

alphabet : any finite set,
each element is
called a letter

Ex: $\Sigma = \{a, b, c, d, \dots, z\}$

$\Sigma = \{A, C, G, T\}$

String: a finite sequence of
symbols

$s = AAGGTTT$ is a string
over alphabet $\Sigma = \{A, C, G, T\}$

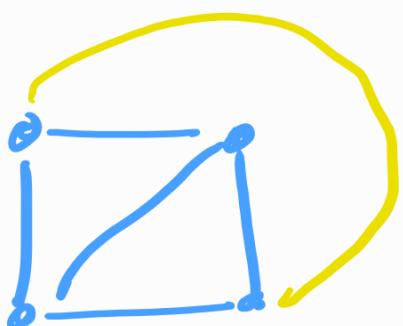
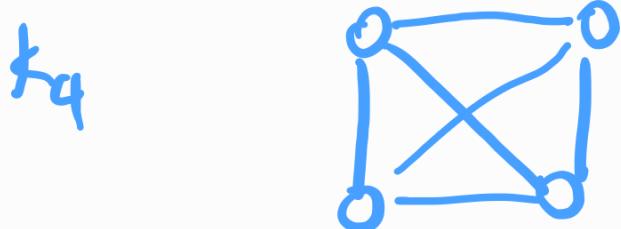
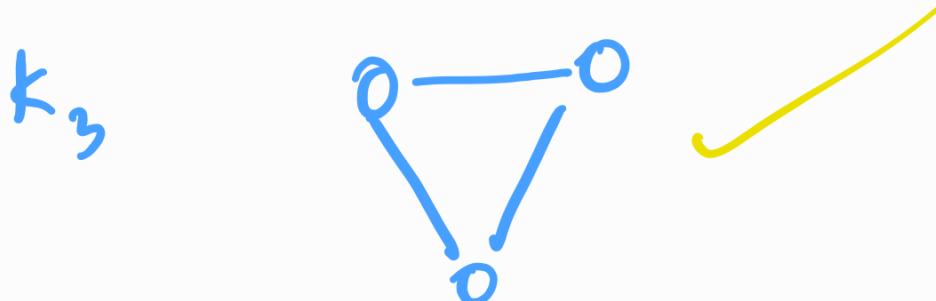
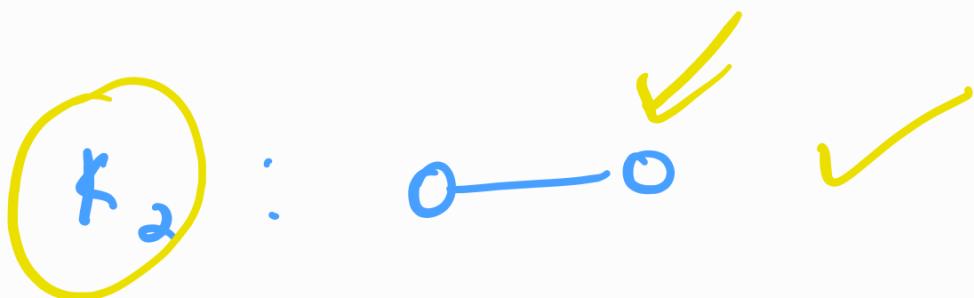
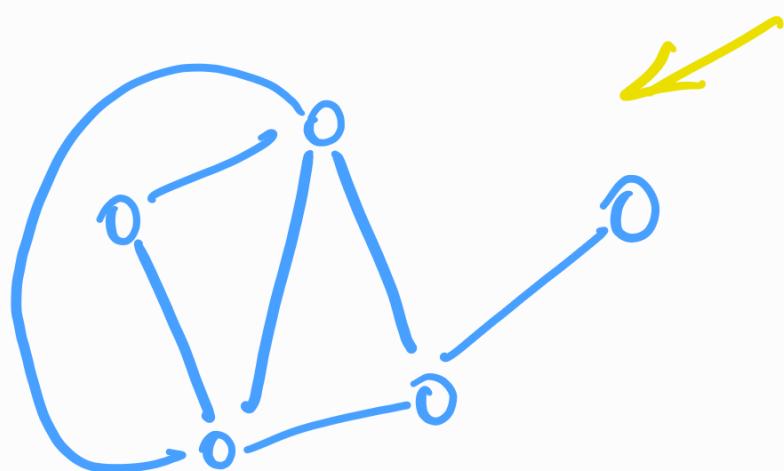
language: a set of strings

