Digital System
Stop Watch
What is stopwatch?

- A digital stop watch is time-keeping device that is designed to measure the time elapsed from the start time to end time of an event.
- It counts in increments every 0.01s.
We have five inputs:

1. **Pause**: start and stop the watch.
2. **Reset**: resets all digits to zeros.
3. **Write to LCD**: writes elapsed time to LCD
4. **HTSeconds**: Used to activate or deactivate the Hundredth seconds.
5. **Clock**, which is 100MHz in our board.
Circuit Design

- Outputs:
  1. Count on 6 7-segment displays.
  2. LCD screen: stop watch & elapsed time.
- Target board: DIGILENT NEXYS-4 Board.
- Target LCD: HD44870.
Data Path Design

We need six counters. Four counters modulo 10, which counts from 0 to 9. And two counters modulo 6, which counts from 0 to 5.
Algorithmic State Machine
LCD

- Use LCD as the second screen
  1. BCD to ASCII decoder
  2. State machine as the LCD controller
References

- VHDL Coding Tutorial- Daniel Llamocca
  http://www.secs.oakland.edu/~llamocca/VHDLforFPGAs.html

- Intro to Digital Design- Darrin M. Hanna
  http://www.digilentinc.com/data/textbooks/intro_digital_design-digilent-vhdl_online.pdf

- An Introduction to Software and Hardware Interfacing 2nd Edition- Han-Way Huang
Any Questions?
Thank you