**EECE 343 Computer Interface Circuits**

**Lab 1**

**Switches and LED Display**

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**Objectives**

The purpose of this exercise is to learn how to connect simple input and output devices to an FPGA chip and implement a circuit that uses these devices. We will use the switches SW17-0 on the DE2 board as inputs to the circuit. We will use light emitting diodes (LEDs).

**Project**

The DE2-series board provides 18 toggle switches, called SW17-0, that can be used as inputs to a circuit, and 18 red lights, called LEDR17-0, that can be used to display output values. Figure 1 shows a simple VHDL entity that uses these switches and shows their states on the LEDs. Since there are 18 switches and lights it is convenient to represent them as arrays in the VHDL code, as shown. We have used a single assignment statement for all 18LEDR outputs, which is equivalent to the individual assignments

LEDR(17) <= SW(17);

LEDR(16) <= SW(16);

: : :

LEDR(0) <= SW(0);

The DE2-series board has hardwired connections between its FPGA chip and the switches and lights. To use SW SW17-0 and LEDR SW17-0 it is necessary to include in your Quartus II project the correct pin assignments, which are given in the DE2-series User Manual.

LIBRARY ieee;

USE ieee.std\_logic\_1164.all;

- - Simple module that connects the SW switches to the LEDR lights

ENTITY part1 IS

PORT ( SW : IN STD\_LOGIC\_VECTOR(17 DOWNTO 0);

LEDR : OUT STD\_LOGIC\_VECTOR(17 DOWNTO 0)); - - red LEDs

END part1;

ARCHITECTURE Behavior OF part1 IS

BEGIN

LEDR <= SW;

END Behavior

Figure 1. VHDL code that uses the DE2-series board switches and lights.

**Procedure**

Perform the following steps to implement a circuit corresponding to the code in Figure 1 on the DE2-series board.

1. Create a new Quartus II project for your circuit. If using the Altera DE2 board, select Cyclone II EP2C35F672C6 as the target chip, which is its FPGA chip.
2. Create a VHDL entity for the code in Figure 1 and include it in your project.
3. Include in your project the required pin assignments for the DE2-series board, as discussed above. Compile the project.
4. Download the compiled circuit into the FPGA chip. Test the functionality of the circuit by toggling the switches and observing the LEDs.
5. Turn in your lab report on the day you demonstrate your project in class.