LE6.1

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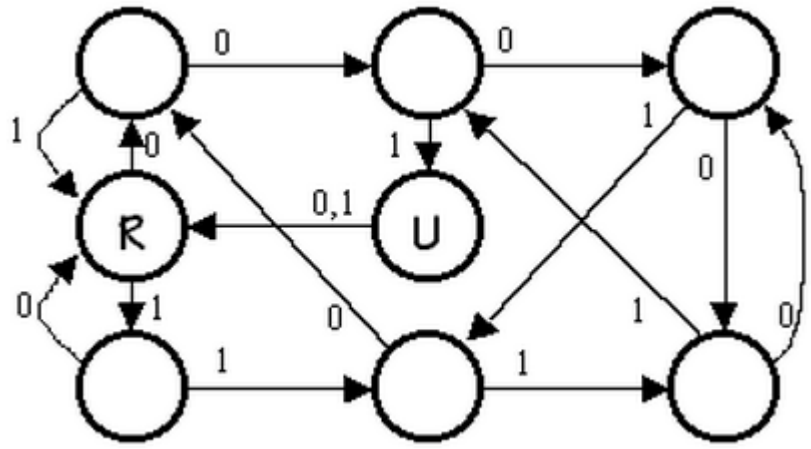
LE6.1.1 State Transition Diagrams

4/4 points (ungraded)

Ben Bitdiddle has designed an electronic lock with three buttons: "reset", "0" and "1". He has provided the following state transition diagram showing how the lock responds to a sequence of inputs.



The lock makes a transition from its current state to a new state whenever one of the three buttons is pressed and released. It ignores its inputs if more than one button is pressed. Pressing "reset" returns the lock to the state marked "R" in the diagram (arcs showing the transitions to the reset state have been omitted from the diagram to make it easier to read). Pressing "0" or "1" will cause the lock to follow the appropriately labeled transition from its current state. The lock opens if it reaches the state marked "U".

(A) After pressing the "reset" button what is the length of the shortest sequence of button presses that will open the lock?

Length of shortest unlock sequence: 3 ✔ Answer: 3

Explanation
3 button presses will open the lock: 0, 0, 1

(B) After pressing the "reset" button what is the length of the longest sequence of button presses that will cause the lock to open after the last button in the sequence is pressed but not open any earlier in the sequence? Enter 1000 if the sequence is unbounded.

Length of longest unlock sequence: 1000 ✔ Answer: 1000

Explanation
The longest such sequence is unbounded. For example, 0000 followed by an arbitrary number of zeroes, followed by 11 (if even number 0's enterred) or 1111 (if odd number of 0's enterred) will cause the lock to open for the first time.

(C) After much use, the "reset" button breaks. Is it still possible to open the lock using only the "0" and "1" buttons assuming you know nothing about the lock's state (except that its locked!) when you start?

- (●) Yes
- ( ) No

✔

Explanation
Yes. A sequence of 1's will open the lock. You have to try the lock after each press of "1" since a different number of 1's is required depending on the starting state.

(D) Suppose Ben wanted to design a lock that required exactly 10 button presses to open after pressing "reset". What is the minimum number of states his FSM would need in addition to the RESET (R) and UNLOCK (U) states?

Number of additional states: 9 ✔ Answer: 9

Calculator

Explanation
Nine additional states are required. If the FSM starts in the R state, the first nine button pushes transition to new, unique states. Then the tenth button push transitions to the U state.

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Answers are displayed within the problem

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What's your method for C? (when the reset button breaks)

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