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Lab 3 Report

Introduction:

We decided to make a circuit that was based off of our SoP results in our prelab. We initially added a not gate for the CS input because the majority of the CS relationships in the circuit involved a not gate. We calculated that SoP was more cost efficient than PoS which meant that it would involve less gates. We connected our inputs to and gates respectively according to the K-maps. We then connected those angates to or gates to successfully depict our function in our circuit. Our circuit operates by utilizing and, or, and not gates in SoP form.

Simulation Strategy:

Our simulation strategy is to have all four inputs correspond to a switch. We will program those switches to Three LEDs. Three LEDs will be on at all times and one of them will always be blank to signal one of the input lights on. The three LED lights will be green LEDs and depending on which light is on, it illustrates the lane that has a green light. The first light (from left to right) would be assigned to CL, the second light would be assigned to LL and the third light would be assigned to RL. I think our simulation should detect all errors because when successfully implementing this logic, it should be able to test for all possible outcomes. When the lights are off, the lights are assumed to be red and whichever green light is on, signals which car can pass (“green light”). There will not be any outputs that are not tested for that the three green light systems could not account for.

Actual Simulation

We did not have any design implementation errors when we simulated our circuit.

Modifying the Circuit with TM

We would add a TM to all of the and gates (see truth table and schematic) to ensure that when TM is 0 that the outputs will always be 0 (or red) and when TM is 1, then the outputs will function like in the problem statement and will vary from 1 or 0.