$L = \{AACGT, AAC\}$

Empty string ϵ

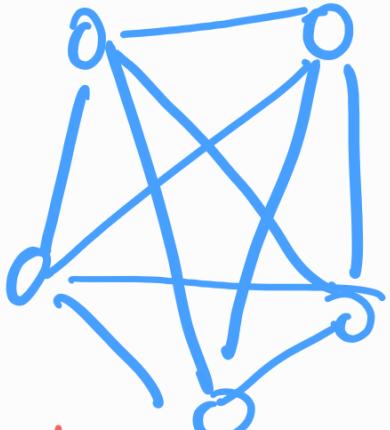
Planar graphs

A graph whose vertices and edges can be drawn on the plane, with no edges crossing.

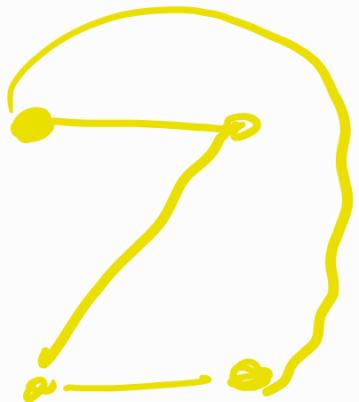
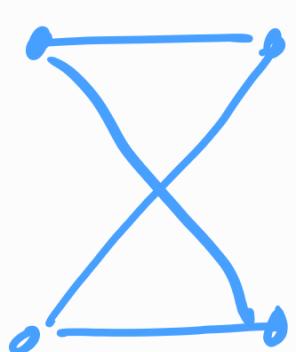
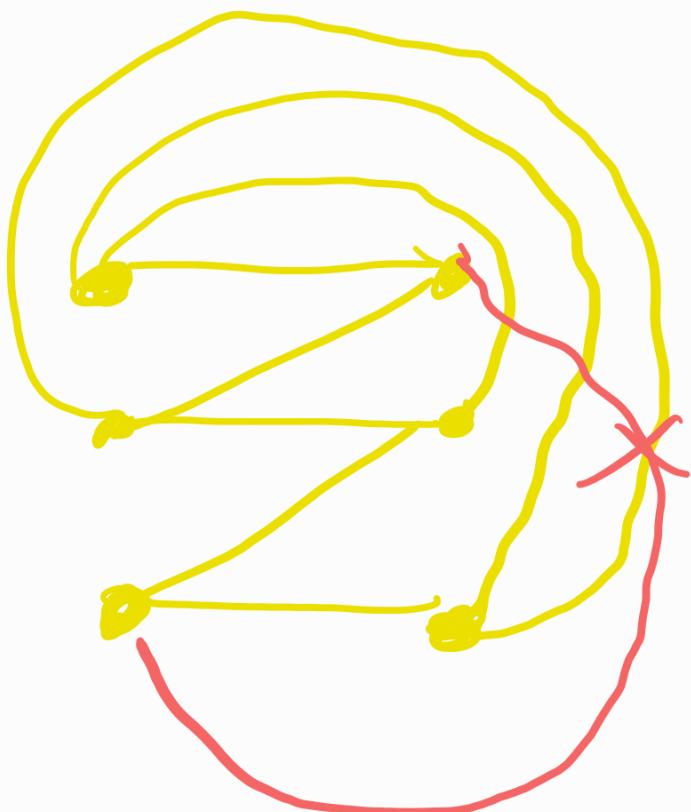
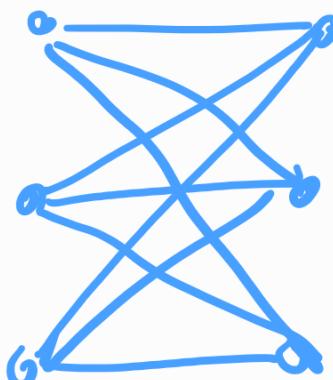


