

CS 232 - Assignment 5

Rules/Tips:

- 1) *The top-level entity description given in the question must be used exactly as it is in your code without changing the entity name or any of the port names and the port names must be in the same order.*
- 2) *While testing any sequential design in ModelSim, always reset your circuit before normal operation. (That is make the reset pin high ('1') for at least one full clock cycle and then start feeding your regular test inputs).*

- 1) Design a mod-10 up-down counter. As long as 'up'=1, the value of 'count' should increase by '1' every clock cycle. As long as 'up'=0, the value of 'count' should decrease by '1' every clock cycle. 'clk' is the input clock signal and 'rst' the reset signal input.

entity Mod10UpDown is

```
port ( clk, rst, up : in std_logic;  
      count: out std_logic_vector (3 downto 0) );
```

end entity;

- 2) Design a 4-bit Booth multiplier. 'a' and 'b' are the 4-bit unsigned input numbers and 'result' is the 8-bit multiplication result.

entity BoothMultiplier is

```
port ( clk, rst : in std_logic;  
      a, b : in std_logic_vector (3 downto 0);  
      result : out std_logic_vector (7 downto 0) );
```

end entity;

Things required in Submission:

1. All VHDL files of top-level and sub-components (.vhd or .vhdl files).
2. Screenshot of Waveforms (Few input patterns are sufficient).
3. A report explaining how you designed (pdf format).

Submission rules:

1. **Deadline:** Wednesday (16th Feb 2022), 23:59 pm.
2. Create a folder named **lab5** (all small letters and no spaces).
3. Inside the above-mentioned folder create 2 more folders named **q1** and **q2** (all small letters and no spaces).

4. Inside the folder, **q1** put all the .vhd or .vhdl files of both top-level entity and sub-components. Also in the same folder put the related waveform screenshots and pdf report related question1. Do the same thing for **q2**.
5. Finally, before you submit the lab5 folder on moodle you will be zipping it. The zip file should have your id number as the name. For eg: if your id is 184070026 then your zip file will be 184070026.zip.