Labs 4 - Test board implementation

Submitted by **Meldrick Reimmer, Khoi Pham and Selma Boudissa**

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1 Problem 1 and 2

Create a design which allows to display a value between 0 and F of one 7 segment Display, and also controllable by the switches on the board: This program is in fact is an advance version of the 7 led display by 7 segment schematic system on Lab 3. I modified it according to the shape of the numbers and letters that will be displayed using these LED components, new schematic is described as followed:

```
if (clk'event and clk='1') then
    case bcd is
        when "0000"=> output7Segment <="0000001";  -- 'display number 0'
        when "0001"=> output7Segment <="1001111";  -- 'display number 1'
        when "0010"=> output7Segment <="0010010";  -- 'display number 2'
        when "0011"=> output7Segment <="0000110";  -- 'display number 3'
        when "0100"=> output7Segment <="1001100";  -- 'display number 4'
        when "0101"=> output7Segment <="0100100";  -- 'display number 5'
        when "0110"=> output7Segment <="0100000";  -- 'display number 6'
        when "0111"=> output7Segment <="0001111";  -- 'display number 7'
        when "1000"=> output7Segment <="0000000";  -- 'display number 8'
        when "1001"=> output7Segment <="0000100";  -- 'display number 9'
        when "1010"=> output7Segment <="0001000";  -- 'display letter A'
        when "1011"=> output7Segment <="0000011";  -- 'display letter B'
        when "1100"=> output7Segment <="1000110";  -- 'display letter C'
        when "1101"=> output7Segment <="0100001";  -- 'display letter D'
        when "1110"=> output7Segment <="0000110";  -- 'display letter E'
        when "1111"=> output7Segment <="0001110";  -- 'display letter F'
        when others=> segment7 <="1111111";
    end case;
end if
```

Figure 1: VHDL Code

Observation The switches on the board handle the signal to pass on the "bcd" port, in order to control the LED to display a particular letter. There will be 4 switches according to 4 bits on the port.

Figure 2: Test bench

Observation: The output7segment get updated its value due proportionally to the value of bcd as described as the rule above. The value here is displayed in hexadecimal mode.

2 Problem 4

The idea is to combine 4 BCD led systems to be able to display not only 0-9 number but from 0-9999.

```
architecture Behavioral of modulo9999 is
begin
   s <= (bcdA * "01")              --multiply by 1
      + (bcdB * "1010")            --multiply by 10
      + (bcdC * "1100100")         --multiply by 100
      + (bcdD * "1111101000");     --multiply by 1000
end Behavioral;
```

Figure 3: VHDL Code

Observation: The algorithm is to sum the 4 digits that generated by 4 BCD led systems with a multiplier of 1,10,100,1000 to get the final 4 digits number (in hexadecimal mode).

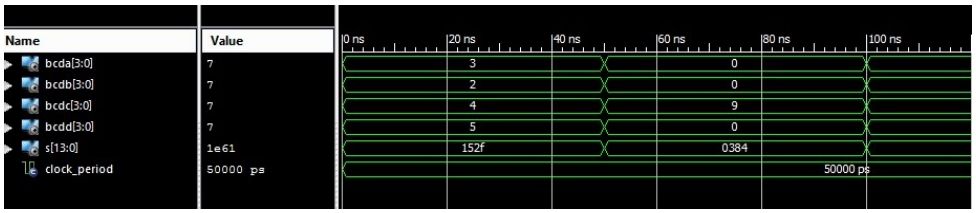

Figure 4: Test bench

Observation: The output s is the computation of inputA*1 + inputB*10 + inputC*100 + inputD*1000, but displayed in hexadecimal mode. Ie. Here 152f is the hexadecimal value of 5423 in decimal. And so on, 0384 is hexadecimal value of 900 in decimal.