K_5 

not
a planar
graph

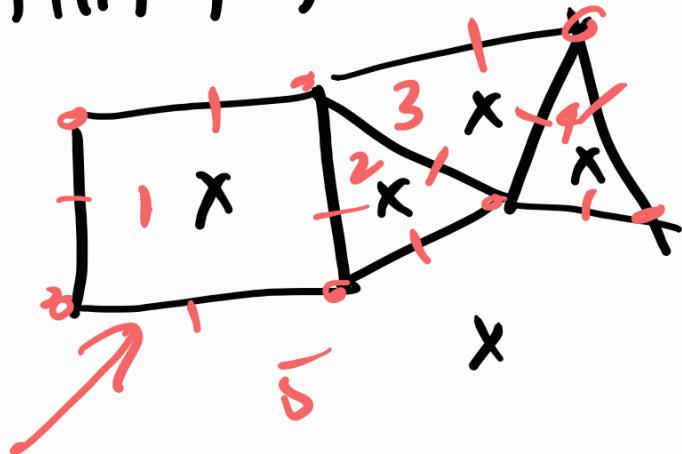


you
can try
but it cannot
be drawn
on a plane

 $K_{2,2}$  $K_{3,3}$ 

Euler's formula (for connected
planar graph.)

$$|V| + |F| - |E| = 2$$



$$|V| = 7$$

$$|E| = 10$$

$$|F| = 5$$

face must contain at least 3 edges

$\therefore 3|F|$ edges could be the total # of edges, but each edge in this case is counted twice therefore

$$\frac{3|F|}{2} \leq |E|$$

$$3|F| \leq 2|E|$$

Chapter 01

Finite Automaton

What is a computation model?

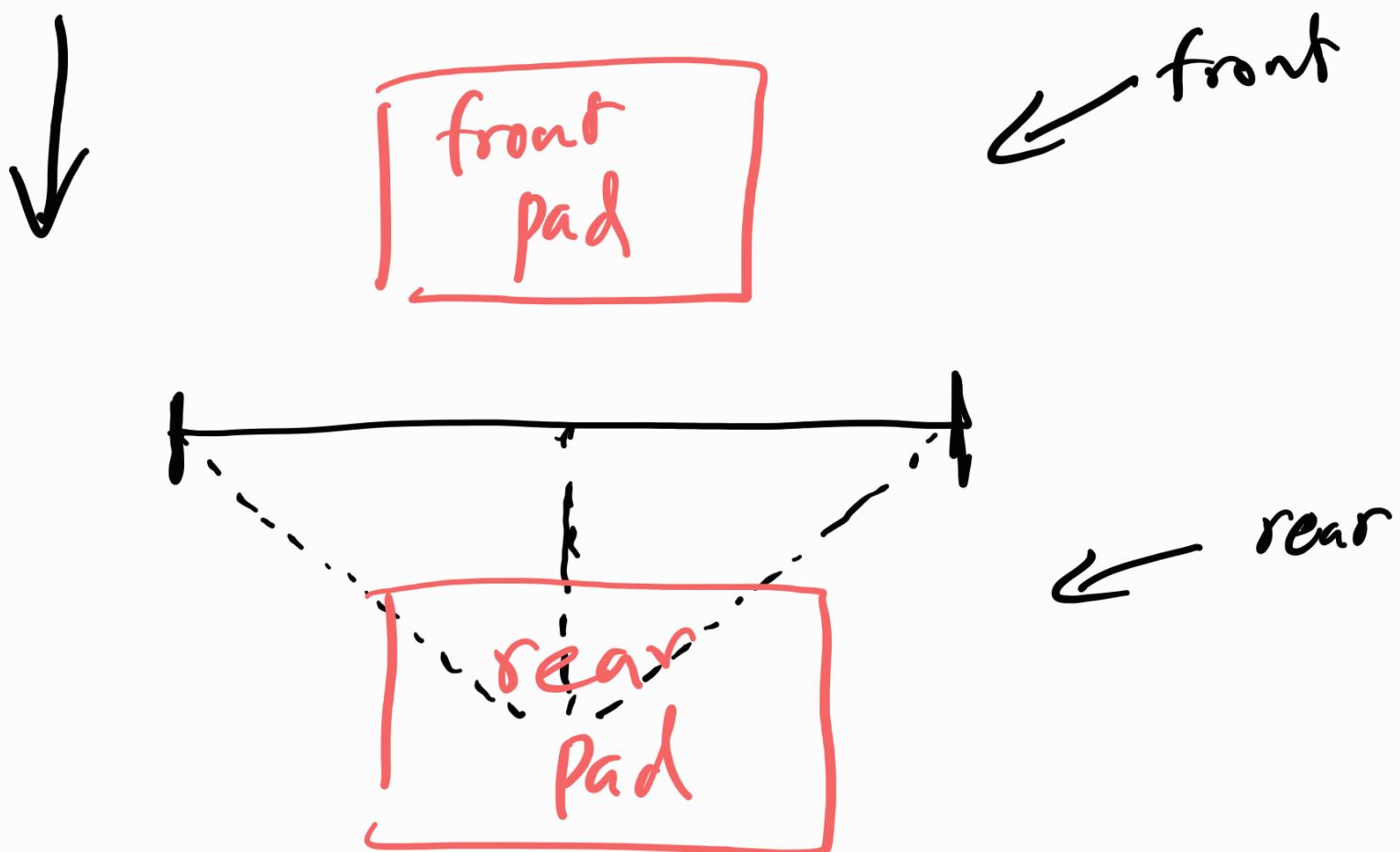
Computational model is an idealized version of a computer.

