

CS 5 Not-Quite-Daily News

Cheating Penguin

Claremont (Antarctic News Service): A disgraced penguin left a local college after being caught violating the institution's honor code.

The bird had been working on a computer science game project when a fellow student discovered that the game's animated fish were in fact live animals trapped in his laptop.

“Apparently he couldn't get the animation to look right, so he thought he could take a shortcut and nobody would notice,” said a professor. “But when water started leaking from his screen, it was pretty obvious that something was going on. By then the fish had died, and the smell was so bad we had to evacuate the lab.”

The penguin will be punished with a one-year suspension and a ban on all future contact with marine life forms.



Real Headlines (Why AI Is Hard)

Drunk Gets Nine Months in Violin Case

Police Begin Campaign to Run Down Jaywalkers

Prostitutes Appeal to Pope

Red Tape Holds Up New Bridges

Miners Refuse to Work After Death

Local High School Dropouts Cut in Half

Man Struck by Lightning Faces Battery Charge

Kids Make Nutritious Snacks

Homework 12

- Building finite-state & Turing machines
 - Mathematical foundations of CS
- Project milestone (“progress report”)

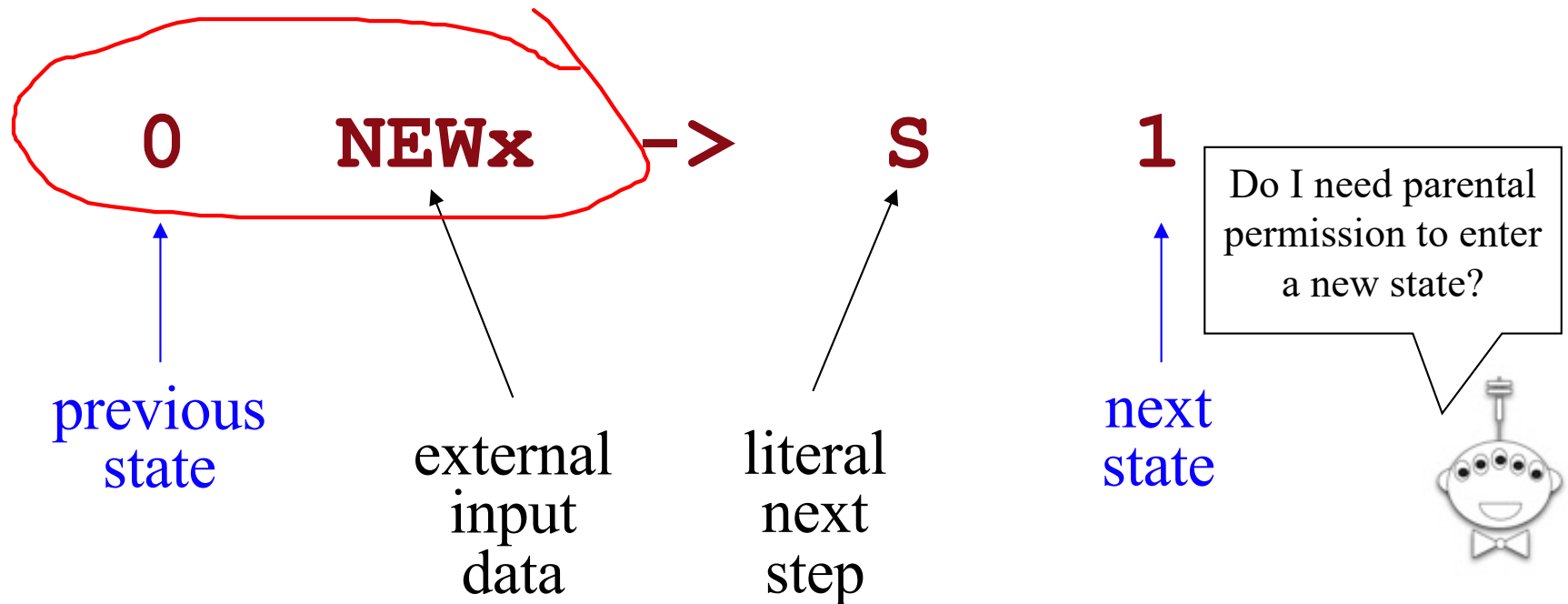
Labs in Weeks 12-13

- Tue and Wed, 2:45 PM and 6 PM
- Entirely optional
 - Work on FSMs (HW 12)
 - Work on final project milestone
- Note: you won't get quick feedback on milestone, so ***join us for lab!***

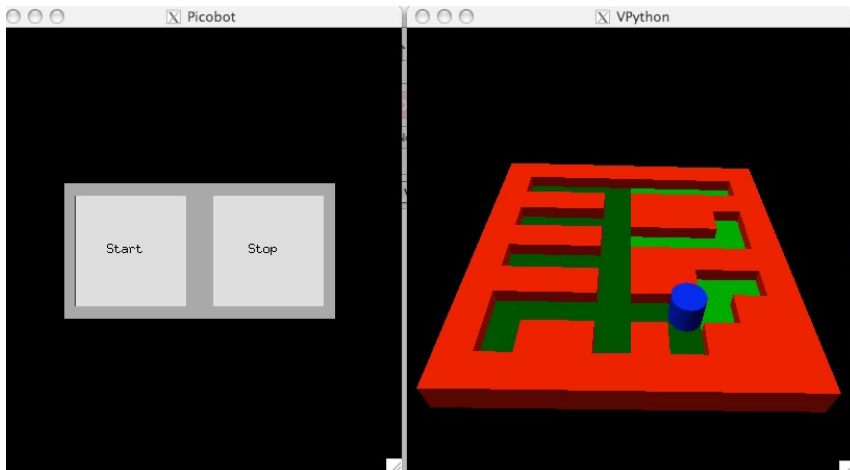
State?

