14:332:437 Digital System Design
Lab 7: Seven-segment Banner

Introduction

In this lab you will design a 7-segment LED display circuit that not only displays the information but also rotates it on every clock cycle.

Background and Objective

You should already be familiar with the 7-segment LED display decoder circuit designed in Colloquium1: Lab 2 of this coursework. There we designed a circuit that could drive only one 7-segment display at a time and consequently displayed only one hexadecimal symbol. The key differences being, that Lab 2 was a combinational circuit and the mode of design entry was schematic.
The DE2-115 Altera board has eight 7-segment LED displays and thus eight hexadecimal symbols can be displayed at any given time instant. The objective of this lab is to use all of the eight displays on our prototyping FPGA board and not only display eight hexadecimal symbols at a time, but also display new information by moving and rotating the data continuously on every clock cycle. There should be a *pause* control that pauses the movement of the display when activated.
For example, all the hexadecimal symbols ”0123456789abcdef” can be displayed as ”01234567”, ”12345678”, ”23456789”,...,”89abcdef”.

Inputs: Your system will have the following inputs of which only the *pause* input is available to the user at runtime.

Clock signal - You must use the clock signal on the DE2-115 FPGA board. *Hint*: The 50MHz clock signal on this board can be accessed by renaming your clock input as $CLOCK\_50$. However, please note that, directly using this clock frequency will flash the LED displays too fast for a meaningful perception. You will have to make sure that the the speed of rotation of the hexadecimal symbols is slow enough for comfortable visual inspection. Thus, there is a need to *divide* the clock rate.
Pause - Controls the *pause* functionality explained above.

What to turn in

Submit the SystemVerilog code for the banner display system on Sakai.
Verify operation on the DE2-115 board during colloquium hours.