Engr354 Class Project Autumn, 2019

T-Bird Tail Lights

DUE: Tuesday, December 10, Final Exam Time (10am)

Objectives

- Design, construct, and test a multi-input state machine;
- Gain experience in defining and building a real-life digital logic system;
- Gain sequential logic design experience;
- Gain maturity in the construction and debugging of logic circuits.

Description

An experiment is under way at Ford to simulate tail light operation of the venerable Thunderbird automobile. The simulation is proposed so that consumer interest can be measured before any cars are built.

Your task is to design and build a circuit that does this simulation. Use six LED's to simulate the six taillights (three on each side of the car) and use two dip switches for the turn signals. One dip switch should be used to indicate a left turn, one dip switch for a right turn. If both dip switches are set, the emergency flasher should be activated.

For a right turn, the three right-hand lights should be activated and the left-hand lights should be off. The three lights should cycle as shown in Figure 1. Operation for the left-hand lights is analogous. When the emergency flasher is activated, all six taillights should flash on and off in unison.

Your circuit should also emulate brake lights. Use a dip switch to simulate the brake pedal. When the brakes are on, all six taillights should be on continuously, except if the right or left turn signal is on. In that case, the three taillights for the turn signal should operate normally, and the other three should be on continuously. Note that the brakes override the emergency flasher.

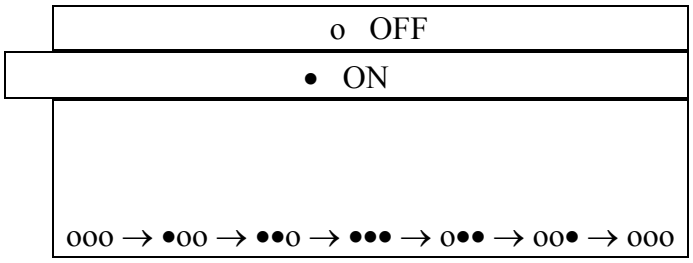

Figure 1. Taillight sequence

Procedure

Design and build the circuit to implement the tail lights as described above. Use RET D flip-flops as the memory elements. Bring your circuit to class on the due date for a demonstration of your design and implementation skills.

Notes

- You may work in groups of one, two, or three but all such groups must be approved by the course instructor;
- Project challenges:
  - Define what are the inputs;
  - Define what are the outputs;
  - Define the necessary logic states.
- The sum of all branching conditions leaving each state must equal one;
- An output can be active, at most, once per state;
- You decide what to do with don't care states;
- Doing a logic simulation before starting construction is a really good idea.

Grading Criteria

Your final project is worth 25% of your grade this quarter. Here are the guidelines for how the final project points will be allocated:

- Hardware checkout – 70%
  You must bring your project to the class room at the final test time and demonstrate it to the instructor.
- Final report – 20%
  Each student must turn in a report. The write-up will be individualized, but the supporting documentation can be shared between team members. The report must contain the following elements at a minimum:
  - Cover page;
  - Introduction;
  - Design – include neatly drawn design diagrams and elaborate on your design process;
  - Results – include the final status of the hardware as wells as a final parts list;
  - Lessons learned;
  - Schematics and pictures.
- Team evaluation and final attendance – 10%

To Turn In

- Each student must turn in a report.