The *state* of a computation (or computer) is

*all the internal information
needed to take the next step*



Picobot == *State* Machine



state pattern -> move new state

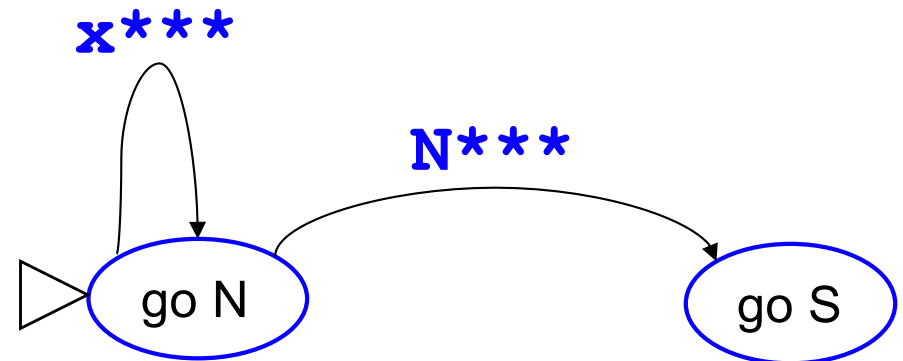
0 **x***** -> **N** 0

0 **N***** -> **S** 1

1 *****x** -> **S** 1

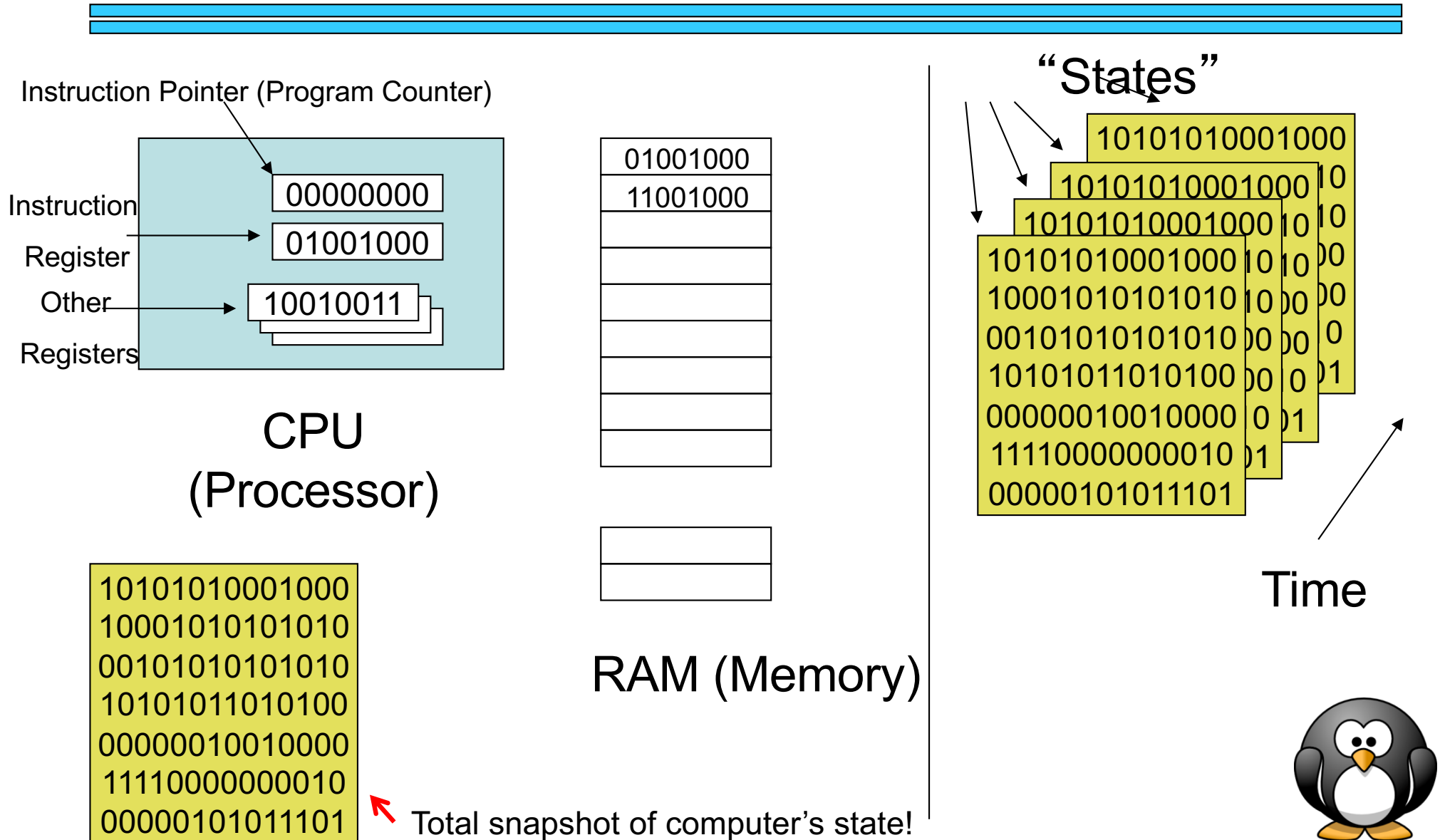
1 *****N** -> **N** 0

transitions move from
state to state



each circle represents a
different robot state

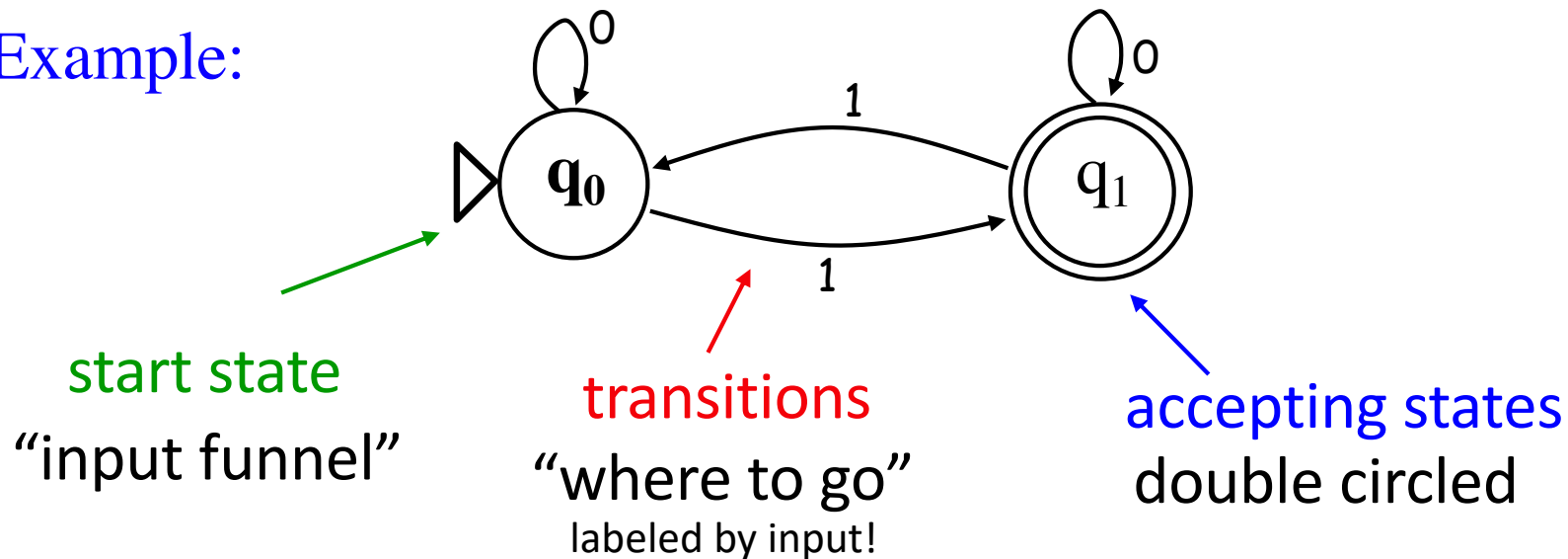
Computer == State Machine



Our Model of Computation: FSMs

FSM or *Finite State Machine* (also called a *Deterministic Finite Automaton*, DFA)

Example:



How it runs:

input sequence **100101**

What does
each state
"mean"?

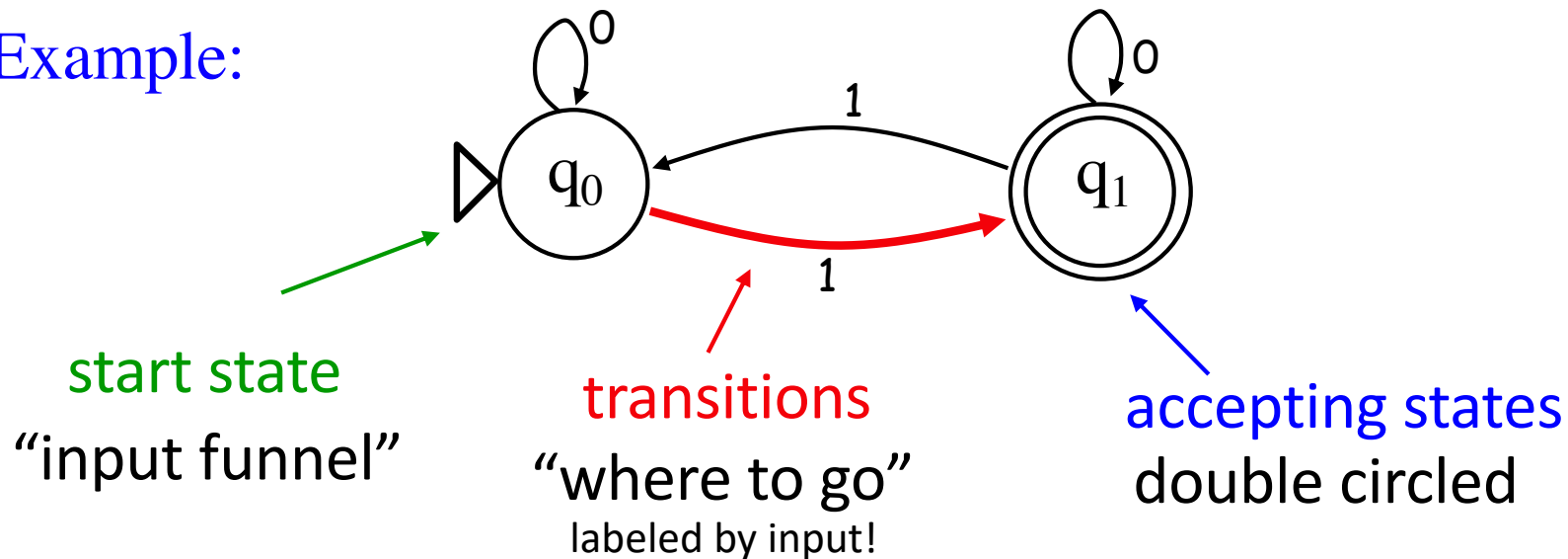
What does
this FSM do
overall?



