WEEK 3

Tutorial Lab

Name: BIPIN KC

UC No: u3309931

Class: Introduction to Information Technology

Date & Time: 5.30pm – Wednesday

**Question:**

You are tasked to design a combinational logic circuit that operates an alarm in a car whenever the driver and/or passenger seats are occupied, and the seatbelts are not fastened when the car is started. The active-HIGH signals DRIV and PASS indicate the presence of the driver and passenger, respectively, and are taken from pressure-actuated switches in the seats. The signal IGN is active-HIGH when the ignition switch is on. The signal 𝐵𝐸𝐿𝑇𝐷 ̅̅̅̅̅̅̅̅̅̅ is activeLOW and indicates that the driver’s seatbelt is unfastened. 𝐵𝐸𝐿𝑇𝑃 ̅̅̅̅̅̅̅̅̅ is the corresponding signal for the passenger seatbelt. The alarm will be activated (LOW) whenever the car is started and either of the front seats is occupied and its seatbelt is not fastened.

**Answer:**

1. **Understand And Analyse the Problem:**

We need to design a logic circuit that activates a **LOW output alarm** when:

* The **ignition is ON (IGN = 1)**, **AND**
* **At least one seat is occupied** (DRIV or PASS = 1), **AND**
* The **corresponding seatbelt is unfastened** (BELTD̅ or BELTP̅ = 1 — remember, these are **active-LOW**, meaning 1 = unfastened).

So, if:

* Driver is seated (DRIV=1) **and** their belt is not fastened (BELTD̅ = 1) → alarm
* Passenger is seated (PASS=1) **and** their belt is not fastened (BELTP̅ = 1) → alarm

The circuit output will be **ALARM = 0** (active-LOW) when these conditions are met.

1. **Describe the problem:**

Ignition (IGN) 🡪Active = high (1 == on)

DRIV (Driver seated) → Active-HIGH (1 = seated)

BELTD̅ (Driver belt unfastened) → Active-LOW (1 = unfastened)

PASS (Passenger seated) → Active-HIGH (1 = seated)

BELTP̅ (Passenger belt unfastened) → Active-LOW (1 = unfastened)

1. Plan the solution:
2. Monitor ignition status: IGN must be High (1)
3. Check DRIV == 1? AND BELTD̅ == 1?
4. Check PASS = 1 AND BELTP̅ = 0?
5. If all conditions are TRUE and IGN = 1? Alarm 🡪 Low: else Alarm 🡪 High

4. Psuedocode:

IF IGN == 1 THEN

IF (DRIV == 1 AND BELTD̅ == 1) OR (PASS == 1 AND BELTP̅ == 1) THEN

ALARM = 0 // Activate alarm

ELSE

ALARM = 1 // No alarm

ENDIF

ELSE

ALARM = 1 // No alarm when ignition is off

ENDIF

**5. Flow Chart:** Created using Draw.io

