



University of British Columbia  
Electrical and Computer Engineering  
Digital Design and Microcomputers  
CPEN312

## Lab 3 - Counters

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For this lab you will design and test an alarm clock using Quartus Prime.

### Tools and Equipment Needed

1. Altera DE0-CV board.
2. Quartus Prime version 16 or newer.

### Activities

Design, code, and test a clock that displays hours, minutes, and seconds using the 7-segment displays available in the Altera DE0-CV board. The clock should display the time using the 12H format; use LEDR9 as AM/PM indicator (for PM turn LEDR9 on). The current time (AM/PM, hours, minutes, and seconds) and the alarm time (AM/PM, hours, and minutes) must be settable using any method of your choice. The alarm is enabled/disabled using SW9 (SW9=1 alarm enabled). If the alarm is enabled, and the current time (AM/PM, hours, minutes) match the alarm time (AM/PM, hours, minutes) then turn LEDR0 on. You can use any of the components available in the schematic editor of Quartus Prime/Lite (flip-flops, counters, decoders, etc.) or create your own components using VHDL. If you prefer, you can code your clock completely in VHDL. On power on, the clock must display a valid time, for example 12:00:00PM or 01:00:00AM, and set the default alarm time to a valid time as well (for example 06:00AM).

Demonstrate your working clock to one of the TAs during your schedule lab hours. Upload to Canvas a zip file containing the Quartus project folder (to reduce the size of the zip file please exclude the 'db' and 'incremental\_db' sub-folders) as well as a SHORT video demonstration of your clock operating. Please show in the video how to set up the clock time and alarm time, how the clock activates the alarm, as well as how the time transitions between 11:59:59PM and 12:00:00AM. (We need the uploaded files for program accreditation purposes.)