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How it runs:

input sequence **1**00101

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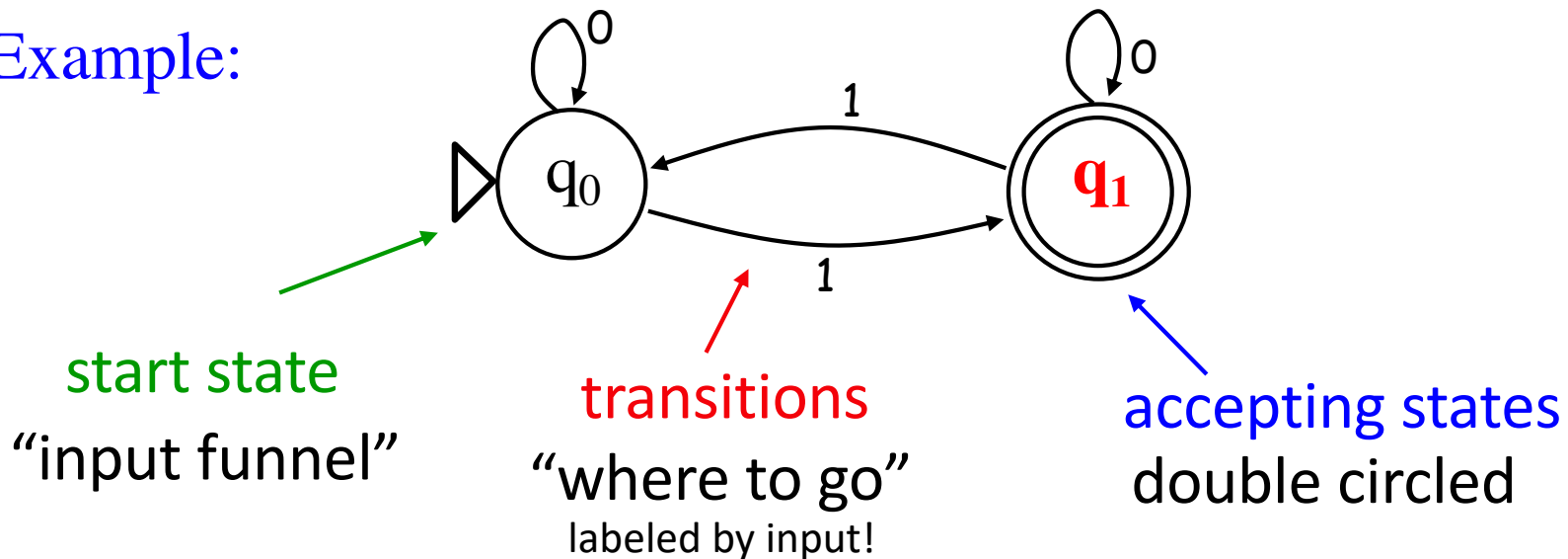
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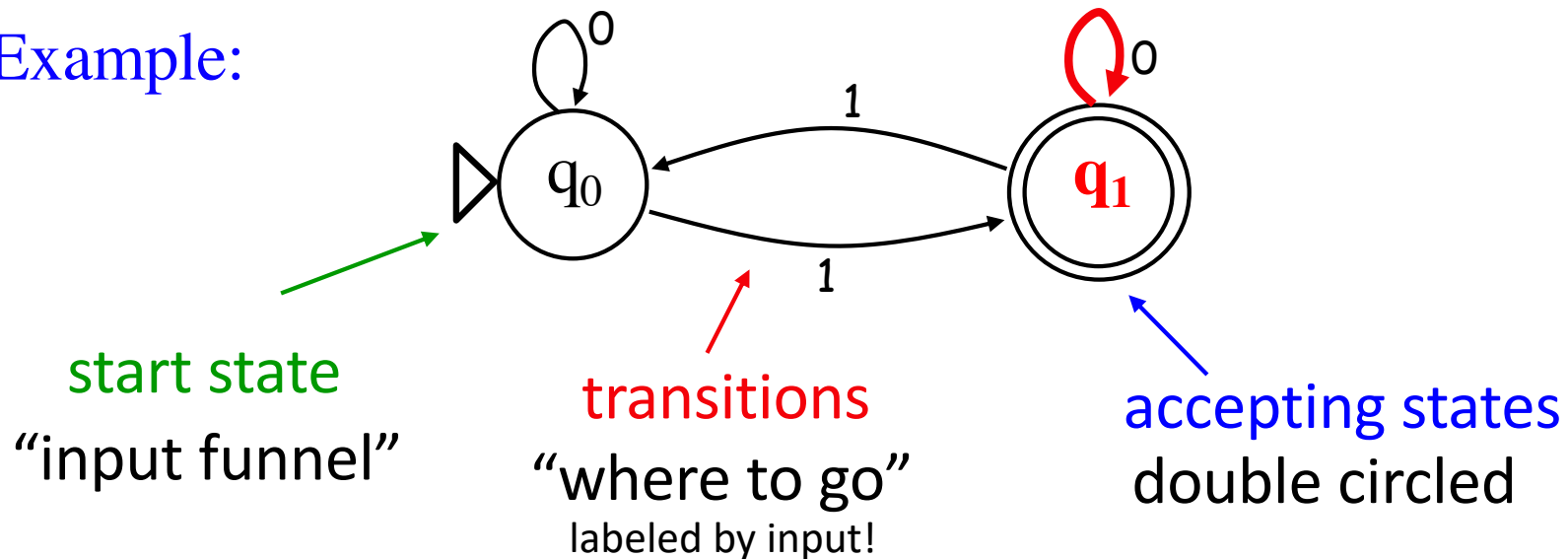
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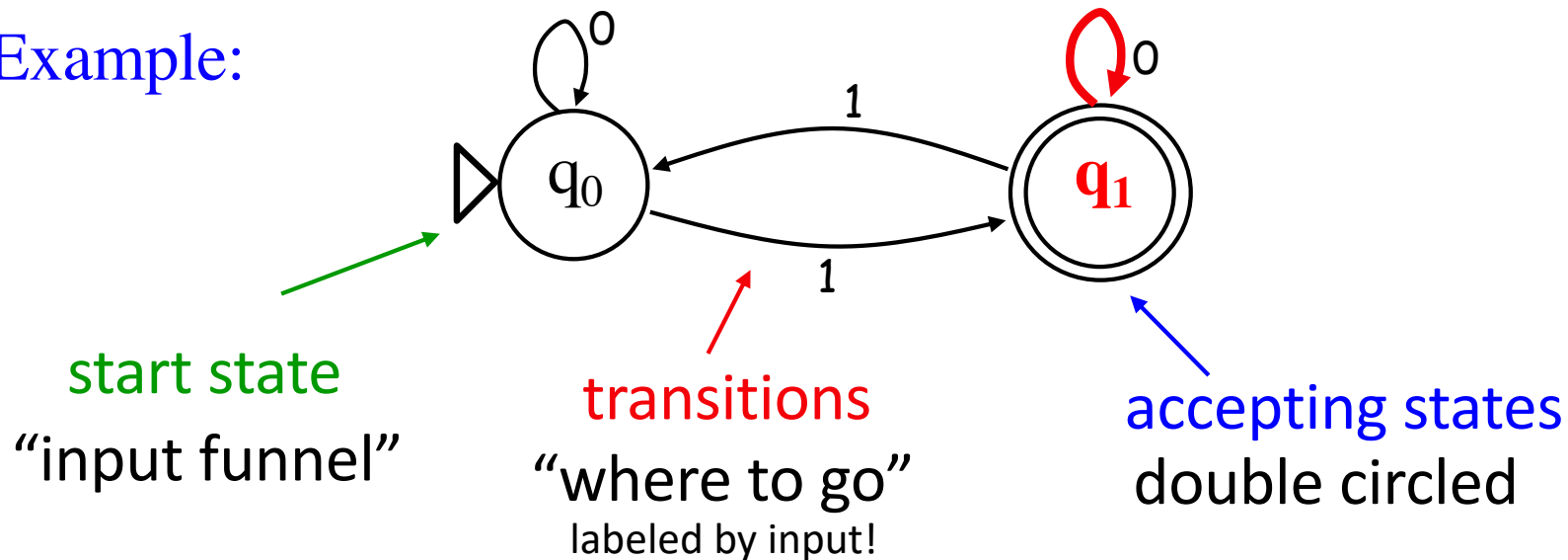