New Output, ERR1

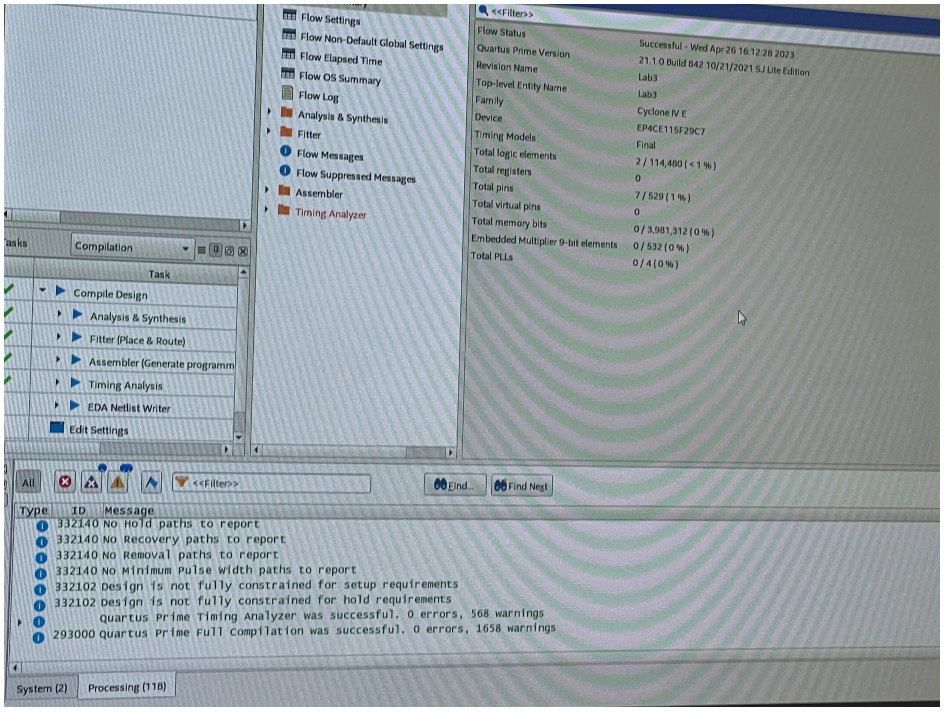
Long Line in Carpool Lane

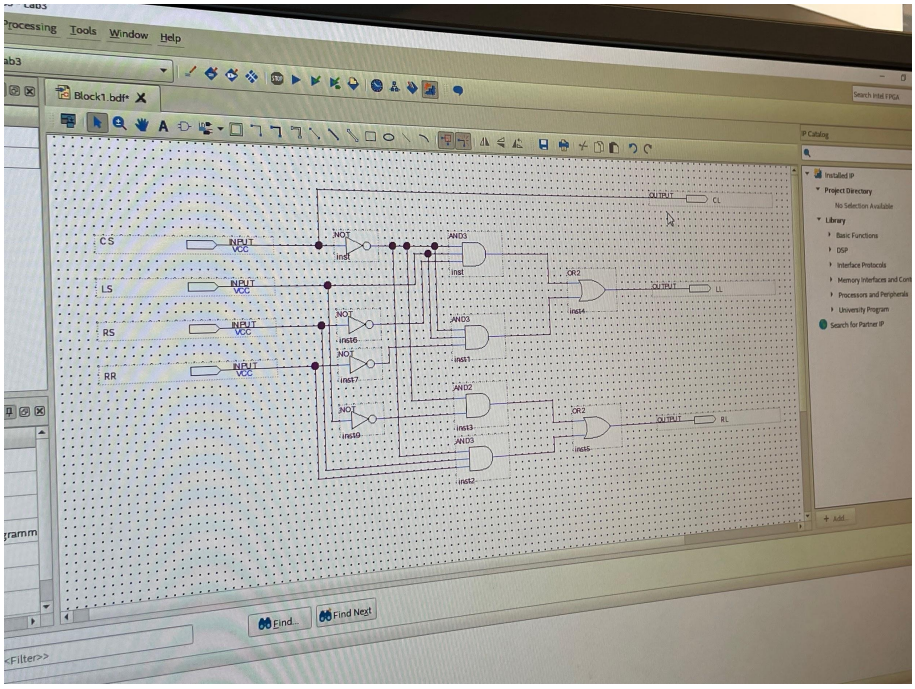
If the line in the Carpool Lane was too long then a possible strategy to make the traffic move by faster would be to only allow the Red Robin light to flash for every three cars that go by in the carpool lane (for every three ones in the CL row). This would ensure that carpool still has priority, while also allowing cars to go in the other lane occasionally. We would also need to ensure that only one green light was on at the same time so the cars do not crash.

IV. REPORT

To be completed with your lab group and turned-in at the beginning of the next lab.

- Write an introduction describing the how your circuit should operate and the design choices you made.
- Include your schematic, simulation results, and proof of successful download and functioning on the FPGA.
- Describe the simulation strategy that you used to test your circuit design. Did it identify any errors in design or implementation? If so, what were they and how did you correct them?
- Do you think your simulation strategy would detect all design errors for this circuit before downloading the circuit to the FPGA? Why or why not?
- When you tested your circuit operation on the FPGA, did you find any design or implementation errors that were not identified in the simulation? If so, describe the errors and discuss why the simulation did not reveal them.
- What logic would you add to create a new output, ERR1 which would be 1 if two or more lights (CL, LL, and RL) were turned on at the same time. How is that logic similar to the logic that created the T1 output?
- Describe how you would modify your circuit to include a fifth input TM, a timer that is turned on at intervals controlled by the traffic density. When TM is "1", the circuit operates exactly as specified in the problem statement. When TM is "0", all output lights are red. Show a schematic for your modified circuit which includes the timer input.
- In the specification for the circuit, the carpool lane always has priority. If there were a long line of cars in the carpool lane, all other traffic would stop completely until the last car in the carpool lane had entered the highway. Describe a possible strategy to prevent total blocking of the cars in the non-carpool lanes but still allow cars in the carpool lanes to wait less time than other cars.





TM	CS	LS	RS	RR	CL	LL	RL
0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0
0	0	0	1	1	0	0	0
0	0	1	0	0	0	0	0
0	0	1	0	1	0	0	0
0	0	1	1	0	0	0	0
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