- Computation models are accurate in some ways and not in others.

Finite Automaton

- A computer with extremely limited memory.

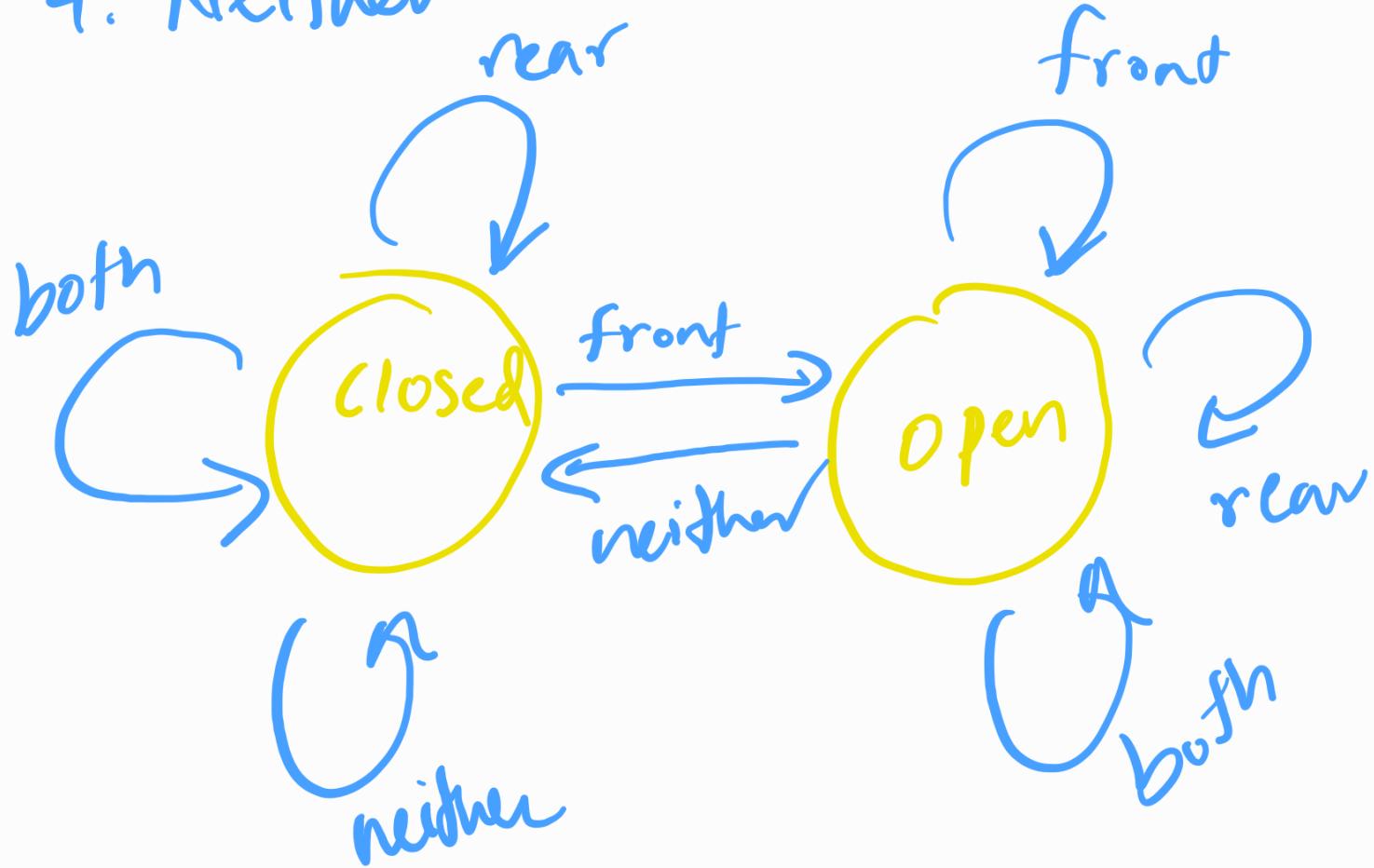
Example: Automatic door
in a supermarket