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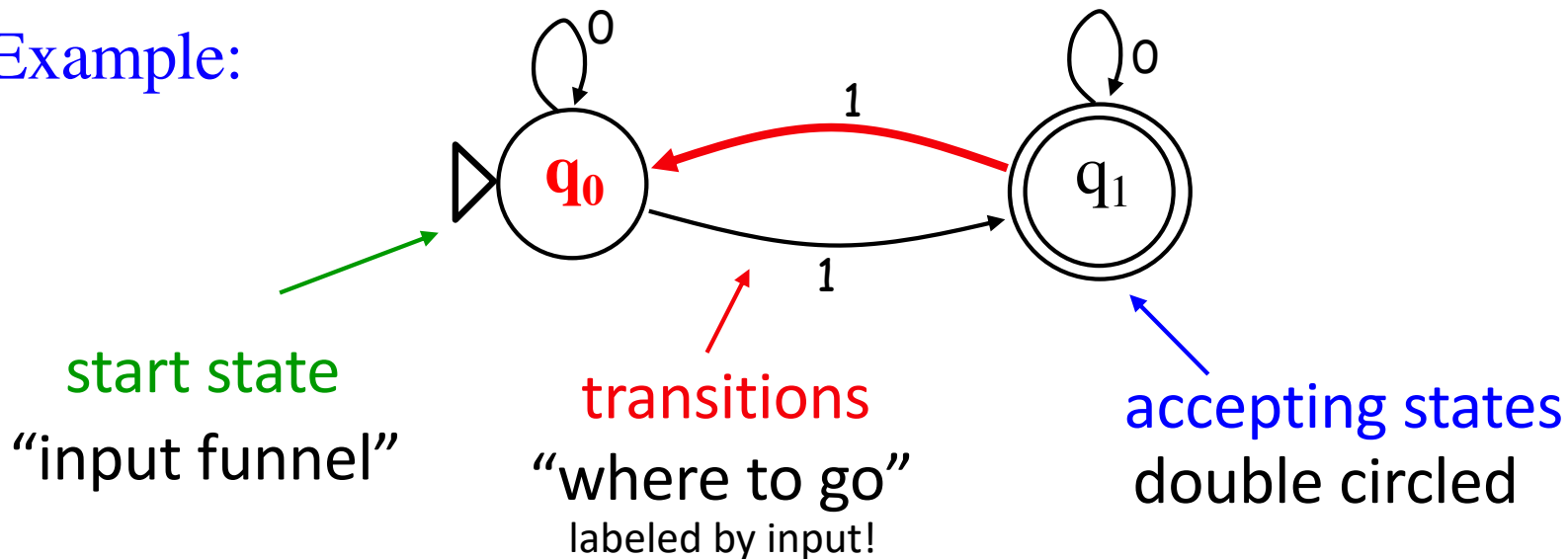
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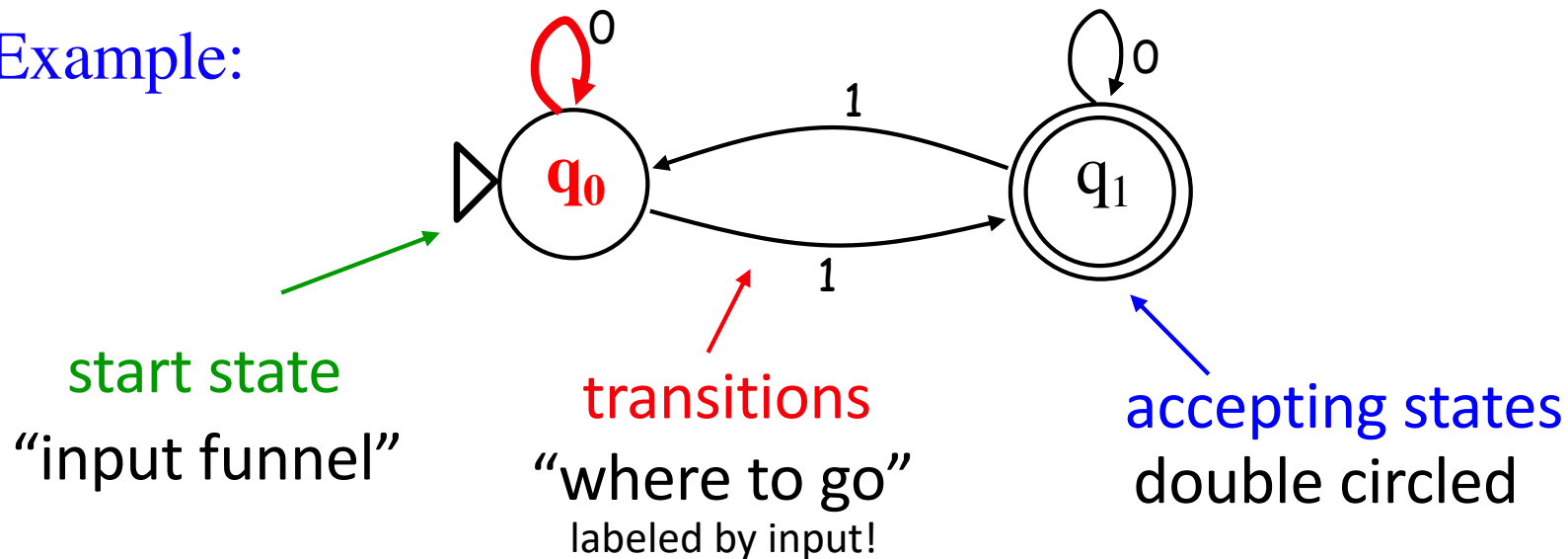
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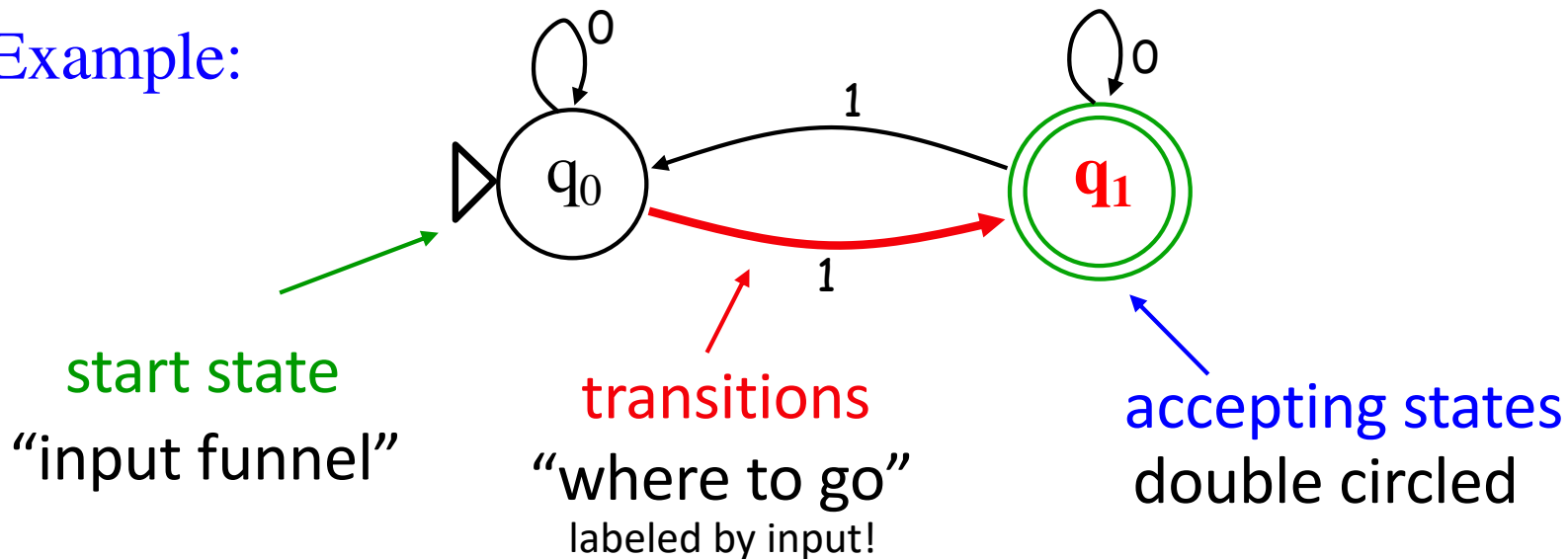
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Example:



