Lab # 3: 7 Segment Display Controller

Objective:

To create a controller that will take three inputs and output the following outputs seen in the table below on a seven segment display.

Input			Output
A	*B*	*C*	*Character*
0	0	0	A
0	0	1	b
0	1	0	C
0	1	1	d
1	0	0	E
1	0	1	F
1	1	0	G
1	1	1	All LEDs Off

We will be implementing this design by calculating and producing an equation(s) from the truth table, then simulating the equation in software to see if the results match expected outputs, and finally implementing the design on breadboard first by FPGA, then utilizing TTL gates.

Part 1: Calculations and Boolean Expression

In this part of the lab, the objective is to determine a truth table that will produce the expected outputs for a seven segment display, using only binary values. From there derive a set of Boolean expressions that will produce the expected result. Show all work necessary for the results given.

Part 2: Simulation

Once the Boolean expression is determined place gates into simulation software to test whether the Boolean expression produces the correct results.[1] Make sure to use the gates provided in the lab kit, make note of how much of each gate there is.[2] Ensure that the design does not exceed the current number of gates available else the design may not be possible to implement with current supplies.

1. If the results of simulation are incorrect first check simulation to see if there are any errors in wiring the diagram. If no errors are found then re-check equations to ensure no mistakes were made.
2. If working with a partner note the increased availability of gates.
3. Build up the hardware as if you are going to place TTL gates on the breadboard. This will be used for the next step. Additionally if this works properly this tells you that your seven segment is getting power and you can switch it on and off properly.
4. If you have any issues check your new wiring. If part 3 worked properly and part 4 is not check wiring for TTL gates. As well as use additional breadboards if necessary.

Part 3: FPGA and Initial Breadboard

Once the Boolean expressions have been confirmed to be correct, program the FPGA using data flow modeling to receive three inputs and necessary number of outputs. From there placed a switch pack with pull down resistors on the other side, as well as the seven segment display with other additional hardware necessary.[3] *Note: Leave plenty of space for the TTL gates for the next step.*

From there attach your FPGA to the switch pack and seven segment display and test your design on the breadboard.

Part 4: TTL Gate Design

For the final part build up the design using previous part of the seven segment display and switch pack. Place the TTL gates on the breadboard, and demonstrate the design to the instructor that it is working properly.[4]

1. If the results of simulation are incorrect first check simulation to see if there are any errors in wiring the diagram. If no errors are found then re-check equations to ensure no mistakes were made.
2. If working with a partner note the increased availability of gates.
3. Build up the hardware as if you are going to place TTL gates on the breadboard. This will be used for the next step. Additionally if this works properly this tells you that your seven segment is getting power and you can switch it on and off properly.
4. If you have any issues check your new wiring. If part 3 worked properly and part 4 is not check wiring for TTL gates. As well as use additional breadboards if necessary.