

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.



Homework 12

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

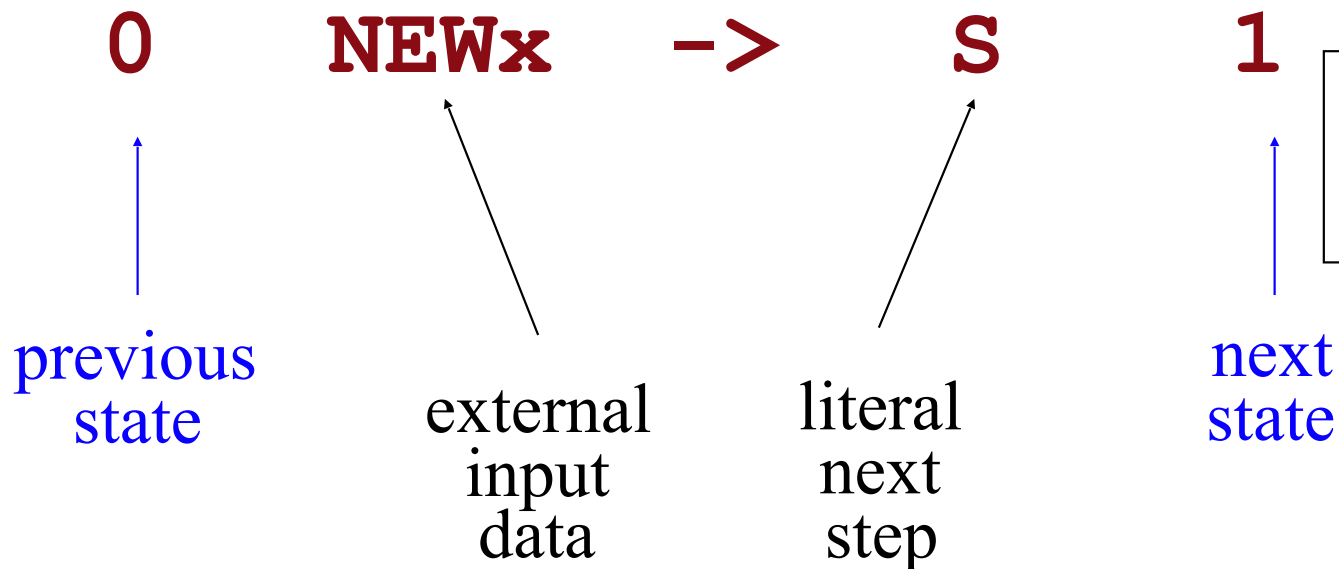
Labs in Weeks 12-13

- 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

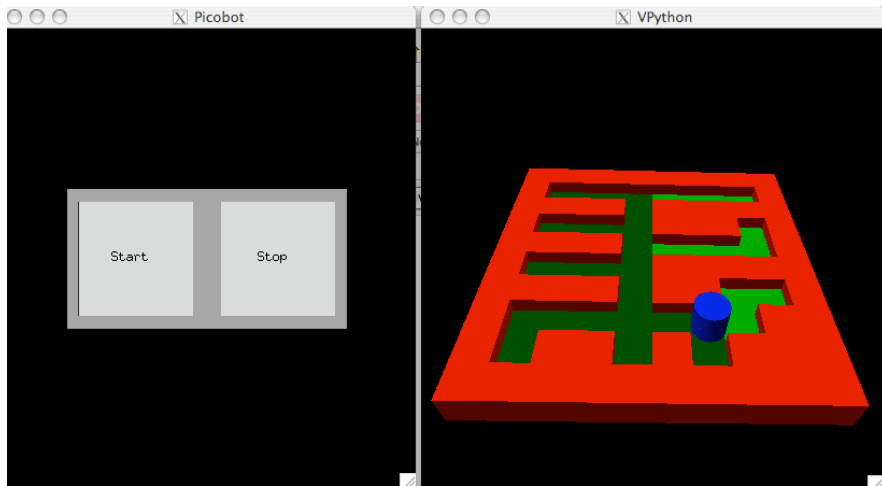
all the internal information
needed to take the next step



Do I need parental permission to enter a new state?