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input sequence

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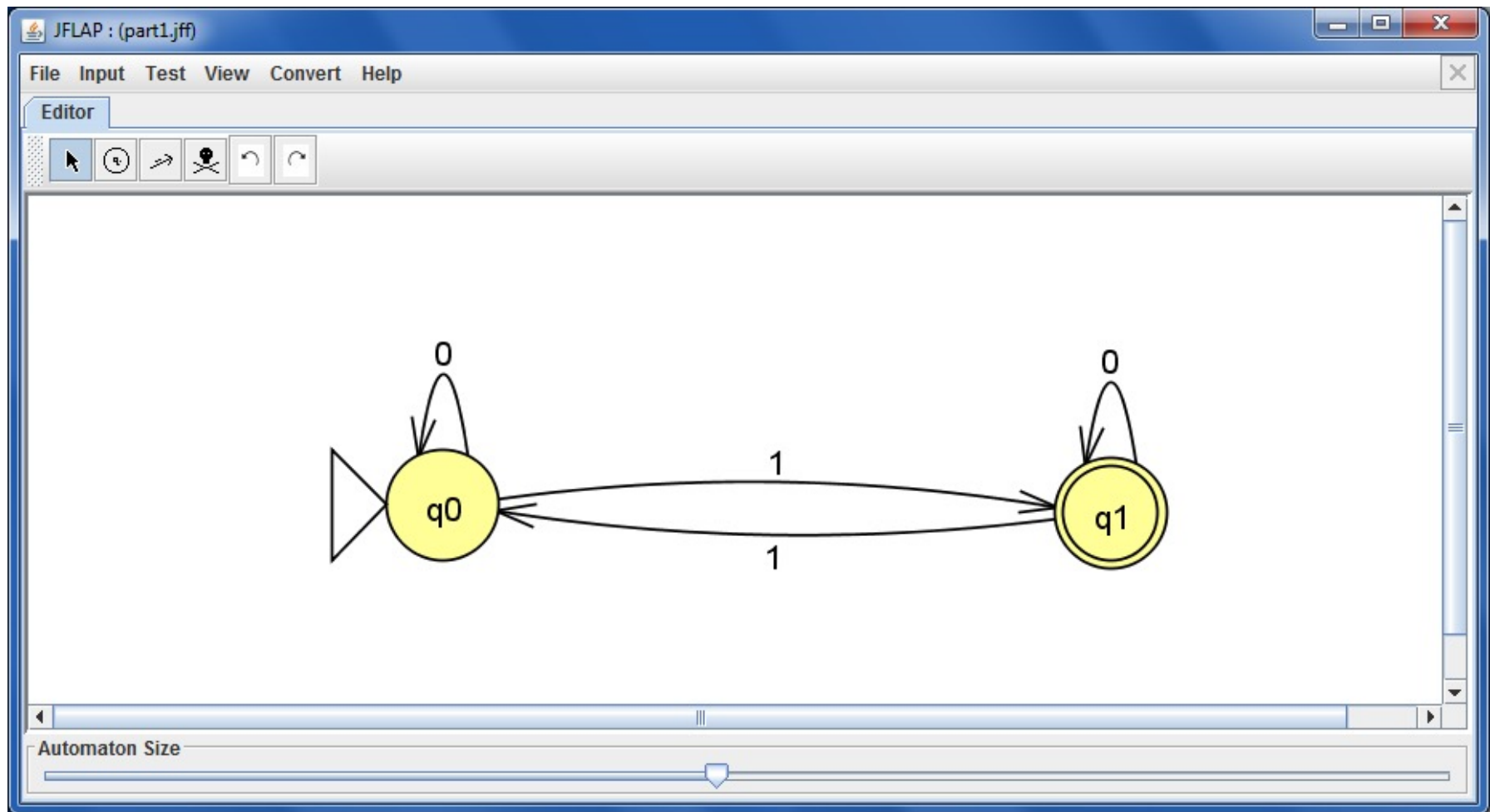
What does
each state
"mean"?

What does
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overall?

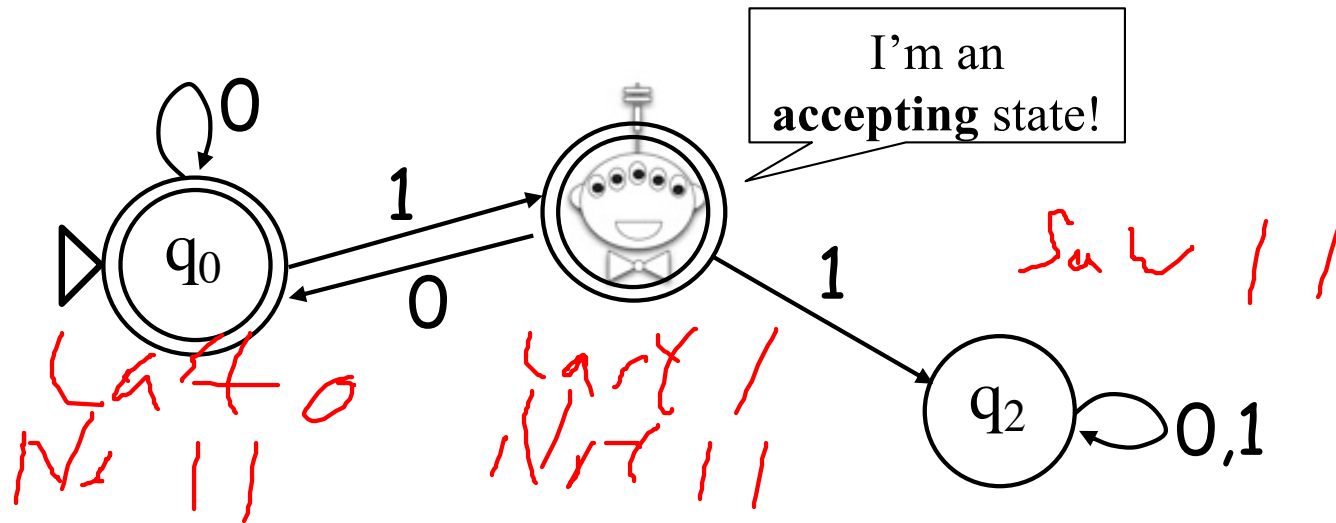


JSFLAP!

Graphical state-machine builder for HW12



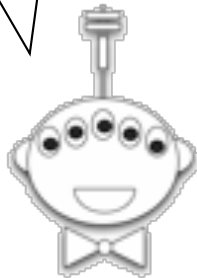
Another Example



1. What are three inputs this machine accepts?
2. How about three it rejects?
3. In English, what inputs are accepted?
4. What does each state *mean*?

