# FPGA Lab 5 – Stopwatch

Purpose: In this lab you will build a digital stopwatch. The main purpose of this lab is to introduce you to the entire design process of building a circuit. You will also learn how to use libraries in the Quartus software, as you will need to use the switch debouncer you made in Lab4.3.

1) **Lab5 : Stopwatch.** Copy the Lab5 folder and open the project. This folder has a top level entity named "TopLevel" that is entirely blank. You will need to create input and output pins for the stopwatch using the names of pins declared in previous projects. The 7-segment converter module is also placed in this folder. You may cut and paste code from previous projects into "TopLevel".

2) The module for debouncing the push-button switch and making a positive-edge pulse can be taken from your last lab by using it as a library. To specify this as a library, select "assignments/settings", then click "User Libraries" under the left hand column of user settings. Enter the path to your library "Lab4.3" by using the browser ("…" symbol). Don't forget to add this path to your libraries by clicking "Add". The path will then be displayed in the Libraries box. The library modules can be accessed in the standard way with the symbol tool (AND gate symbol).
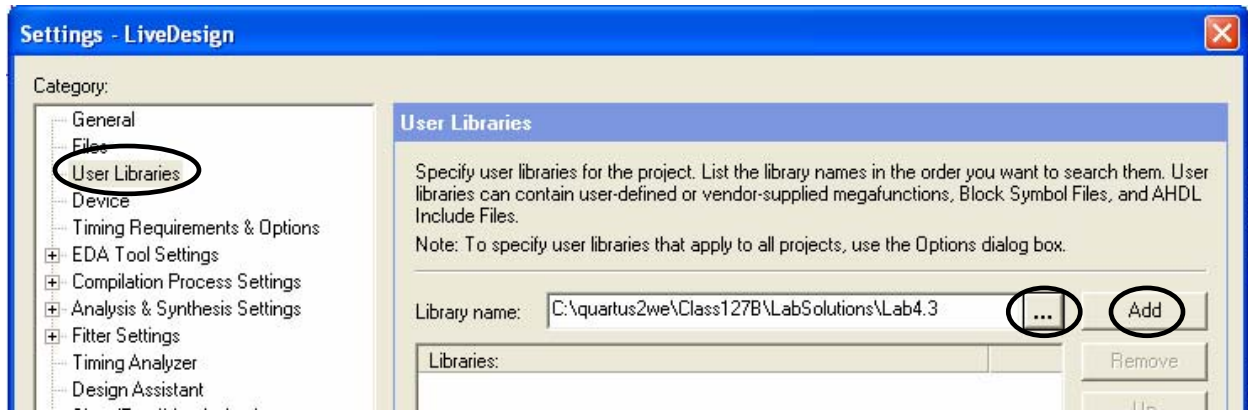
3) Design the stopwatch to displays tenths's of seconds, seconds, minutes, and hours, with decimal points between the time units. Have the stopwatch cycle through 3 states of a state machine with a pushbutton. The 3 states are counter-clear, counter-start, and counter-stop.

4) How is it possible to quickly simulate the stopwatch, or test the "hours" counter?