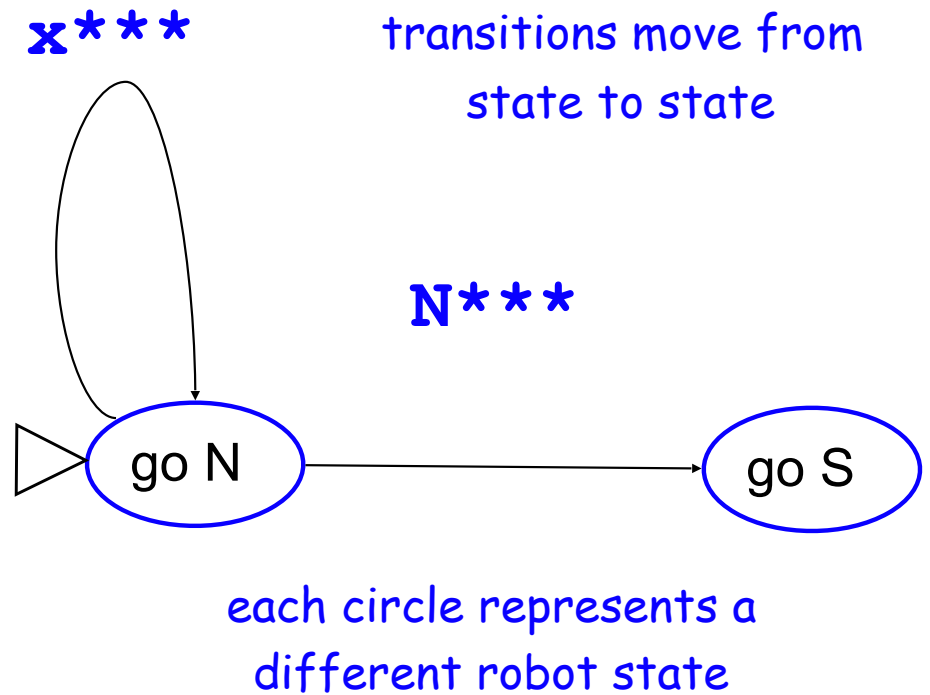


Picobot == *State* Machine

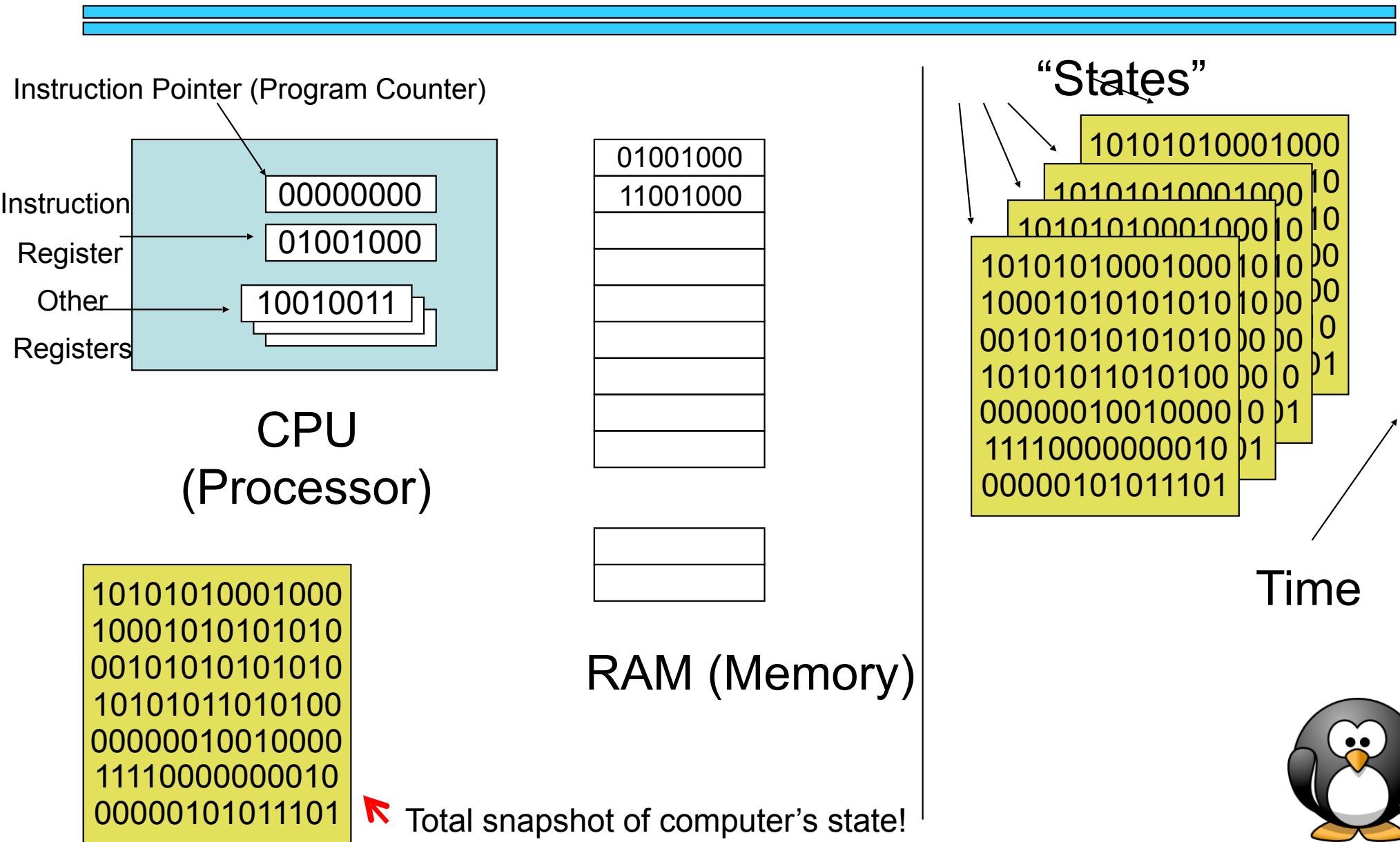


state pattern -> move new state

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



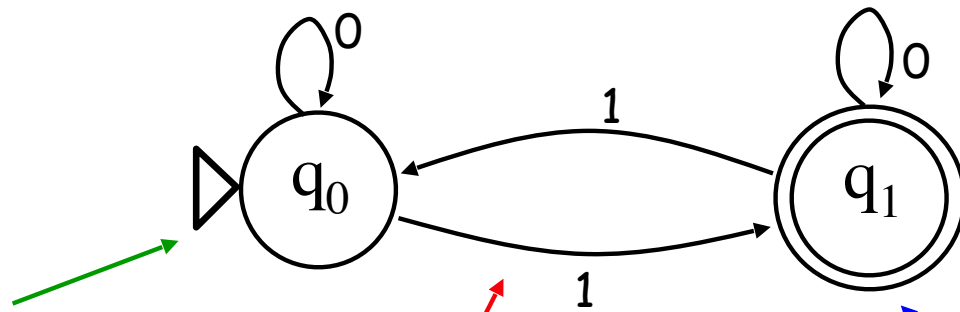
Computer == State Machine



Our Model of Computation: FSMs

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

Example:



start state
“input funnel”

transitions
“where to go”
labeled by input!

accepting states
double circled

How it runs:

input sequence **100101**

What does each state “mean”?

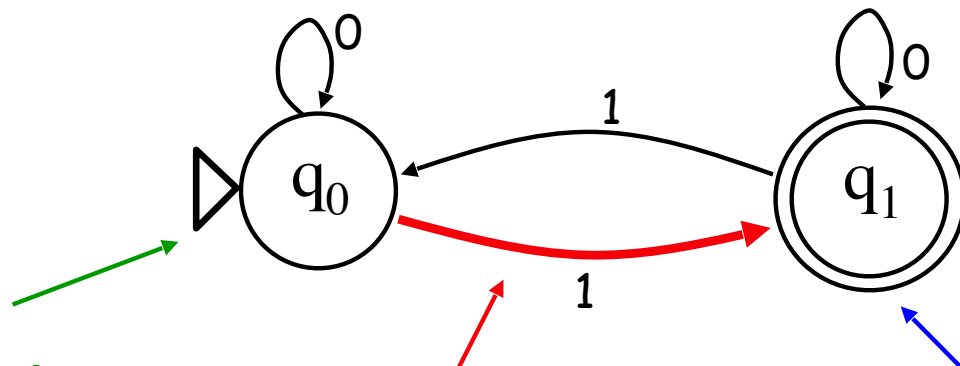
What does this FSM do overall?



