Exercise 5

a) The Tempura specification for the control system HAL, including how the system updates the status of **door_1** based on the states of the infrared sensor (**ir_sensor**), the entry button (**btn_enter**), and the exit button (**btn_exit**). Here's a summary and verification of the steps:

Summary of the Tempura Specification

Inputs:

ir_sensor: Boolean value indicating the presence of an object (true = object detected, false = no object detected).

btn_enter: Boolean value indicating the state of the entry button (true = button pressed, false = button not pressed).

btn_exit: Boolean value indicating the state of the exit button (true = button pressed, false = button not pressed).

Output:

door_1: Boolean value indicating the condition of door D1 (true = door open, false = door closed).

Specification:

The specification defines how **door_1** is updated based on the inputs:

```
HAL(ir_sensor, btn_enter, btn_exit) = door_1'
```

The value of **door_1'** is determined by the following conditions:

```
door_1' = (ir_sensor && !door_1 && btn_enter) || (!ir_sensor && door_1 && btn_exit)
```

This expression can be explained as:

door_1 will open (**true**) if the infrared sensor detects an object (**ir_sensor = true**), the door is currently closed (**!door_1**), and the entry button is pressed (**btn_enter = true**).

door_1 will close (**false**) if the infrared sensor does not detect an object (**!ir_sensor**), the door is currently open (**door_1**), and the exit button is pressed (**btn_exit = true**).

Scenario: A Short Visit at Space Station

Initial State:

- `door_1` is initially closed (`door_1 = false`).

Entering the Airlock:

- As the astronaut approaches the airlock, the infrared sensor is activated (`ir_sensor = true`).
- The astronaut presses the entry button (`btn_enter = true`).
- The system updates `door_1` as follows:

Exiting the Airlock:

- After 10 minutes, the astronaut returns to the airlock, reactivating the infrared sensor (`ir_sensor = true`).
- The astronaut presses the exit button (`btn_exit = true`).
- The system updates `door_1` as follows:

```
door_1' = (!ir_sensor && door_1 && btn_exit) = (false && true && true) = false
```

- `door_1` remains closed when the astronaut departs the airlock.

```
door_1' = (ir_sensor && !door_1 && btn_enter) = (true && true && true) = true
```