ECE 4401 (Fall 2014)
Lab 2 – Design of a Calculator

Specifications:

1- The push buttons should be used to perform the desired operation (add, multiply or equal).
   a. Use 1 button each for add, multiply and equal.
   b. Use the remaining 1 button for reset.
2- On reset, the 7-segment LED display should match the value of the switches. Note that the switches are 8-bit but the LED display is 16-bit, so the high 8 bits of the LED display will read 00.
3- The calculator should be able to do 2 operations, add and multiply.
4- The operands (8-bit) should be provided through the 8 switches available on your board.
5- The 7-segement displays should display the operand, as it is entered. Upon pressing 'equal', it should display the result.

A sample sequence is shown below:

Action	LED Display
1. Switches=**0x01**, Press BTN3	0001
2. Press BTN1 (+)	0001
3. Press BTN0 (=)	0002
4. Press BTN2 (x)	0002
5. Switches=**0x06**, Press BTN0 (=)	000C
6. Switches=**0x06**, Press BTN0 (+)	0006
7. Switches=**0xFF**, Press BTN0 (=)	0005
8. Press BTN0 (x)	0005
9. Switches=**0xFF**, Press BTN0 (=)	FFFB

Notes:

- Buttons can cause multiple pulses, so they must be debounced.
- After entering the first operand, if you press 'multiply' immediately after pressing 'add', it should perform the 'multiply' operation, just as a normal calculator.
- You will need a 2 ms clock for the debounce module.
- You need to support negative numbers. That means you will have to sign extend the 8-bit input to a 16-bit number.
- You will need to support using the result as an input to the next operation. For example, going from line 3 to line 4 in the example above.
- If the display is showing the result of a previous operation, and you want to use the same input for the next operation, you will need to temporarily change the input value. For example, on line 6, the display is showing 000C, but the switches have 06. To input a 06, we have to temporarily change the inputs, for example, to 07, and then change the switches back to 06.
- The library modules you need for this lab are,
  - clock_divider
  - debounce
  - word2leds (which uses hex2led and char_led_control)