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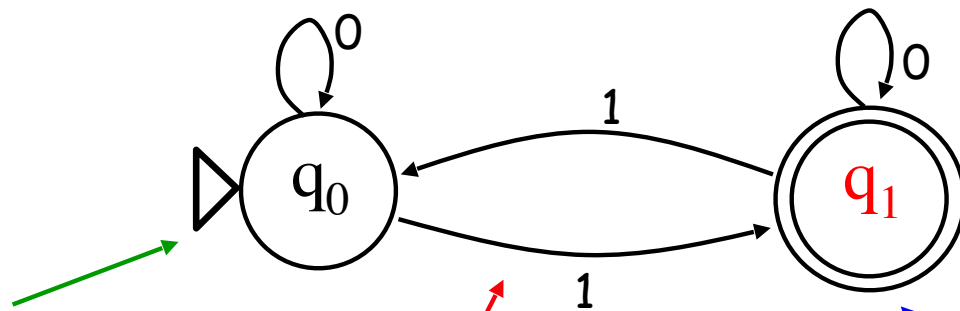
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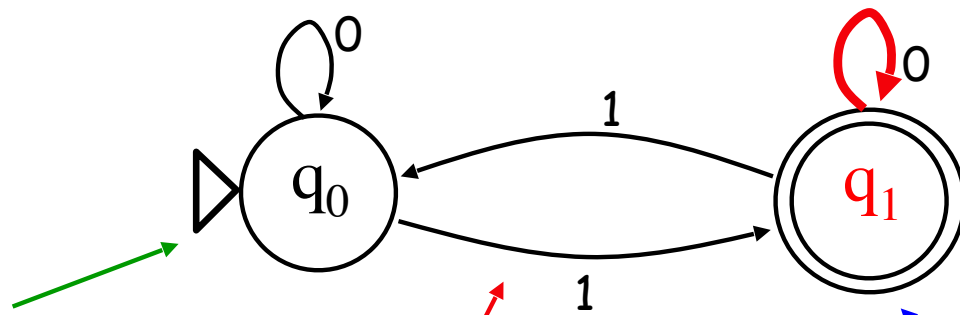
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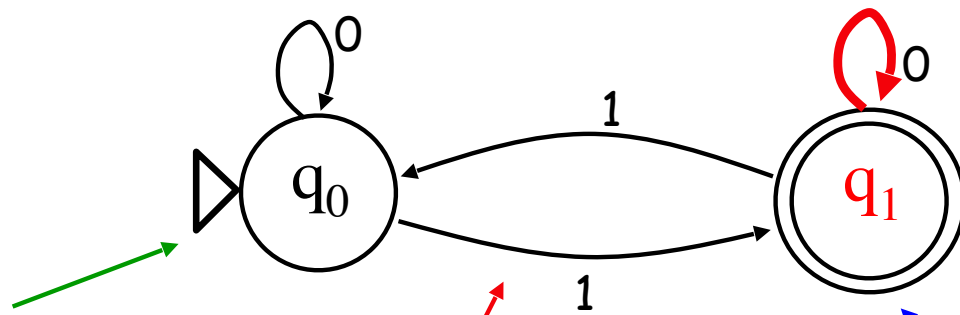
