LE10.3

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LE10.3.1: Computation by FSMs

1/1 point (ungraded)

We saw that certain functions, such as parentheses checking, cannot be performed by any finite state machine. Which of the following can be performed by an FSM? Assume, in each case, that the device is to take a series of 0s and 1s that represent the digits of a binary number entered left-to-right. The device is to have a single output, which is 1 only under the specified conditions:

(A) When the last 277 digits entered have been alternate 1s and 0s.

- (●) Yes, can be performed by FSM
- ( ) No, cannot be performed by FSM

✔

Explanation
Yes. Its a bit tedious for 277 digits, but you should be able to sketch one for 3 or 4 digits.

(B) When more 0s than 1s have been entered.

- ( ) Yes, can be performed by FSM
- (●) No, cannot be performed by FSM

✔

Explanation
No. Requires unbounded counting.

(C) When an odd number of 1s and and even number of 0s have been entered.

- (●) Yes, can be performed by FSM
- ( ) No, cannot be performed by FSM

✔

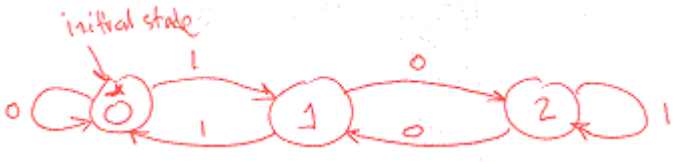
Explanation
Yes, unbounded counting is not required.

(D) When the number entered thus far is divisible by 3.

- (●) Yes, can be performed by FSM
- ( ) No, cannot be performed by FSM

✔

Explanation
Yes, can be done by a 3-state machine. If the value of the number entered so far is N, then after the digit b is entered, the value of the new number N' is 2N + b. Using this fact:
if N is 0 mod 3 then for some p, N = 3p + 0. After the digit b is entered, N' = 6p + b. So N' is b mod 3.
if N is 1 mod 3 then for some p, N = 3p + 1. After the digit b is entered, N' = 6p + 2 + b. So N' is b+2 mod 3.
if N is 2 mod 3 then for some p, N = 3p + 2. After the digit b is entered, N' = 6p + 4 + b. So N' is b+1 mod 3.
This leads to the following transition diagram where the states are labeled with the value of N mod 3.



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- Division by 3 fsm. — 2
  Hi. Related to finiteness of this fsm I have following suggestions: suppose we have 3 states, on every state we calculate N - 3 until i...
- 277 digits question. — 14
  Hi. Why it is tedious for 277 digits to compute correct result? There should be no more then 3 states, say "0","1" and "no". Obviously...

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