Sétif 1 University
Faculty of Sciences
Common Core Mathematics and Computer Science

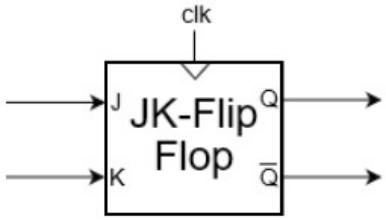
2nd semester (year 2024/25)
Machine Structures 2 course
Kara Abdelaziz professor

Machine Structures 2 exam

(duration 1h30)

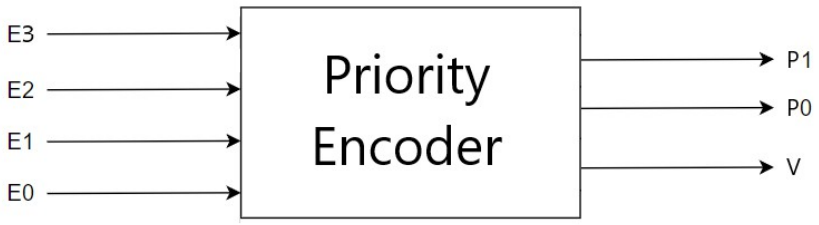
Exercise 1 :(4 points)

1. What is the purpose (الهدف) of studying Digital Electronics in a Computer Science course ?
2. In one sentence, describe what is the primary function of a Multiplexer ?
3. If a Parity Controller has an input of 1011, what would its output be, assuming (فرضًا أن) it outputs '1' for odd parity ?
4. Based on the JK-FlipFlop diagram below, what would be the values of Q and $\overline{Q}$ after the rising edge of the clock if (J, K) where (1,0). And what would be their values if the second rising edge, (J, K) where (1,1) ?



Exercise 2 :(5 points)

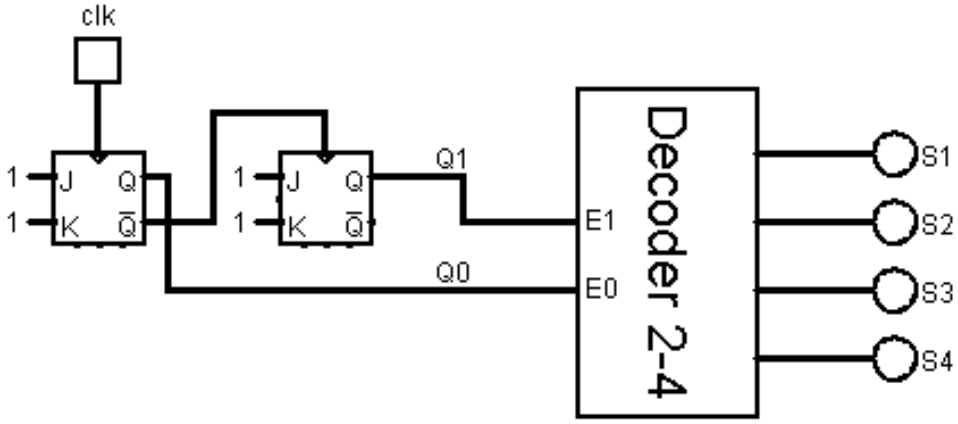
A priority encoder (similar but not the same as priority controller seen in course), is a Combinational Circuit that accepts multiple binary inputs and produces an encoded binary output representing the position (or index) of the highest priority input with the active input (input with value 1). If multiple inputs are active, only the one with the highest priority is encoded.



For example, following the Global Scheme above and assuming E3 has the highest priority, and E0 the lowest. The input (E3, E2, E1, E0) = (0, 1, 1, 0), will produce the result (P1, P0) = (1, 0), which is 2 in decimal, implying that E2 got the priority. The output V (for Valid) is active if at least one of the 4 inputs is active.

1. Using the 5-steps method, design the 4 bits Priority Encoder circuit described above.
2. Deduce (استنتج) the results (without execution) of the circuit, for the input (0000) and the input (0001). Explain based on these results, the purpose of (الهدف من) the output V.

Exercise 3 :(4 points)

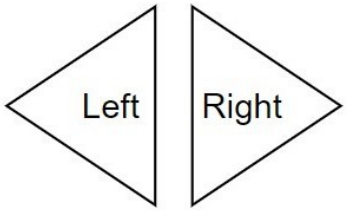


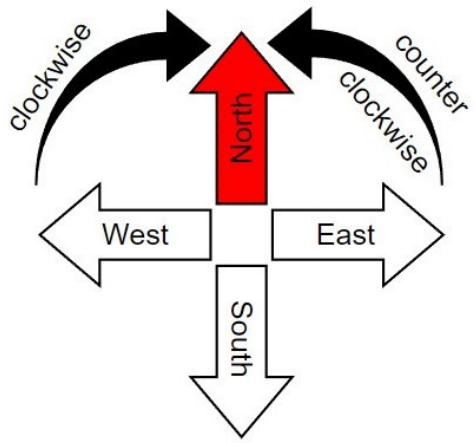
1. Draw the timing diagram of the circuit shown above. It has to show the execution through (عبر) 6 clock cycles, tracing the clock, Q0, Q1, and the output signals. The initial value of the FlipFlops is 0.

2. Name the circuit that the 2 FlipFlops implement in the circuit above.

Exercise 4 :(7 points)

We have to build a Sequential Circuit to control a Signalisation display (إشارات ضوئية) to point to a specific direction in the road (الطريق), like depcted in the diagram below. 4 LEDs are used for 4 directions, but only one direction is turned-on at any given time. The way to change direction is controlled by 2 buttons, *left* and *right*. The initial state points to the *north*, and from there it is possible to change the direction clockwise (إتجاه عقارب الساعة) using the *right* button, or counter clockwise using the *left* button.





Question : Use the 7-steps method to design the Sequetial Circuit of the Signalisation display controller.

دعوة بالتوفيق