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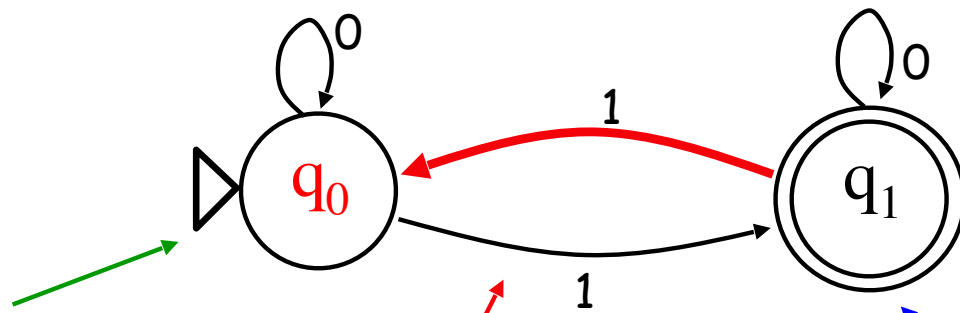
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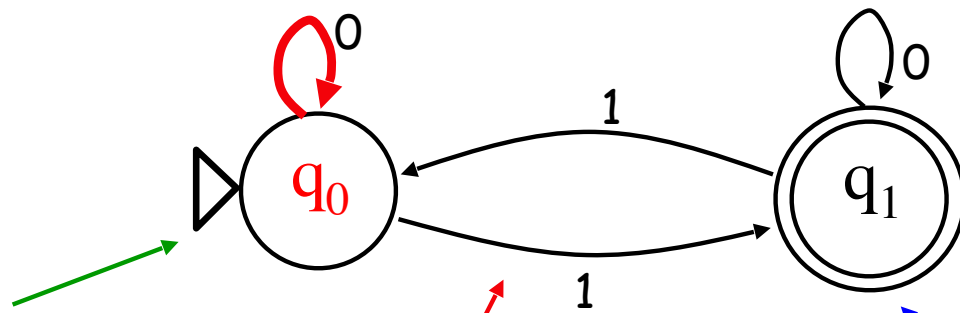
