COMPUTER TECHNOLOGY PROJECT 2022/ 2023

Important information

- The student must upload a .zip file labelled as 1A_Surname1Surname2Name.zip (for example 1A_MartinezRuiz_Carmen.zip) containing two files:

Memoria.pdf : this file must explain the solutions for each one of the subcircuits (see more information below in section "Evaluation of the project") along with the final integration in the *main* circuit.

Circuito.circ: this file is the Logisim circuit.

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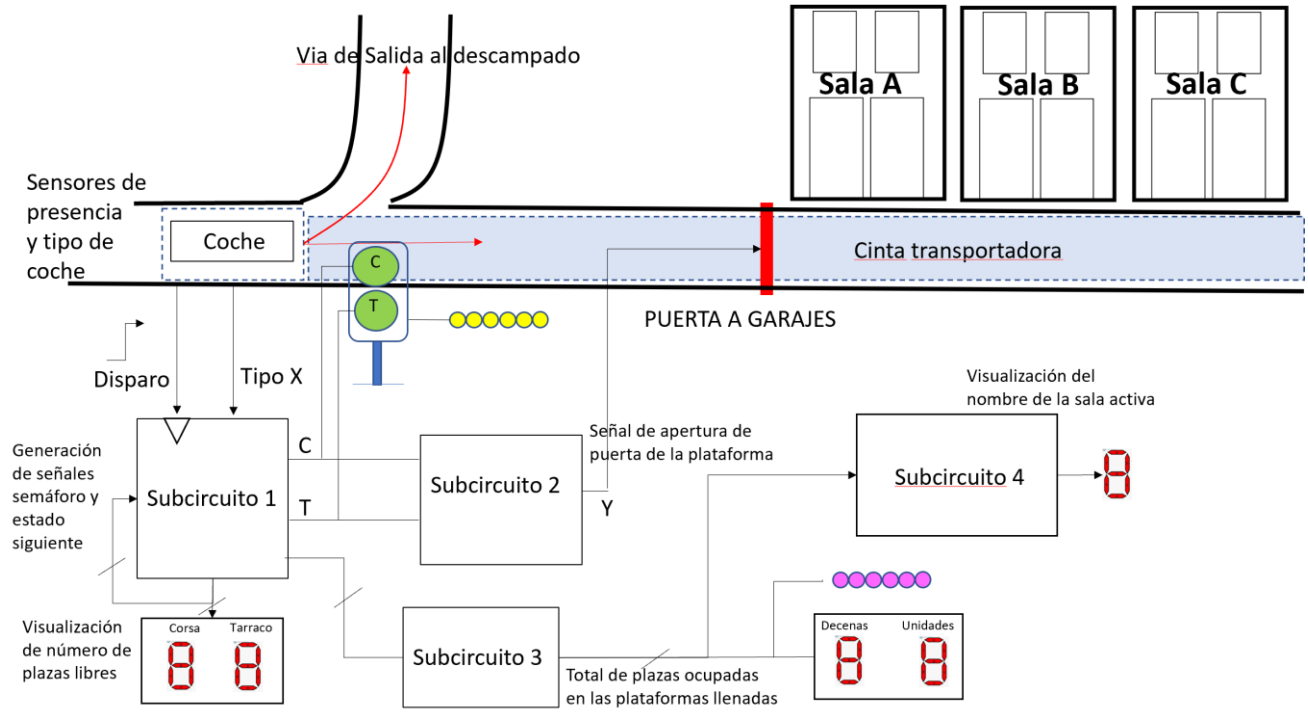
- A maximum of two students can submit the Computer Technology project. In this case, the maximum score will be 1.3 points.

The problem

A Seat factory has an indoor garage with three separate storage rooms (ParkingA, ParkingB, ParkingC). Each parking can store 2 Seat Corsa cars (smallest space in the figure) and 2 Seat Tarraco cras (largest space in the figure). When a car is manufactured, a conveyor belt moves the car to one of the three lounges, taking into account that priority is ParkingA-ParkingB-ParkingC and that a parking is used if and only if the previous one is full. The parking that is being used is named *Active Parking*. When there is no room for a specific car type in the *Active Parking* (still incomplete), the conveyor belt moves the car to an outdoor parking.