The Alien's Life Advice

Faculty talk among
themselves about two
kinds of students



Don't be the
second kind

No Occurrences of 110

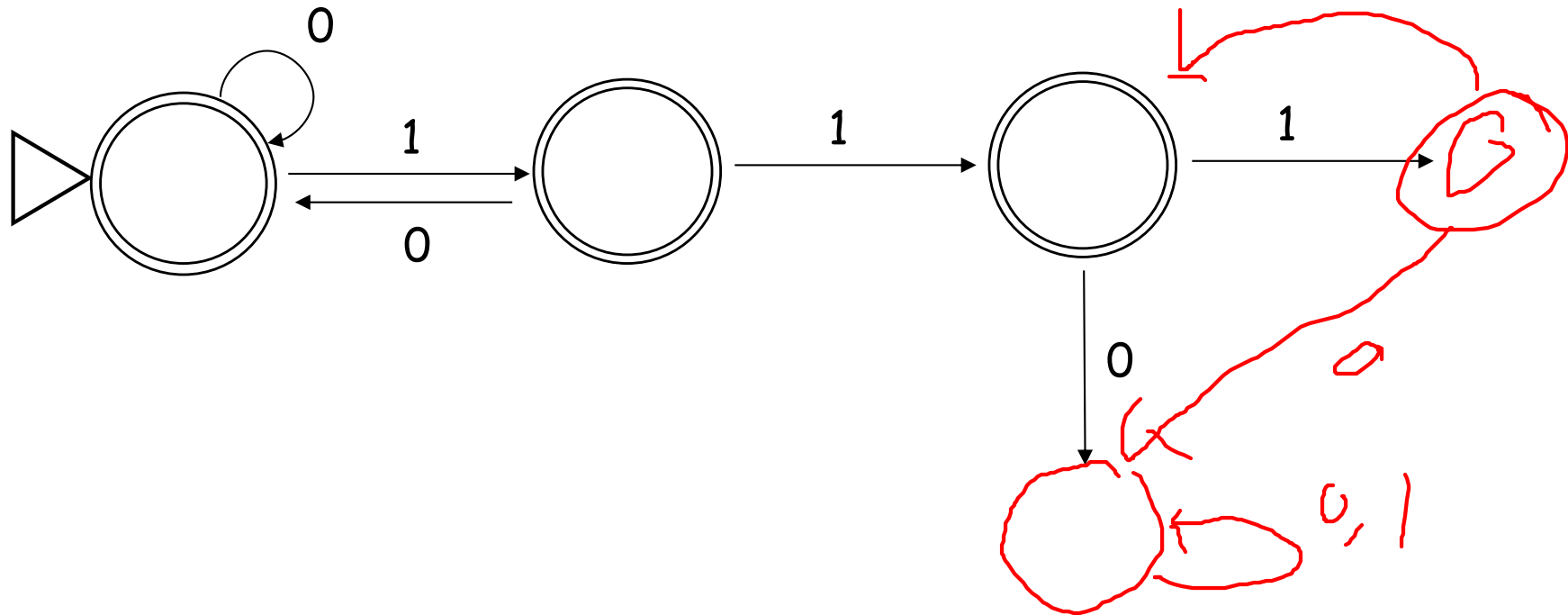
Draw an FSM to accept strings that don't contain the pattern 110 anywhere



Does your solution
use the minimum
number of states?

No Occurrences of 110

Draw an FSM accepting strings that do ***NOT*** contain the pattern **110** anywhere

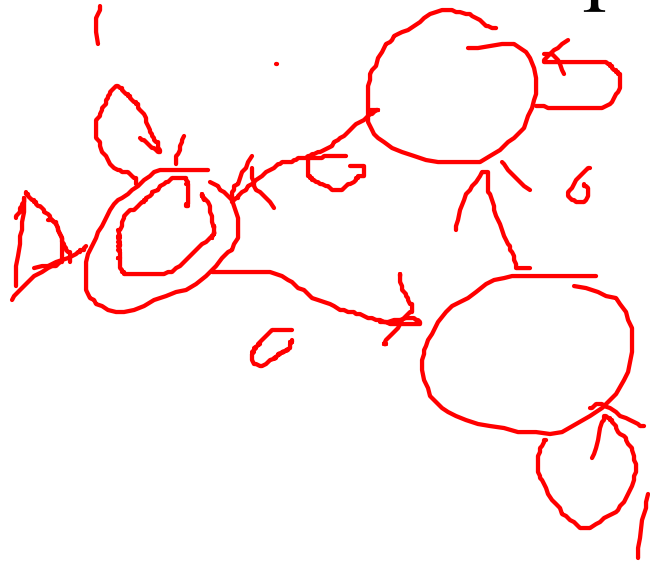


The *minimum possible* number of states?

4

Zeros Are a Multiple of 3

Draw an FSM to accept strings for which the number of zeros is a multiple of 3



This seems to
require some
circular reasoning!

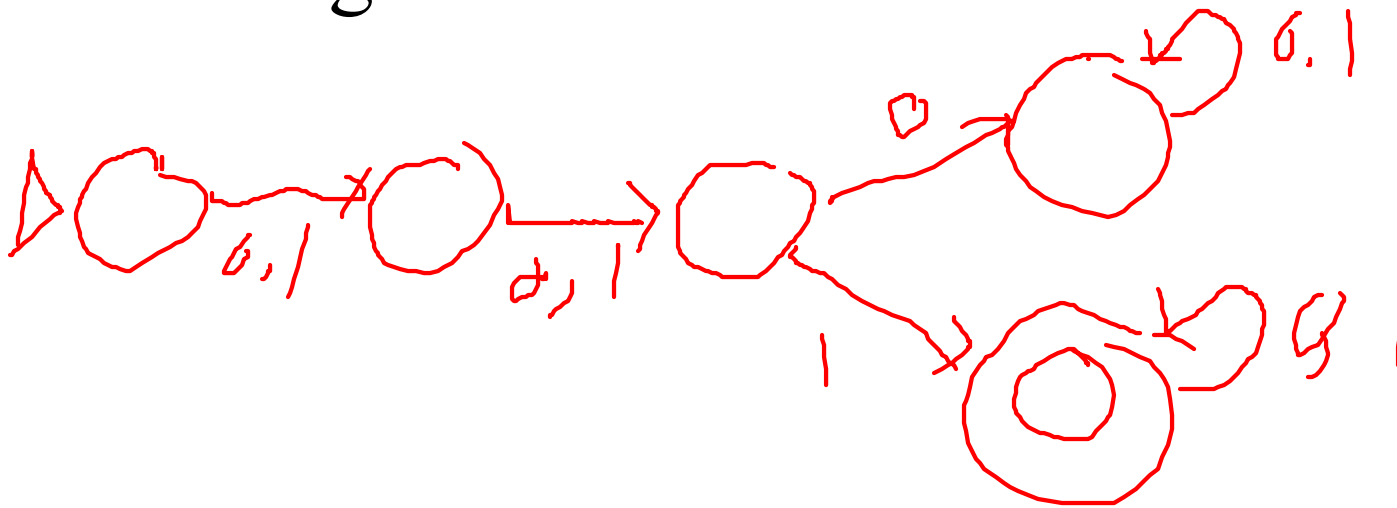
Worksheet problem!

Zeros Are a Multiple of 3

Draw an FSM to accept strings for which the number of zeros is a multiple of 3

Third From Left Is 1

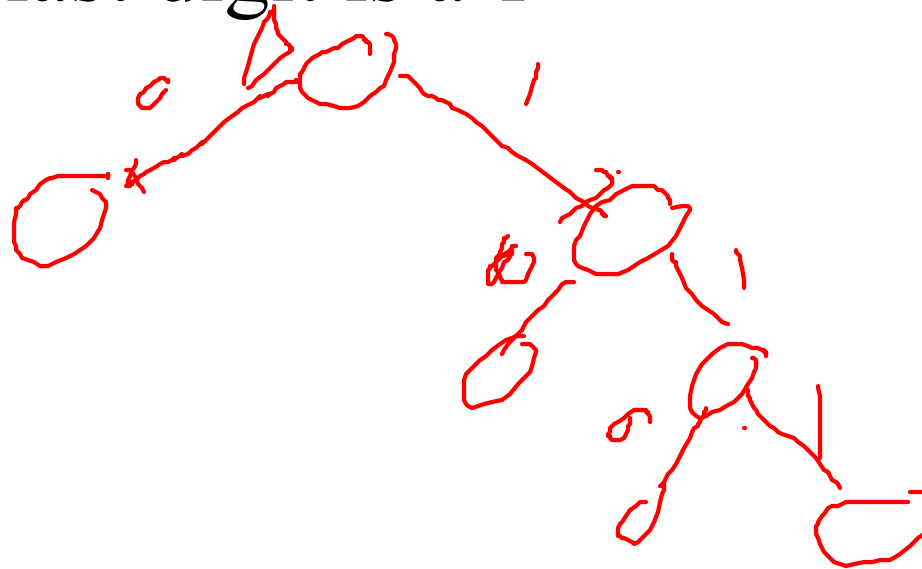
Draw an FSM to accept strings for which the third digit from the left is a 1



This one makes me
feel loopy!

Third-to-Last Character Is a 1

Draw an FSM to accept strings for which the third-from-last digit is a 1



Start with a tree-like structure!