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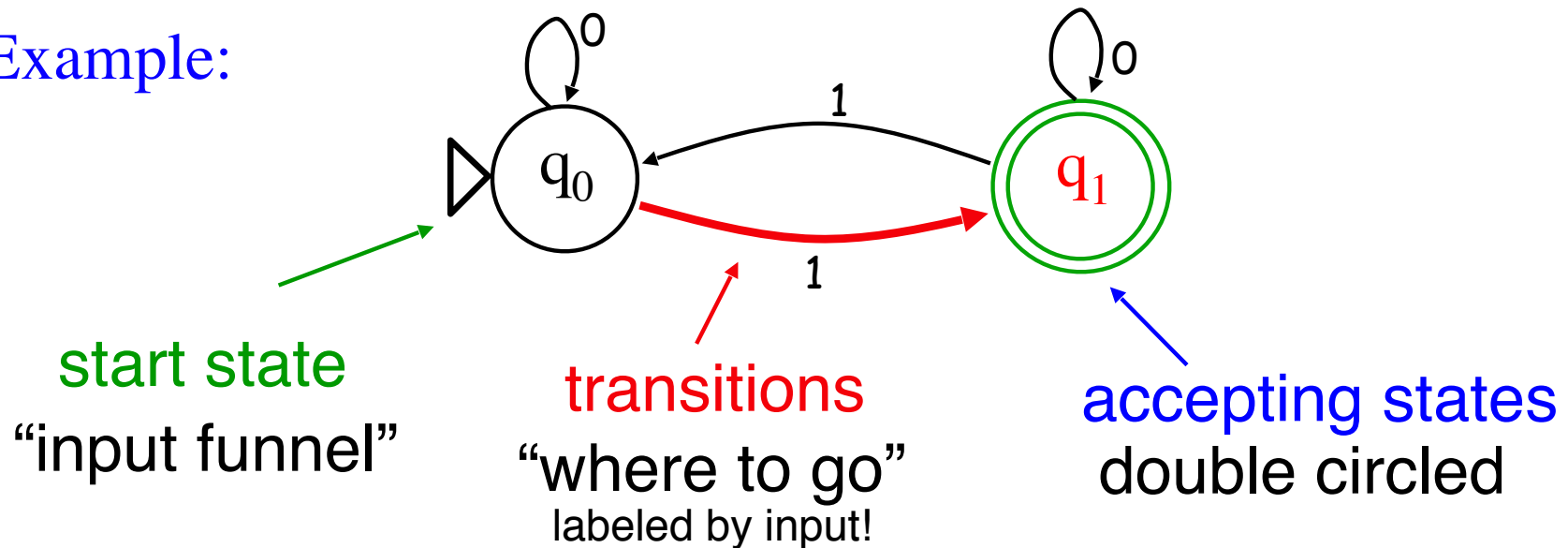
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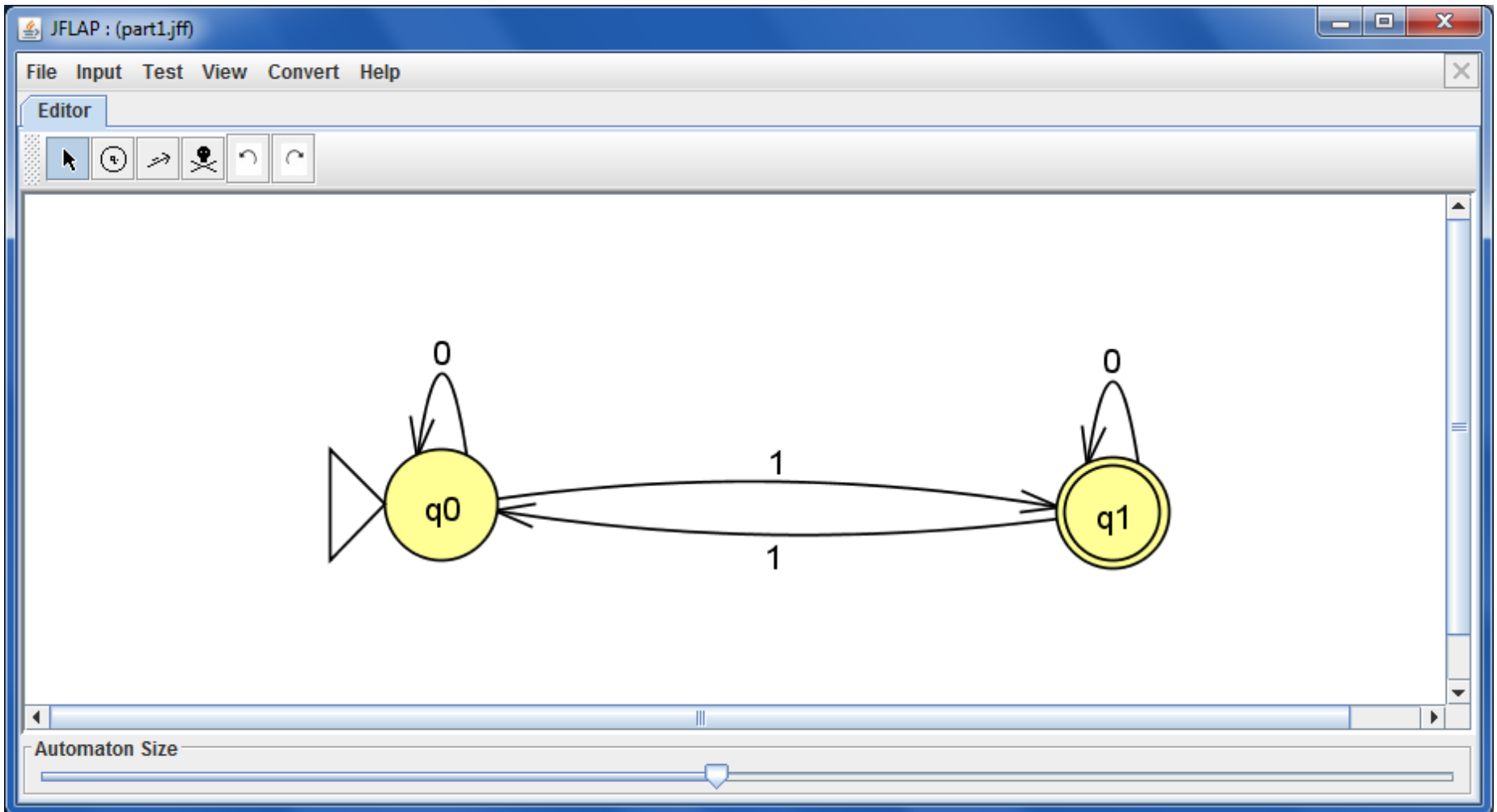
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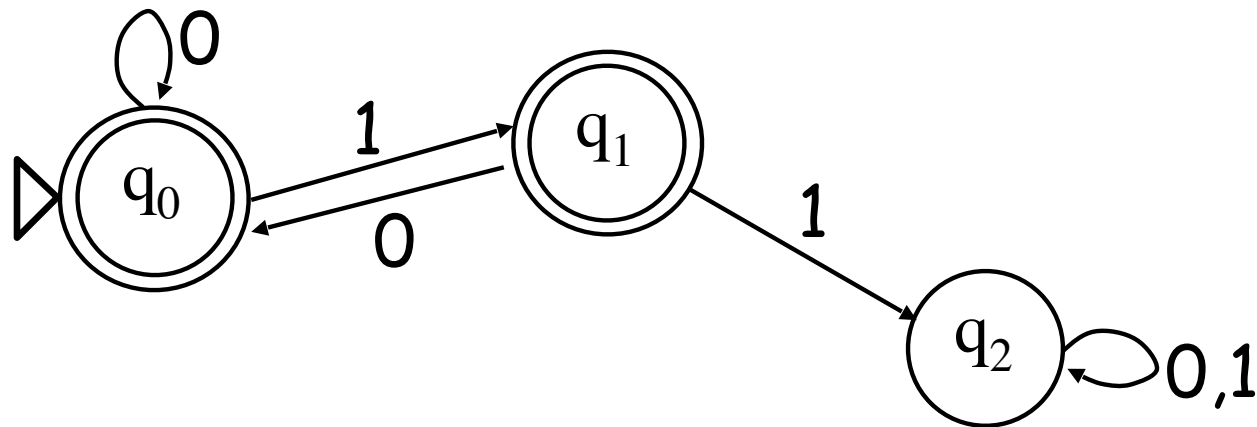