controller is either closed
or open

There 4 possible inputs:

1. Front
2. Rear
3. Both
4. Neither

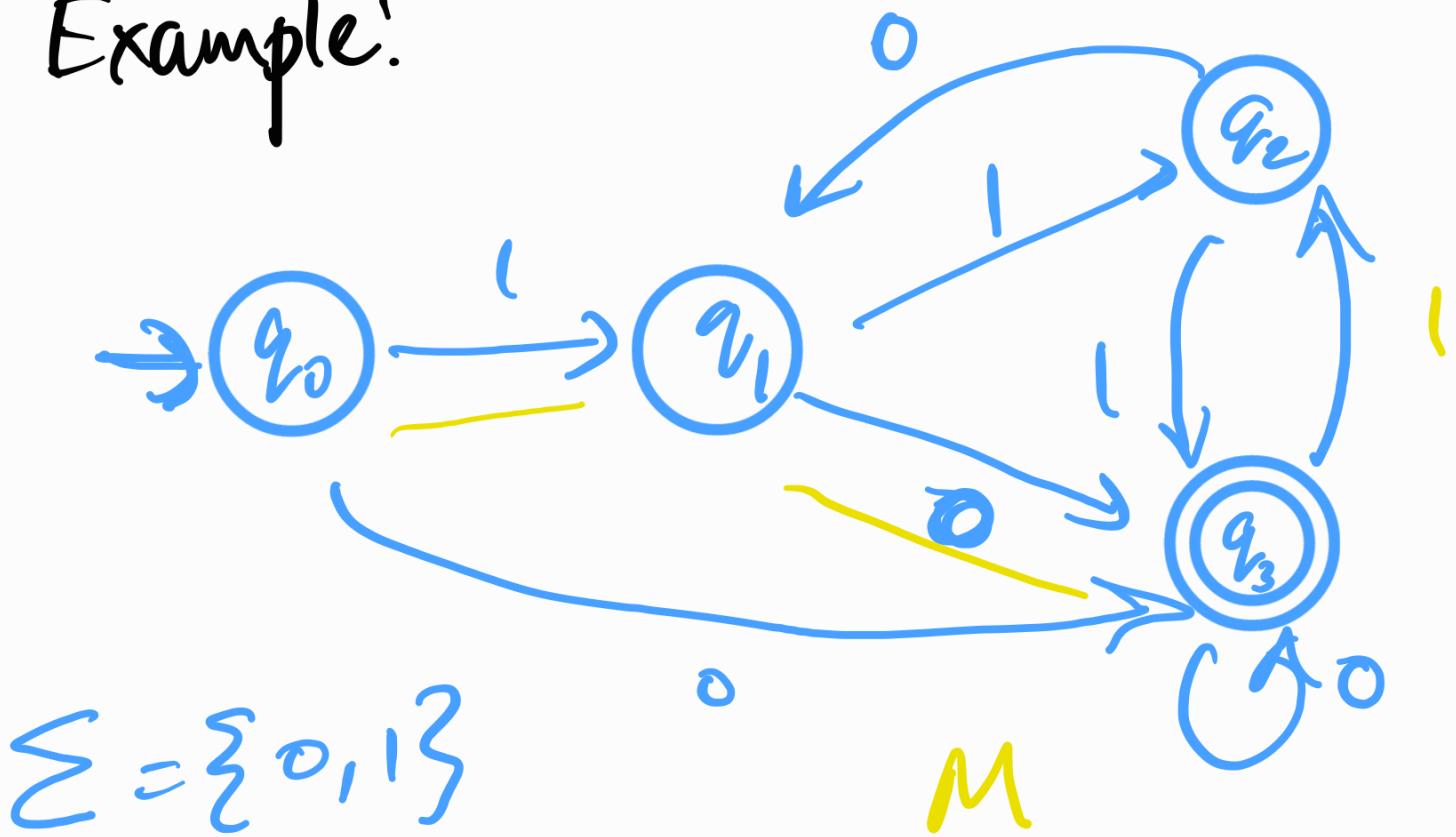


Memory of this machine
is 1 bit.

Now let's look at this in
a mathematic perspective.

Let's abstract this concept
of finite automaton, without
reference to any application.

Example:

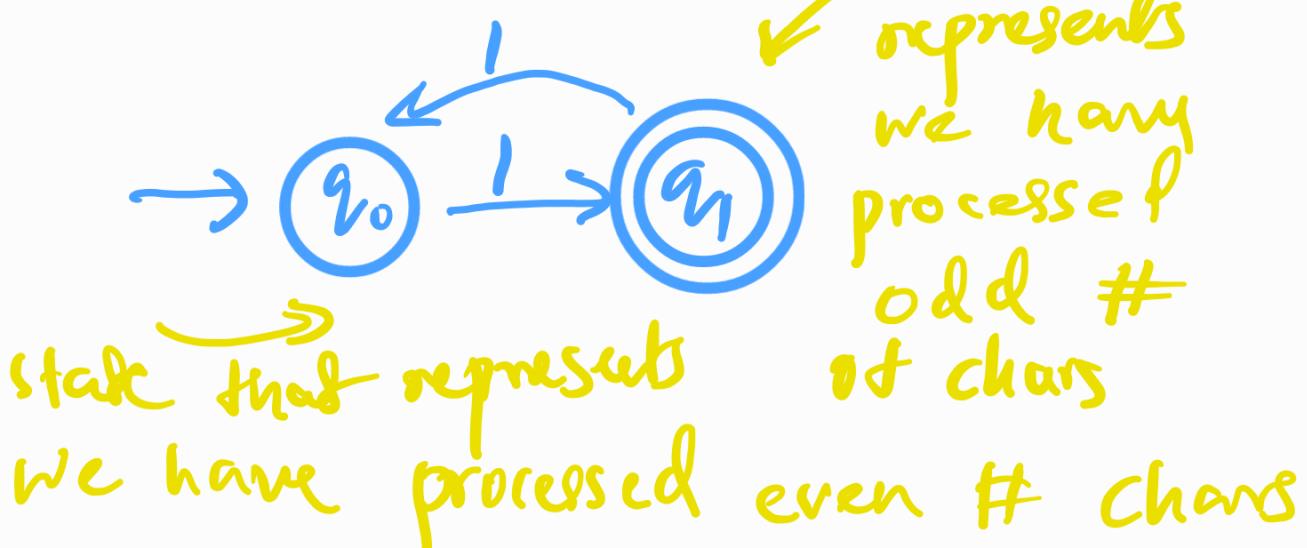


$\underline{1} \underline{0} \checkmark$ accepted
 by machine
 M
 $\underline{1} \underline{0} \underline{1} \times$ not accepted
 by M

Ex': Design a finite state automaton which accepts

$$A = \{ w : \text{the length of } w \text{ is odd} \}$$

$$\Sigma = \{ 1 \}$$



- States are nodes
Some states are accepting states
- arrows represent transitions
- inputs are symbols available
~~in the alphabet~~