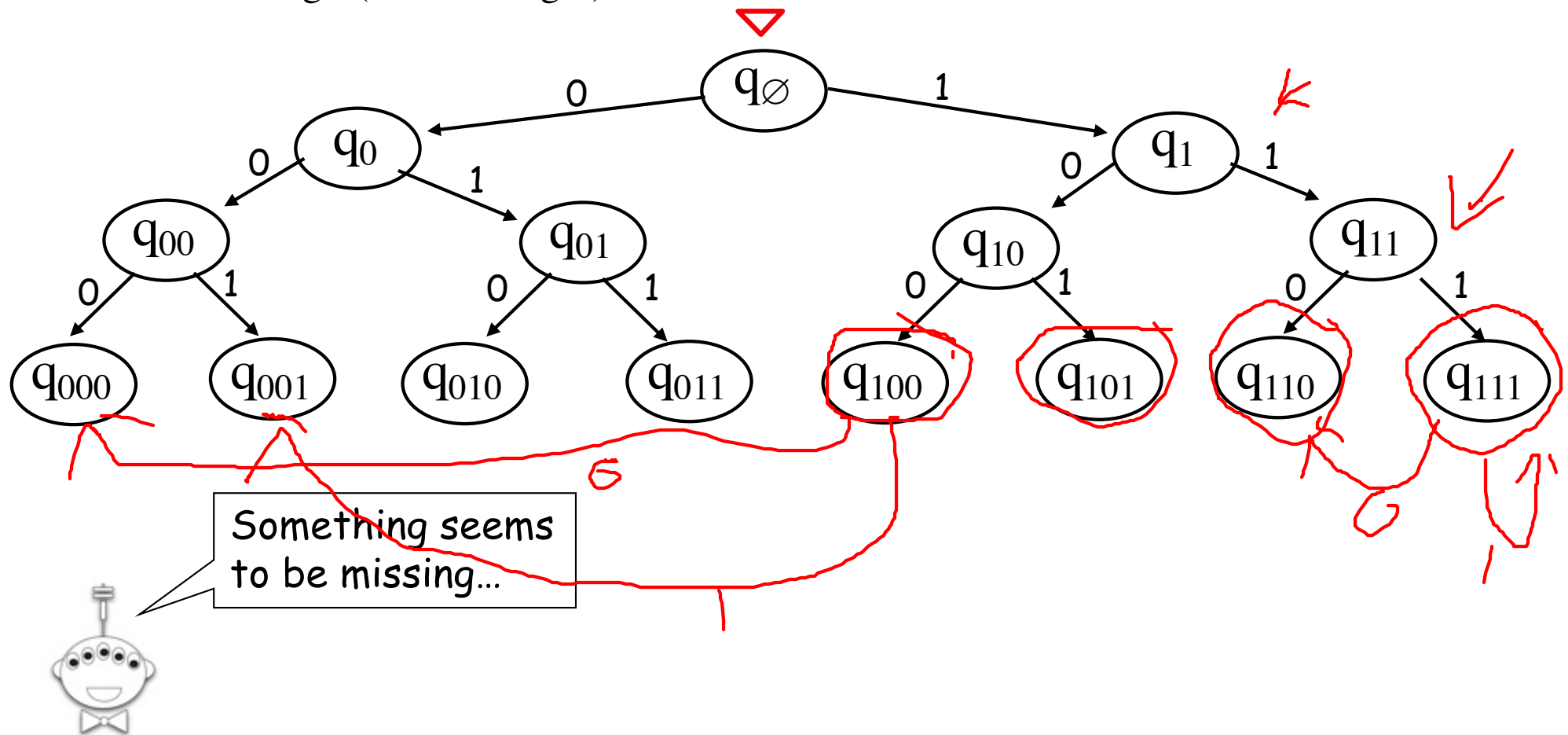
Third-to-Last Character Is a 1

Draw an FSM to accept strings for which the third-from-last digit is a 1

The *minimum possible* number of states?

Third-to-Last Character Is a 1

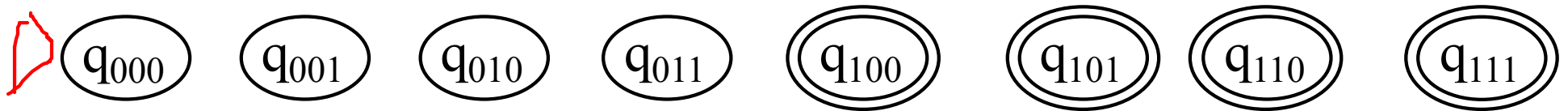
Draw an FSM accepting strings whose third-to-last digit (from the right) is a **1**.




The *minimum possible* number of states?

Third-to-Last Character Is a 1

Draw an FSM accepting strings whose third-to-last digit (from the right) is a **1**.



Where does
this go? 

8 states suffice!

FSM Computability

Are there limits to an FSM's capabilities?

only 1s and 0s?

OUTPUT ?

variables, lists, memory?

Two More FSMs

What FSM accepts inputs whose first character is the same as the last character?

Is this even possible?



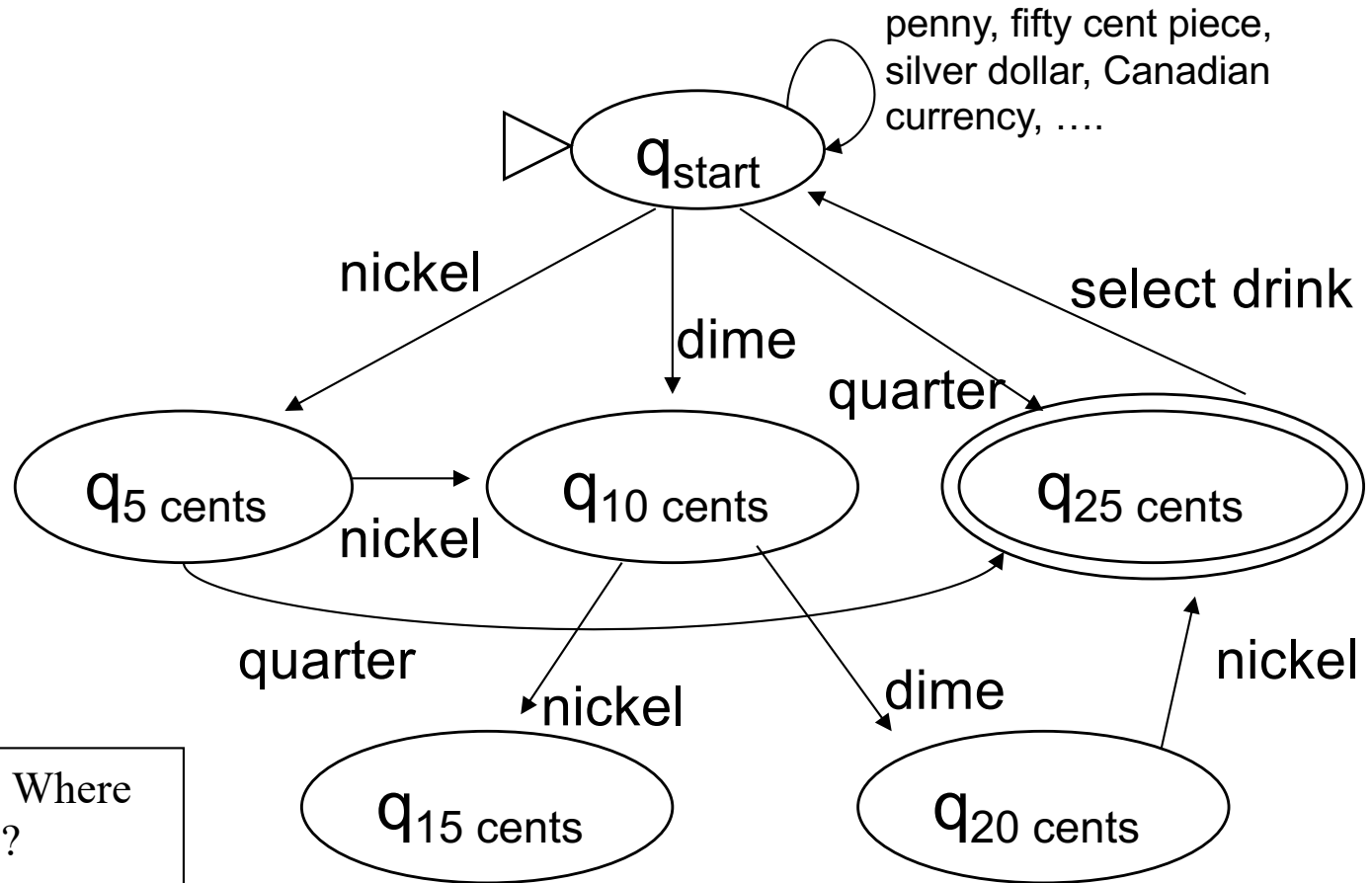
Two More FSMs

What FSM accepts inputs that are *palindromes* ?

