Lab 0

Switches, LEDs, and Multiplexers

The purpose of this lab is to learn how to utilize some I/O devices (i.e., switches and LEDs) on an FPGA development board and implement simple Multiplexer circuits utilizing these I/O devices.

Part 1 (Building a 3-bit 2x1 MUX)

For this part, you will design the circuit in Figure 1 and implement it on the Nexys board. The circuit implements a 2x1 MUX with 3-bit inputs and outputs. In other words, the inputs X, Y and output M are all 3-bit signals.

1. Write Verilog code to describe a 2x1 MUX with 1-bit inputs and outputs (you can use dataflow or behavioral modeling for this item). Call the file `mux_2x1_simple`
2. Use the `mux_2x1_simple` to implement a 3-bit input/output 2x1 MUX as shown in Figure 1. In other words, instantiate several instances of the `mux_2x1_simple` module to create the 3-bit version. Call the file `mux_2x1_3bit`
3. Verify the functionality of your code by implementing it on the Nexys board using the following IO specifications:
    a. SW2 ← SW0 for the input X
    b. SW5 ← SW3 for the input Y
    c. SW15 for the select signal
    d. LED2 ← LED0 for the output M
    e. LED15 to reflect the status of the select signal

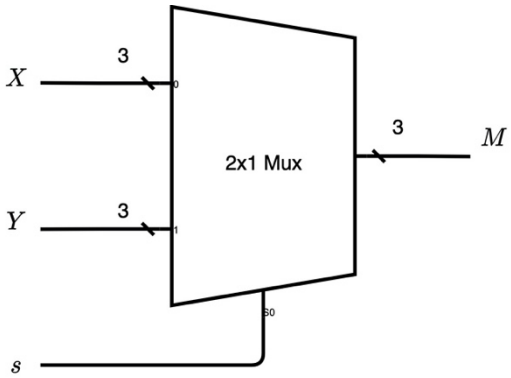

Figure 1: 2x1 MUX

Part 2 (Building a 3-bit 4x1 MUX)

For this part, you will use several instances of the `mux_2x1_3bit`, that was developed in Part 1, to design and implement a 3-bit 4x1 MUX as shown in Figure 2. The circuit implements a 4x1 MUX with 3-bit inputs and outputs. The MUX will route X, Y, Z, or W to M depending on the value placed on S0 and S1.

1. Write Verilog code to describe the 4x1 MUX, you should instantiate as many `mux_2x1_3bit` as necessary. Call the file `mux_4x1_3bit`

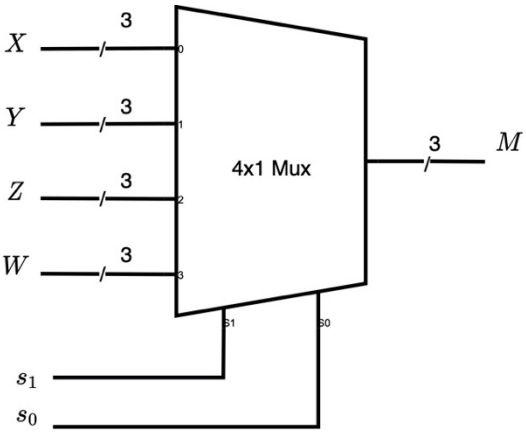

Figure 2: 4x1 MUX

2. Verify the functionality of your code by implementing it on the Nexys board using the following IO specifications:
    a. SW2 ← SW0 for the input X
    b. SW5 ← SW3 for the input Y
    c. SW8 ← SW6 for the input Z
    d. SW11 ← SW9 for the input W
    e. SW15 ← SW14 for the select signal
    f. LED2 ← LED0 for the output M
    g. LED15 ← LED14 to reflect the status of the select signal