As the car approaches the garage, sensor X measures the length of the car and classifies the car as Corsa or Tarraco. If X=0, the car is Corsa, if X=1, the car is Tarraco. At the same time, a traffic light composed of two LEDs C and T show if there is room or not for the types Corsa and Tarraco in the *Active Parking*. As mentioned, when there is no room in the *Active Parking* for a specific type (Corsa or Tarraco), the car will be moved outside the garage and stored in the exterior parking. On the contrary, if there is room for the sort of car detected, the garage door will open automatically and the car will be moved to the *Active Parking*. This door is activated by signal Y.

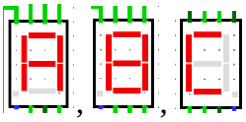


As can be seen in the figure, *Subcircuit 1* solves the issue of the state transition in the *Active Parking* as well as the traffic light, generating the values of C and T. It will be assumed that when a car approaches, a clock trigger "Disparo" is generated and that this signal activates *Subcircuit 1*. This signal will be taken as the clock signal of the whole circuit (use a button). At the same time, the external variable X provides the type of the car. In addition, two displays will show the number of free seats for Corsa and Tarraco in the *Active Parking*.

Subircuit 2 provides signal Y, which opens the indoor garage. If Y=1 the door will start opening, otherwise the door will remain closed.

Subcircuit 3 visualises the total number of the cars stored in complete parkings. Therefore, it will visualise the numbers 0, 4, 8 or 12. Use two displays, one for tens and another for units.

Subcircuit 4 visualises the letter of the *Active Parking* using the Logisim component *7-Segment Display*. Therefore, it will visualise letters A, B or C as follows:



Additional comments:

- When an *Active Parking* has been filled (case C=0, T=0), 6 yellow LEDs must be illuminated. In this situation, an extra trigger signal "Disparo" must be pressed only with the mission to update: the name of the new *Active Parking* (it will be B or C), the numbers of free spaces Corsa and Tarraco (it will be 2 and 2) and the total number of cars in complete parkings (it will be 4, 8 or 12). The trigger signal "Disparo" can then be pressed again to detect the arrival of a new car.
- When ParkingA, ParkingB and ParkingC are full (that means 12 parked cars), 6 magenta LEDs must be illuminated and the whole system must be blocked.
- The FFs to be used in subcircuits 1 and 3 depend on the name and surname of the student. The sequence of FFs is calculated according to the table below.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	x	y	z
JK	JK	JK	JK	T	T	T	T	D	D	D	D	D	D	JK	JK	JK	T	T	T	D	D	D	D	D

For example, the student Alberto Ruiz will use the necessary FFs among this ordered list: A(JK), l(D), b(JK), e(T) ,r(T), t(T), o(JK), R(T), u(D), i(D), z(D). If the design provided by this student uses 7 FFs, the design will included the flip flops JK, D, JK, T, T, T, JK, T, D, D, ,D, in this order.

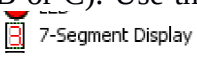
Evaluation of the project

a) *Subcircuit 1*: (45%)
- Define inputs, outputs and states of the circuit (15%)
- Find the excitation table (5 %)
- Free design. Explain the implementation of the circuit, including the displays for free parking seats and LEDs C and T (10%)
- Simulation of subcircuit 1 in Logisim. Important remark: the subcircuit must be ready for simulation (15%)

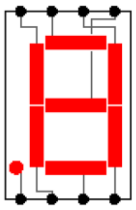
b) *Subcircuit 2*: (5%)
- Explain the implementation of this circuit.
- Simulation of subcircuit 2 in Logisim. Important remark: the subcircuit must be ready for simulation.

c) *Subcircuit 3*: (20%)
- Free design. Explain the implementation of this circuit. If a part of the circuit is solved by using a finite state machine, the student must: define the states, find the excitation table and explain the implementation.
- Simulation of subcircuit 3 in Logisim. Important remark: the subcircuit must be ready for simulation.

d) Subcircuit 4: (15%)

- Solve the visualization of the letter of the *Active Parking* (A, B or C). Use the component *7-Segment Display* (do not use *Hex Digit Display*) from the Logisim library 

.The organization of the pins are shown in the figure below.



e) Integration of subcircuits 1, 2, 3 and 4 in Logisim (15% puntos)

- Explain the integration
- Create a main circuit that integrates subcircuits 1, 2, 3 and 4. The circuit must be ready for simulation. Don’t forget to include the trigger signal “Disparo” and the input X.