EE421/621 Digital Electronics
Department of Electrical and Biomedical Engineering
University of Nevada, Reno

Follow and run through the following steps, and **make sure you input the right parameters** as **DE1-UserManual** disclosed. You are expected to learn

- How to program DE1Board resources (e.g. LED) using Quartus II
- How to write and simulate simple VHDL codes
- How to compile and run a FPGA-based function

1. Read through the file "Quartus VHDL Tutorial-1" and follow the procedure in this file to run a simple logic gate VHDL

2. On the basis of what you learned in step 1, you need to build a 32-bit counter. Using the VHDL code below to build your counter in Quartus II (including compiling and simulating). For the simulation of a time clock, you may refer to "Quartus VHDL Tutorial-2" to find how to assign a pin as a clock.

If you assign 50MHz on-board clock to the clock of the counter, which bit of the counter (e.g, COUNT_OUT(25), COUNT_OUT(28), etc) can be assigned to LED0 and toggle it at around 1.3 seconds?

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_ARITH.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;

entity counter is
Port (      CLOCK : in STD_LOGIC;
            DIRECTION : in STD_LOGIC;
            COUNT_OUT : out STD_LOGIC_VECTOR (31 downto 0));
end counter;

architecture Behavioral of counter is
signal count_int : std_logic_vector(31 downto 0) := "00000000000000000000000000000000";
begin
    process (CLOCK)
            begin
            if CLOCK='1' and CLOCK'event then
                    if DIRECTION='1' then
                    count_int <= count_int + 1;
                    else
                    count_int <= count_int - 1;
                    end if;
            end if;
end process;
COUNT_OUT <= count_int;
end Behavioral;
```

3. Read through the files "Introduction-Quartus" and "Quartus VHDL Tutorial-3".

4. Practice more VHDL codes in the book (codes are electronically available in the book CD).