# Lab 2 (15 marks)

**Files from eDimension:**

- Lab2.v
- labkit_nexys3.ucf

**Checkoff List:**

Please be ready with the following when checking off Lab:

1. Have your Verilog code ready to be examined on the computer monitor.
2. Set the labkit's switch[0] to 0 and demonstrate the led[0] is blinking at 1 Hz frequency.
3. Set the labkit's switch[0] to 1 and demonstrate the led[0] is blinking at 2 Hz frequency.
4. Demonstrate that the led[0] blinks only when the switch[1] is set to 1.
5. Demonstrate the extra features/functionalities that you implemented (exercise 2) in addition to the expected outcome in exercise 1.

During checkoff you may be asked to discuss one or more questions.

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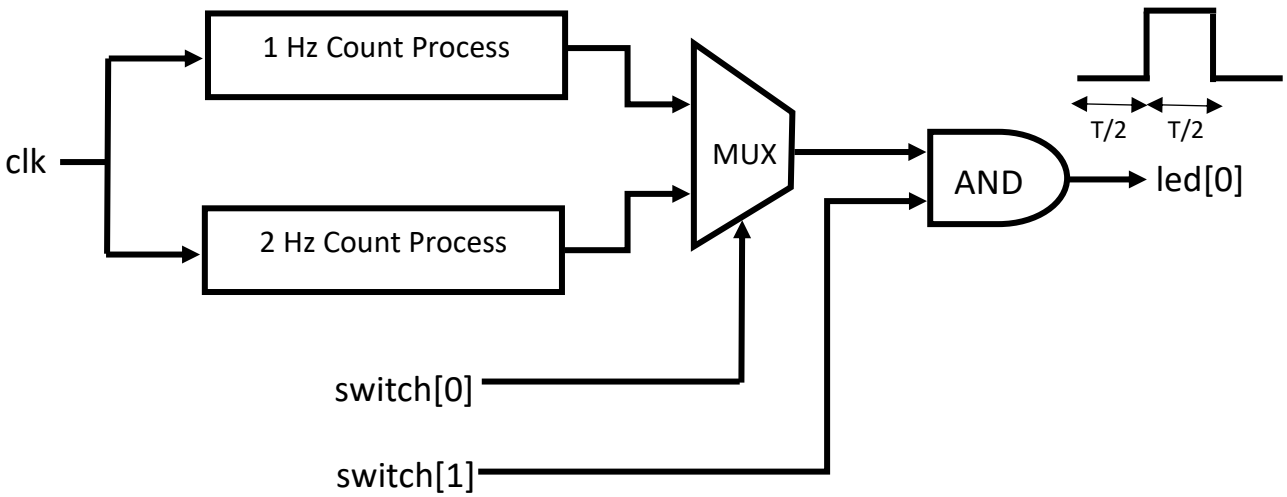
**Exercise 1: Writing sequential logic Verilog code (5 marks)**

In this exercise, you will design and implement a Verilog module that takes the labkit's (NEXYS 3) inbuilt clock (oscillator) as an input and blinks its led[0] according to two frequencies (1 Hz and 2 Hz) based on a 2-to-1 multiplexer, as shown in the following diagram.




Download the source files from eDimension: **lab2.v** and **labkit_nexys3.ucf**. You should now be able to create a new Xilinx project that includes lab2.v and labkit_nexys3.ucf. Compile and load the bit file into the labkit. You should be able to see that labkit's led[0] is continuously ON without any blinking (where the led[0] is controlled by the switch[1] as the AND gate has

been implemented). Now, change the Verilog code (lab2.v) so as to achieve the functionality explained in the above.

**Implementation Tips:**

- Calculate the half periods of the two frequencies 1 Hz and 2 Hz (that is "T/2" in the diagram).
- Identify the frequency of the labkit's inbuilt clock (oscillator).
- Based on the labkit's clock frequency and calculated half periods, calculate the number of required clock cycles to implement 1 Hz and 2 Hz count processes.
- Verilog **procedural blocks** with '**posedge** clk' may be needed to implement the count processes.
- Please refer **Exercise 3** in the **Introduction to Verilog** lesson for more insights.

**Exercise 2: Adding extra functionalities to Exercise 1 (10 marks)**

In this exercise, you are expected to add any extra features/functionalities to the above implemented design. Few ideas are as follows:

- Use more LEDs (labkit has 8 LEDs) and blink them according to different patterns and frequencies (e.g., Knight Rider LED Scanner https://youtu.be/KFSpxY_KM5A)
- Use labkit's switches to control LEDs.
- Use both LEDs and seven segments.