Tabular DFAs



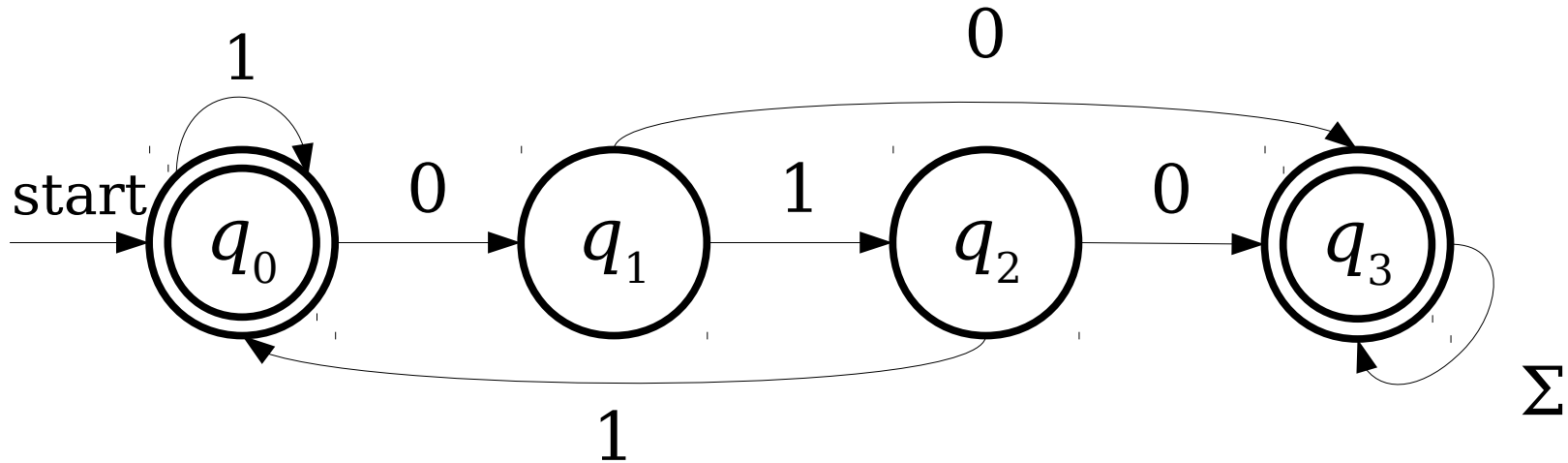
	0	1
q_0	q_1	q_0
q_1	q_3	q_2
q_2	q_3	q_0
q_3	q_3	q_3

Tabular DFAs



	0	1
* q_0	q_1	q_0
q_1	q_3	q_2
q_2	q_3	q_0
* q_3	q_3	q_3

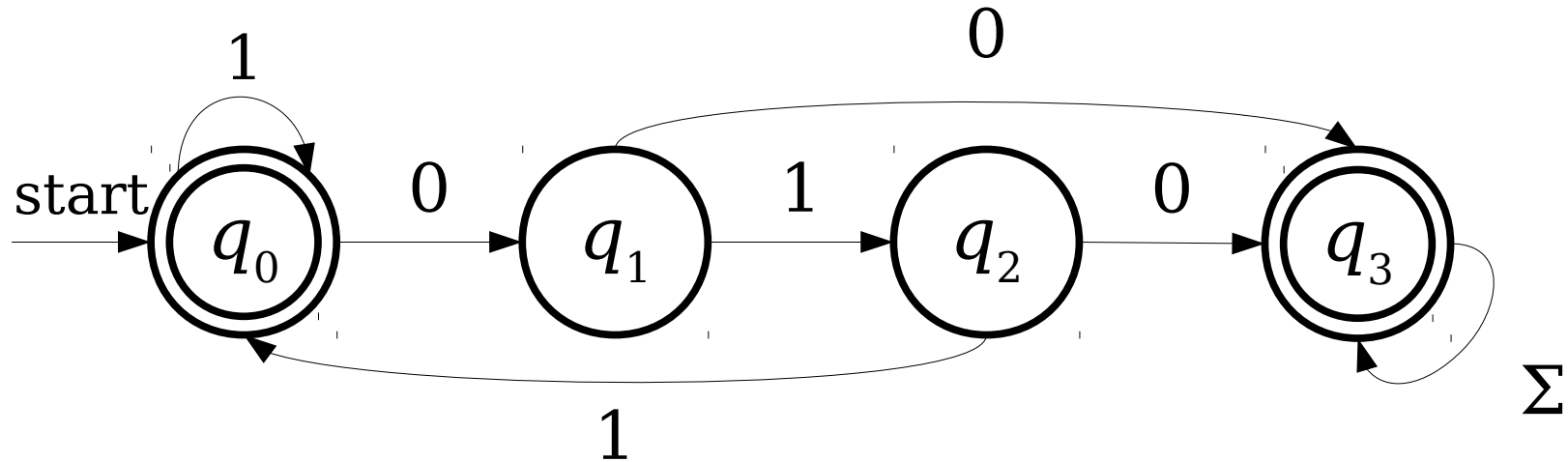
Tabular DFAs



These stars indicate accepting states.

	0	1
* q_0	q_1	q_0
q_1	q_3	q_2
q_2	q_3	q_0
* q_3	q_3	q_3

Tabular DFAs



Since this is the first row, it's the start state.

	0	1
* q_0	q_1	q_0
q_1	q_3	q_2
q_2	q_3	q_0
* q_3	q_3	q_3

The Regular Languages

A language L is called a **regular language** if there exists a DFA D such that $\mathcal{L}(D) = L$.

If L is a language and $\mathcal{L}(D) = L$, we say that D **recognizes** the language L .