JFLAP!

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*?

No Occurrences of 110

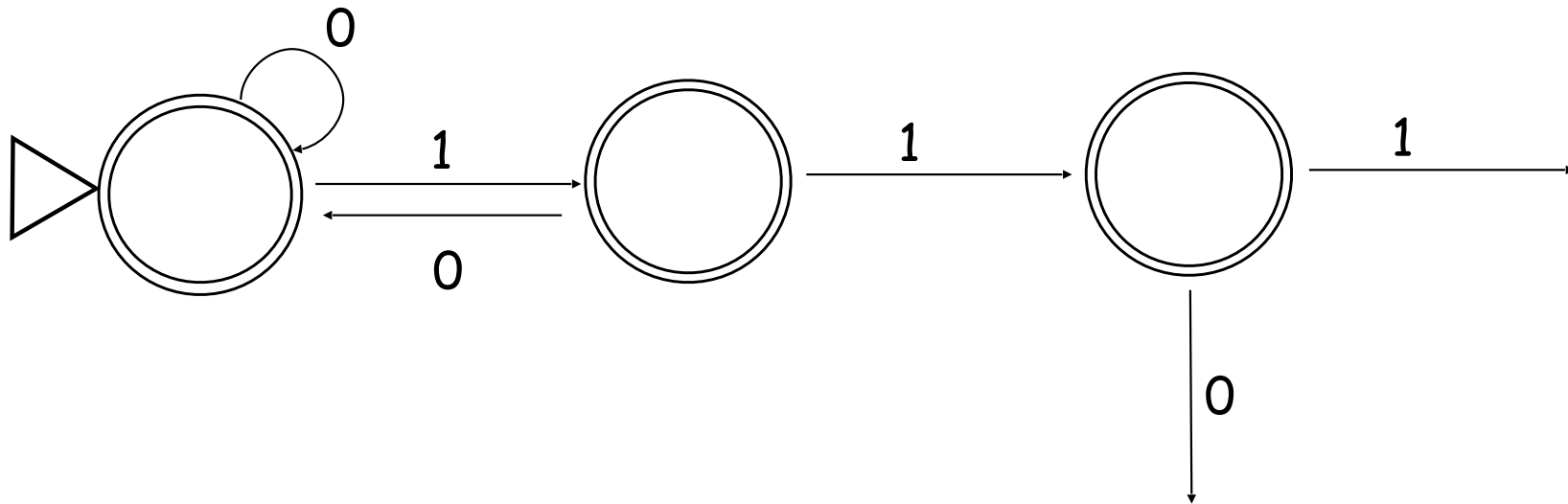
Draw an FSM to accept strings that don't contain the pattern 110 anywhere



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?

Stretch Break!

A THEOREM:

LIST ALL MATH JOKES IN ORDER OF LENGTH.

ASSUME THERE IS A LARGEST MATH JOKE, L .

CREATE A NEW MATH JOKE J BY APPENDING TO L THAT JOKE ABOUT THE PIRATE WHO HAS A WHEEL ON HIS CROTCH THAT IS "DRIVIN' ME NUTS!"

J IS NOW LARGER THAN L , WHICH IS A CONTRADICTION.

THEREFORE THE SET OF MATH JOKES IS INFINITE.

NOW,

ASSUME A GOOD MATH JOKE, M .

IF M IS A GOOD JOKE, THEN IT IS FUNNY.

IF A JOKE IS FUNNY THEN EVERYONE WILL KNOW IT.

IF EVERYONE KNOWS A JOKE, THE JOKE WILL NOT BE FUNNY.

IF A JOKE IS NOT FUNNY, THEN IT IS NOT A GOOD JOKE.

THEREFORE, IF M IS A GOOD JOKE, M IS NOT A GOOD JOKE.

BY CONTRADICTION, THERE ARE NO GOOD MATH JOKES.

THEREFORE:

THERE ARE INFINITELY MANY MATH JOKES AND NONE OF THEM ARE GOOD.

QED

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!

