BME 328 Lab 1 – Timer-Counter-7 Seg Display Project

15 Marks (2 weeks) Due Date: Week 3

1. Objectives

- To work with standard "off-the-shelve" integrated circuits (ICs).
- To get familiar with NI Multisim 14.2.
- To implement simple digital circuits using standard ICs.
- To learn to read schematic diagrams.

2. Pre-Lab Preparation

- 1. Install and activate NI Multisim 14.2 by following the instructions in *Multisim*-*DesktopWindowsInstallGuide.pdf*. You can find this document on D2L.
- 2. Familiarize yourself with NI Multisim 14.2 by completing the tutorial (pages 1 to 17 only) in *Multisim-Tutorial.pdf*. You can find this document on D2L.
- 3. Study and understand the 555 Timer, Up/Down counter with 7-segment display schematic diagram shown in Figure 1.

The 555 Timer (LM555CN) produces a square wave (pulse) for the counter to count. Calculate the output frequency as function of RA, RB and Capacitance using 555 data sheet.

The 4029BD_5V is a 4-bit binary/decade up/down counter consisting of D-type flip-flops with a gating structure to provide toggle flip-flop capability. The counter can be used in either Binary or BCD operation. It also can be used either as a Down-counter (when you connect pin 10 to ground) or as an Up-counter (when you connect pin 10 to 5V) as shown in Figure 1.

The 74LS47D is a BCD-to-seven segment decoder that also has an output drive capability for driving LEDs. It converts a 4-bit binary coded decimal value to drive the appropriate LEDs on the 7-segment display.

Detailed logic diagrams of the LM555 Timer, the 4029 Binary/Decade Up/Down Counter and, and the 74LS47D BCD-to-Seven segment Latch/Decoder/Driver can be found in the Datasheets folder on D2L.

3. Laboratory Work

- 1. Construct the circuit of the schematic diagram shown in Figure 1 using NI Multisim 14.2.
- 2. You may need this circuit in a future lab, so do not disconnect it when you are done.
- 3. Measure the output frequency from 555 timer.
- 4. Measure and draw waveforms on outputs QA, QB, QC, QD of 4029 Counter.
- 5. Find the values on outputs ABCDEFG of 74LS47D Decoder when it displays 0 to 9.
- 6. Change the value of RA and measure the frequency.
- 7. Change the counter connection to count down.

REFERENCE: <u>http://faculty.ucr.edu/~vladimf/ee120a/Lab_1.pdf</u>



Figure 1