EECS 3201 :: Lab 4
Shot Clock

Administrative Instructions

Demonstration: Labs must be demonstrated during lab periods on the week of November 2-6. You may demonstrate your lab on an earlier week with the permission of the TA, but only during your designated lab period.

The TAs will be extremely busy towards the end of the lab. You are **strongly advised** to prepare as much as possible in advance, work efficiently in the lab, and to demonstrate as early as possible. **Leaving the demonstration to the last minute is at your own risk.**

Group composition: You may work in groups of **at most two**. Working by yourself is OK if there is enough equipment. Groups of three or larger are **not allowed.** There is no need to stay with the same lab partner as in previous labs, but you can if you want to.

To make the best use of your time in the lab, you should write your Verilog code beforehand. You can then use the lab time to debug your design using the actual board.

Scoring: This lab is scored out of 5 marks.

- *Demonstration:* Once done, you will demonstrate your work to the TA. Correctly demonstrating the result is worth 3 marks. If you can't get the design to work, you can still demonstrate, but you will lose marks. *You will get a grade of zero if you don't demonstrate anything by the end of the lab period.*
- *Question:* The TA will ask **each** group member a question, for example to modify the circuit. Correctly answering the question is worth 2 marks.

It is possible for group members to receive different grades, for example, different grades can be received on the question.

Value: This lab is worth 3/10 of your total lab score and 3% of your final grade.

Background

In most basketball leagues, a team with possession of the ball has a given number of seconds to take a shot on the basket, or else they lose possession of the ball. In the NBA, WNBA, and OUA, the shot clock is set to 24 seconds, while in the NCAA, the shot clock is set to 30 seconds. In the arena, there is normally a digital display that shows the time remaining, called the shot clock.

Problem

Your task is to create a shot clock with the following features, starting with a 24-second clock:

- The clock counts down from 24 to zero *in base 10*, displaying the time remaining in seconds (as a base-10 integer) on the seven-segment displays;

- If the clock reaches zero, the display holds at zero until reset; and
- At any time, whether it has reached zero or not, the clock can be reset by pressing a button; once reset, it immediately starts counting down again from the maximum time.
- The clock can be paused by pressing a different button, and un-paused by pressing the same button.
- The maximum time can be selected to either 24 or 30 seconds, via a switch.

One approach would be to reduce the 50 MHz system clock to a 1 Hz clock using a clock divider. (This is just a suggestion, you don't have to do it this way.)

You may use your code from previous labs to complete this lab. If you do, make a note of this in a comment in your code (e.g. // this file previously submitted as part of Lab 3).

In the lab:

- Compile, assign pins, and upload your program to the board. (It is up to you which switches and display to use on the board. Pin labels are given in the DE10-Lite user manual.)
- Check for errors and fix them.
- Once you are happy with your design, demonstrate it to the TA. The TA may ask to see your Verilog module, and will also ask each group member a question about your design.