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

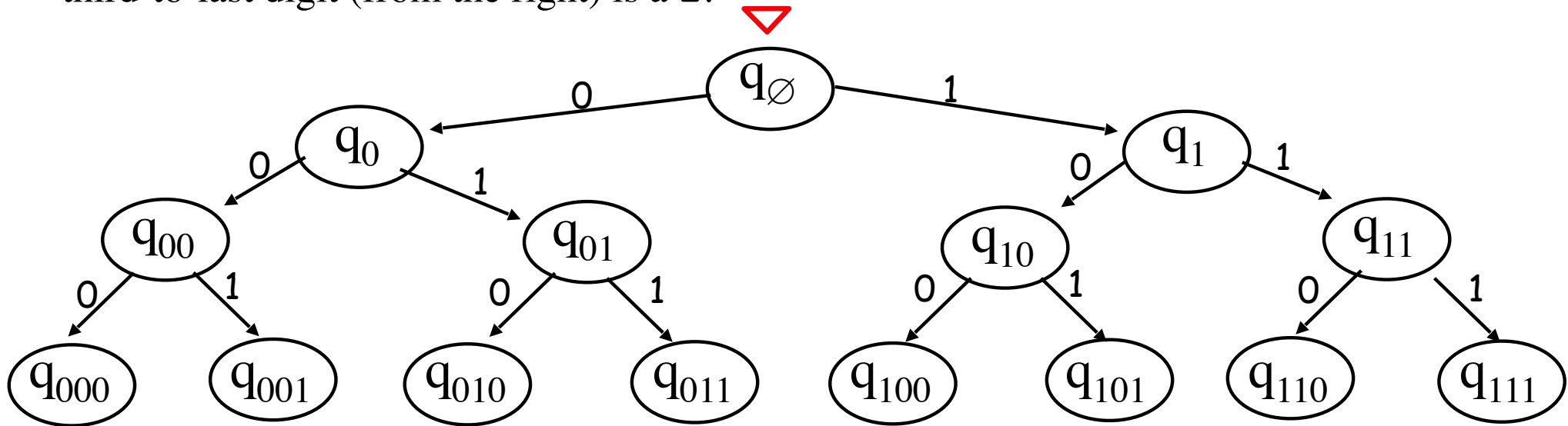
Draw an FSM to accept strings for which the third-from-last digit is a 1



Start with a tree-like structure!

Third-to-Last Character Is a 1

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



Something seems to be missing...



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?



