FSM review assignment - An automatic car

Purpose

You will be presented with a description of a system and are tasked with representing the system in three ways: A State Diagram, a Truth Table, and a Circuit Diagram.

System Description

Lets create a super simplified automatic car, the automatic car has 2 essential sensors, one to see if there is quite a bit of traffic on the road (**traffic** or **T**), and one to see if there is a human crossing the road (**crossing** or **X**), assume all other sensors are irrelevant to the functioning of the car. The car has 3 states it may be in, **Stopped**, **Accelerating**, **Decelerating**. Assume the car decelerates in a way that would never cause the car the stop.

NOTE : This is a hypothetical scenario, do not use it as a reference on how to actually drive

When **Stopped**, if there is nobody crossing the road (crossing = 0) (irrelevant of the state of **traffic**), the car will accelerate, else the car will remain stopped

When **Accelerating**, if there is nobody crossing the road and there is low traffic (crossing=0, traffic = 0) continue accelerating, if someone crosses the road (crossing = 1), immediately stop the car irrespective of the amount of traffic, if the amount of traffic gets higher, but nobody is crossing the road (crossing = 0, traffic = 1) start decelerating

When **Decelerating,** if there is nobody crossing the road, and there isn't much traffic on the road (crossing = 0, traffic = 0), start accelerating, if there is nobody crossing the road, and there is some traffic on the road (crossing = 0, traffic = 1), continue decelerating, if there is someone crossing the road (crossing = 1), irrespective of the amount of traffic on the road, stop the car (or goto the Stopped state).

System Details

For reference, let's say cars store their current state in an *enum* as a 2 bit state (Current State: c0 as LSB, c1 as the MSB).

Enum reference chart

State	Enum (c1, c0)
Stopped	00
Accelerating	01
Decelerating	10

However - because of the newly formed *Automated Car Standards* ***ACS420***, the cars output display their states differently to the normal user, as follows:

State	Displayed State (DS1, DS0)
Stopped	11
Accelerating	01
Decelerating	00

Tasks

1. Convert the system description into the FSM state Diagram.
    a. Assume the initial state is **Stopped**
2. Convert the FSM State Diagram to a Truth Table.
    a. Label the crossing state as **X,** and if there is traffic as **T**
    b. Keep your input labels in descending order from left to right.
    c. Label the current 2 bit state as c1 and c0.
    d. Label the next 2 bit state as n1 and n0.
    e. Label the output with DS1 and DS0

3. Create the boolean equations for DS1, DS0, n1 and n0 and add this to the PDF to be submitted
4. Convert the boolean equations for n1 and n0 a functional FSM controller circuit, then convert the n1 and n0 values to the **Displayed State** values via any appropriate means (such as an encoder)