Assignment-7 (CS 232) by Utkarsh Ranjan

Traffic Junction

Introduction

- In this we had to design a digital circuit called a traffic lights controller to control 15 lights - r,g,y for each of the five lanes.
- Following rules were followed while designing the circuit
    1. At a time only one lane should be given a green signal, and during that time, the rest of the lanes should be given a red.
    2. After a green on a particular lane, yellow should be given on the same lane for a short while, after which it turns red, and simultaneously the next lane will be made green.
    3. The green signal duration for the smaller lanes (L1 & L4) is 30 seconds.
    4. For the rest of the lanes, which are highways, it is 60 seconds.
    5. If there is no one waiting on the smaller lanes then they will not be given green and skipped to the next lane.
    6. If there is at least one person on the lighter lane, only then it will be given a green for 30 seconds.
    7. The yellow signal duration is 5 seconds for all the lanes.

Circuit Component

```
entity TrafficLightsController is
    port ( clk, rst, tr1, tr4 : in std_logic;
    r, g, y: out std_logic_vector (4 downto 0) );
end entity;
```

It has a `time_count` variable which counts the time since a particular lane has been given green light.
It further have two variables `state` and `prev_state` which stores the current lane which is green and the previous lane which was green.

Clock Frequency : 5 sec for one cycle.

Entity Description

- When reset signal is '1' , L_2 lane is made green.
- The entire implementation is done in a single process.
- Cases when reset is not '1' are handled accordingly depending on variables `state` , `prev_state` and `time_count` values.
- Updates are made in the values of signal green, blue and yellow.

Testbench

- In the Test Bench file there are three processes. One process is updating the `clk` ensuring its periodic update after every 5 sec.
- Another process is updating the `rst` signal for the first cycle.
- The third process take the input for the TrafficLightsController component of the testbench file.
- The test cases are hardcoded to cover all the cases involved in the problem.