

EE142--Digital Design

Project 2: TRAFFIC LIGHT CONTROLLER

Project overview:

Your task in this project is to design and simulate a traffic light controller. You should follow the given hierarchical design below, but you will be required to design each component on your own. ***You can use counters and comparators as blocks but you should design your own counter and comparator blocks.***

Project details:

Consider the crossroad in Figure 1. Your task is to design a traffic light controller for this crossroad.

In each road, there are counters and traffic lights. Traffic lights work with your design outputs, i.e., when you give '1', it means it is green, and when you give '0', it means it is red.

The main road is '1', i.e. traffic density is very high in this road, and you need to design a controller such that it prevents the traffic jam in this crossroad.

Please ensure the following rules for the controller:

- The number of cars in each road will be given to you as binary inputs. **You do not need to count the number of cars.**
- We have a threshold, '10', for the number of cars in the main road. If the number of cars in the main road is above this threshold, the light in the main road should be green, even if the number of cars in road II is larger than the number of cars in the main road.
- If the number of cars in the main road is below the threshold, the light in the road with more cars should be green. If the numbers are equal, the main road should be green. The green light should be green till all cars in the associated road leave the crossroad, and then the other light should change to green. When all cars leave the crossroad, the light in the main road should be green.

Design hints:

- You need to design a counter/counters such that it/they will count down with a 1 Hz clock, if the light in this road is green, i.e., only one car can leave the crossroad in 1 sec. The upper limit for the counter is '31' (inputs are also two 5 binary numbers).
- You need two comparators such that one of them will compare the number of cars in the main road with the given threshold, and the other will compare the number of cars in roads I and II.
- Please keep in mind that you need to update the counter/counters values with the input. You can use multiplexers for this objective.

Grading policy:

- Working implementation: 40%
- Demo: 30%
- Report: 30%.

Please note that you are expected to design by using minimum number of gates.

Project Report Outline:

1. Introduction: should include problem definition and report outline.
 2. Design preliminaries and Circuit Design: First part should clearly explain the design strategy, which is used in the project along with all necessary details (such as Karnaugh maps, hierarchical procedures, etc.). Second part should include implementation of your design in Xilinx. (special symbols, blocks, etc.)
 3. Simulations/Analysis: should include simulation outputs for a sample input set and comments on these outputs.
 4. Conclusion: should include a general overview of a project. (success, further improvements, etc.)
- It is obvious that unethical behavior and plagiarism will not be tolerated. Please note that, your report must be **at most 4 pages long**.

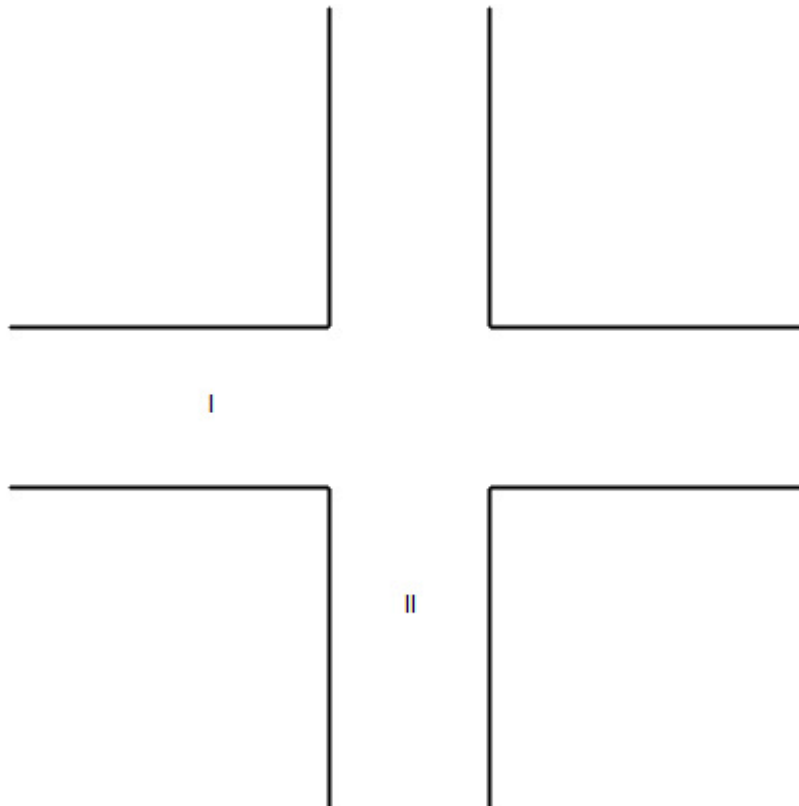


Figure 1