Are computers
more powerful
than FSMs?



FSMs are Everywhere!



25 cent Cokes? Where is this machine!?

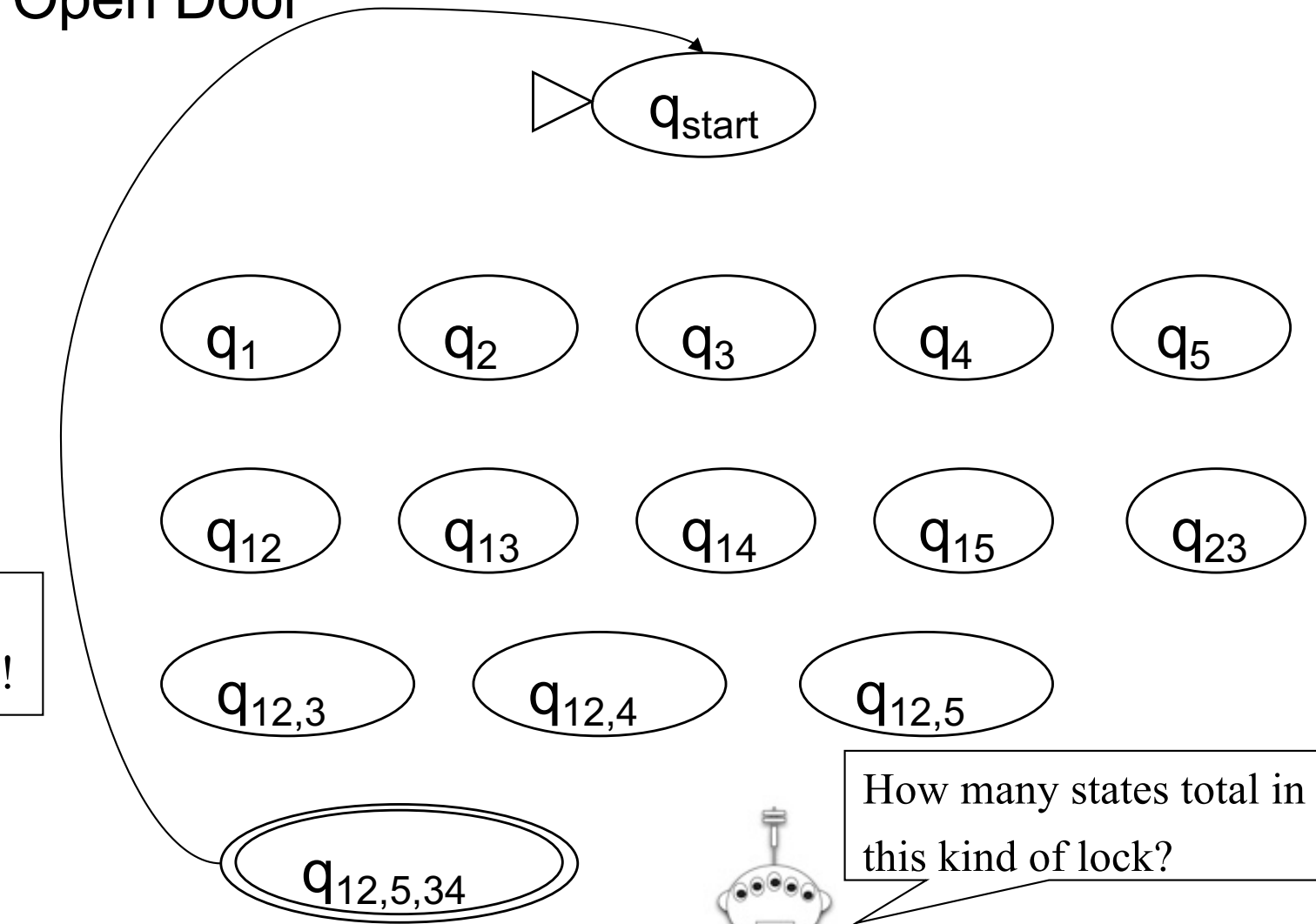


(some transitions not shown)

FSMs are Everywhere!



Open Door



There's a lot missing here!



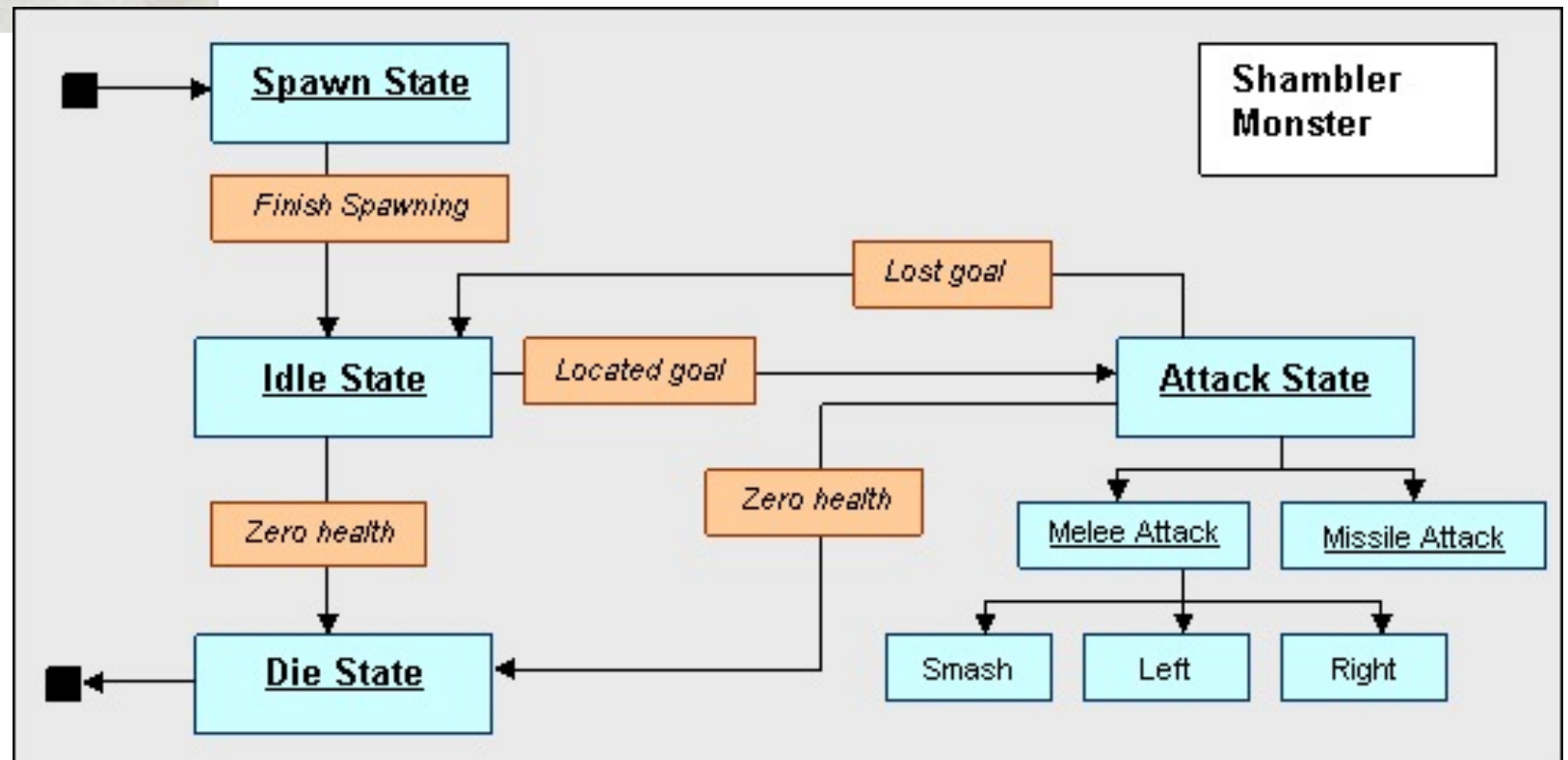
How many states total in this kind of lock?





FSM == FearSoMe?

The FSM controlling Quake's Shambler monsters...



I'm *Quaking* in my AstroBoots

