Laboratory 2: Time-Division Multiplexor and Clock Divider

1. Is the 4-digit seven-segment displays on the BASYS 3 board is a common anode for common cathode? Please explain.
Ans: Basys 3 7-segment use common anode which is connected to power source and 1 cathode for each LED connecting with ground

2. From the wiring of the board, which logic do you have to assign to the 7-segment pins (a to g and dot) to turn the LED on.
Ans: To turn on LED we need to assign logic 'low' that means it is active low.

3. Given that the clock of the BASYS3 is around 10ns, how many bits do you have to divide the clock with to get the appropriate clock for the TDM. Please provide you analysis (calculation).
Ans: since dividing 1 time will decrease clock speed by half e.g. 10ns to 20ns. In the lab we aim for around 20fps that means we are going to display 4 digits every 50ms so the clock for each digit is 50/4 = 12.5ms

Target clock = 12.5ms = 12.5×10^{-3} s
Base clock = 10ns = 10^{-8} s
we can now formulate the equation as following

$$10^{-8} \times 2^{n} = 12.5 \times 10^{-3}$$
$$n = \log_2\left(\frac{12.5 \times 10^{-3}}{10^{-8}}\right)$$
$$n \approx 20$$

So, we must divide the clock by 20 times