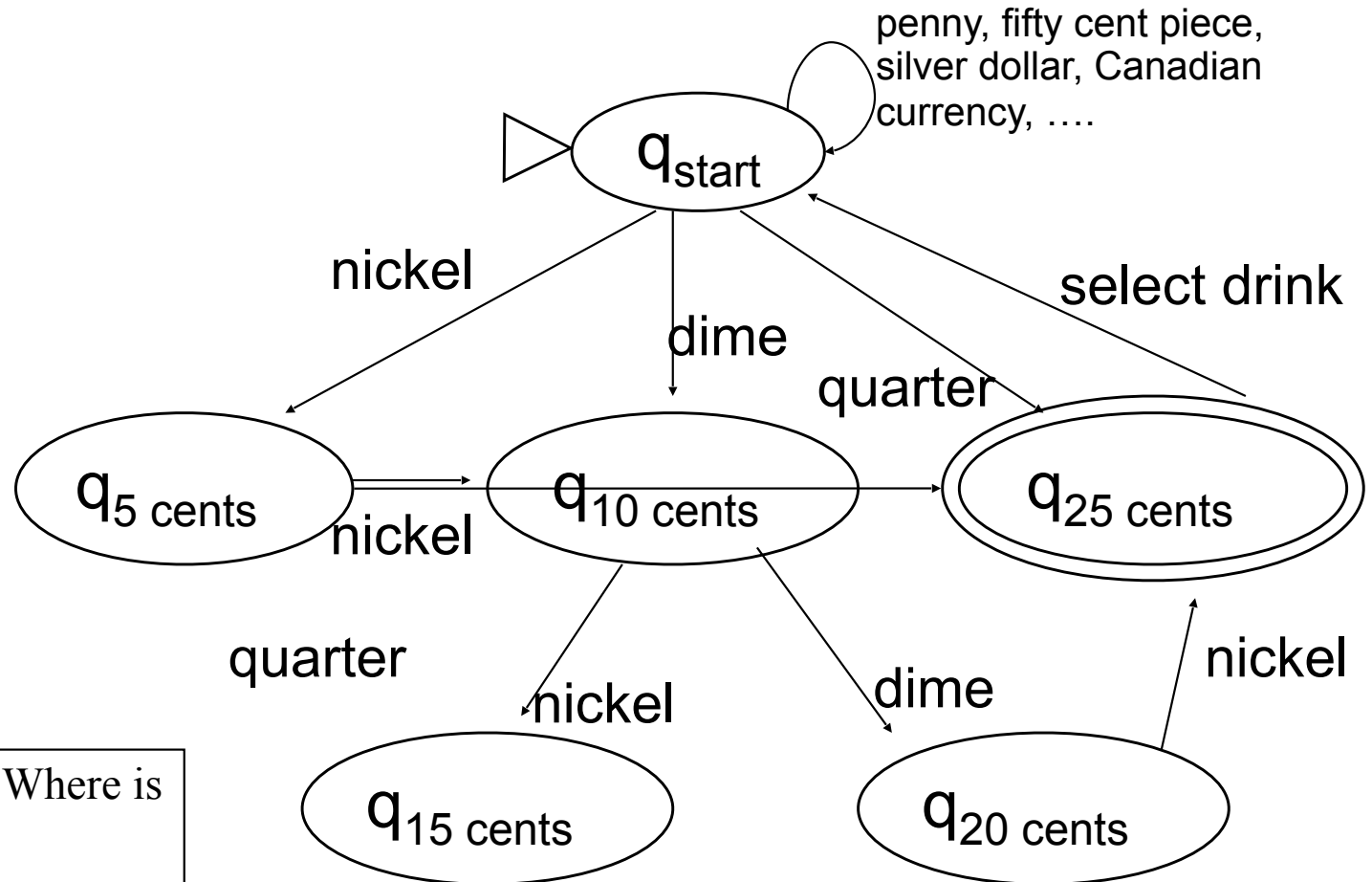
Two More FSMs

What FSM accepts inputs that are *palindromes* ?

Are computers
more powerful
than FSMs?



FSMs are Everywhere!



25 cent Cokes? Where is this machine!?

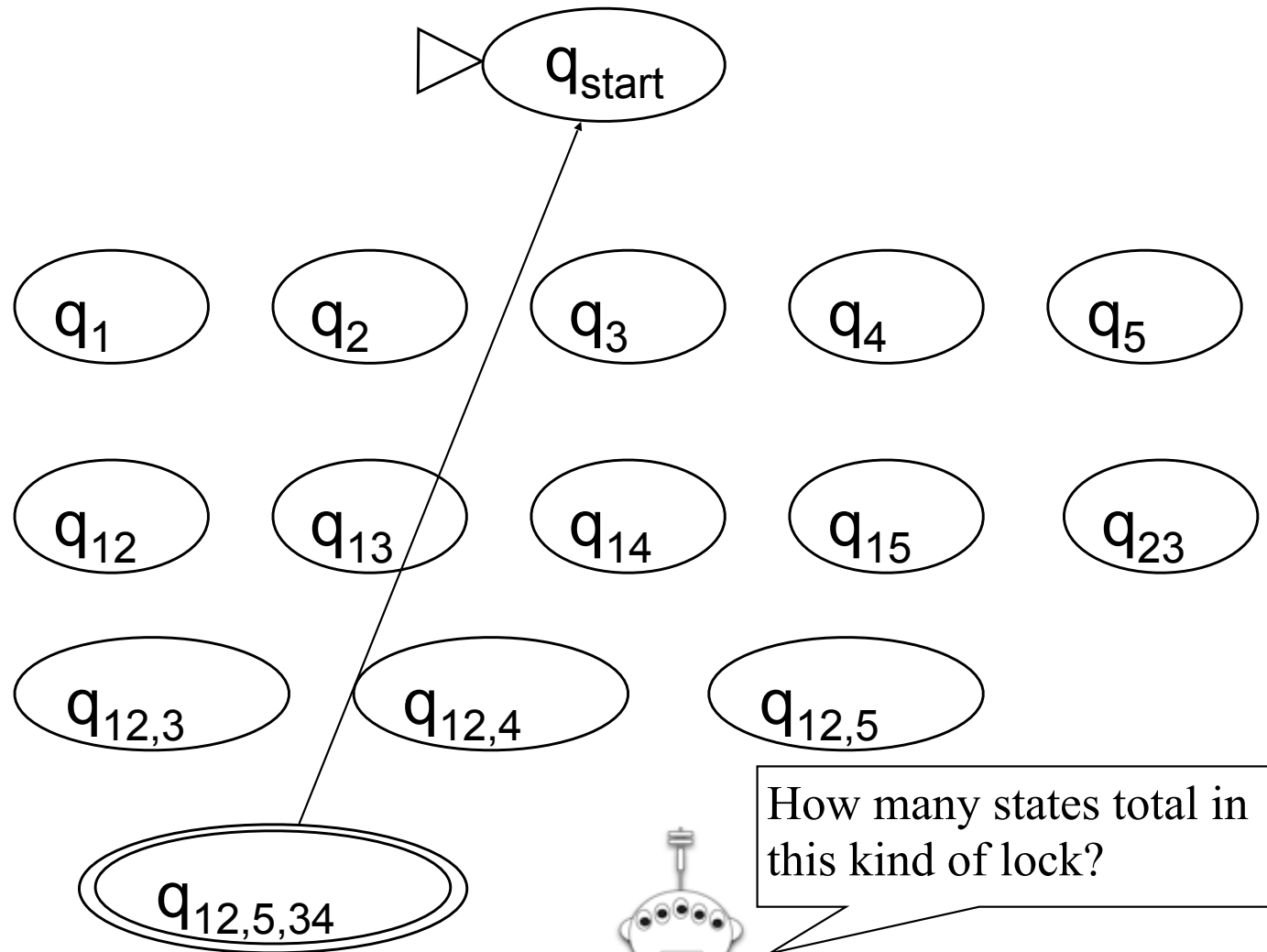


(some transitions not shown)

FSMs are Everywhere!



Open Door



There's a lot missing here!



How many states total in this kind of lock?



CS5 Black Worksheet

Name: _____

Date: _____