EE Quals 2016

Computer architecture and logic design

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Question 1

You are to design the traffic-light controller for the intersection of two streets (A and B). Each street has a single input from a WALK button pushed by pedestrians wishing to cross the street (WALK_A and WALK_B). The lights are controlled by two outputs: RED_A and RED_B. When RED_A is 1, then the red light is on and the green light is off for street A. Same for RED_B.

If no pedestrians present and the WALK buttons are not pushed, the lights alternate between allowing traffic on A and B every 1 minute. If a WALK button is pushed, the current cycle is finished, and then both lights are RED for 1 minute, before returning to the previous alternating A/B cycle.

A: Create a state diagram, and show the state transition table.

B: Encode the states in the minimum number of bits.

C: Design the sequential circuit to implement the state machine.

Question 2

It’s very important for a traffic-light controller to be reliable, and to fail safely. What techniques can we use to reduce the chances of a crash if the system fails?