Even 1s and all runs of 1 are odd:

Your task is to create a state diagram that accepts binary strings $(0, 1)$.

Your state diagram must accept all strings that satisfy both of the following conditions:

- There must be an **even** number of occurrences of 1 in each string.
- Each run of 1s must be odd.

A **run** is defined as the continuous sequence of one or more identical characters in a string. For example, in the string '001100111', there are two runs of 0s ('00' and '00') and two runs of 1s ('11' and '111').

For example, the following strings **should** reach an accepting state: 'ϵ' (there are an even number of '1's and the second statement is vacuously true),'01110111','101','1111101','00010100' while the following **should not** reach an accepting state: '1110' (1 occurs an odd number of times),'01010110' (there is an even length run of 1s), '0110011'

Your state machine will only be given inputs 0, and 1.

Hint: it is possible to solve this using just 7 states, though you are welcome to use more.

Binary Addition (Mod 5) :

Professor Martinez needs a state machine that will recognize certain *base-2* numbers. It should read the digits in left-to-right order. *That is, if you've seen number x and read a new digit d, your new number is $2x + d$.* The machine should be in a accept state whenever the number read so far is *congruent to 3 mod 5.*

Reminder: Binary numbers use 0 and 1. That is, your state diagram will be designed for inputs 0 and 1.

Draw a deterministic state diagram that will meet his needs.

Hint: A state diagram can be drawn using just 5 states.