

# INTRODUCTION TO COMPUTER ARCHITECTURE

## LAB 5

### Multiplier

## 1 A suggested approach

In planning to build your multiplier, it is useful to consider how the circuit will be used and controlled. Specifically, you should use:

- 4 switches to set the *multiplier* value.
- 4 switches to set the *multiplicand* value.
- 1 button to control the *clock* (using the normal output).
- 1 button to control the *multiplexers* (using the negated output).

You may notice that neither of the buttons is used to control the *master reset* input on the 74LS273 chip: this choice is intentional. That input should be hard-wired to be 1—that is, we won't even use that capability on the chip. Instead, given the ability to control the multiplexers, we will have the ability at any time to use that button to select initial values to load into the *product/multiplier* register.

Specifically, one would operate the multiplier by performing the following steps:

1. Set the multiplicand and multiplier on the switches.
2. Depress and hold down the multiplexer control button.
3. Depress and release the clock button, load the initial values into the *product/multiplier* register.
4. Release the multiplexer control button.
5. Depress and release the clock button **four times**, performing the four steps of computation.

All together, you should need:

- 1 x 74LS273 (register), whose Q outputs should be wired to 8 LED's.
- 2 x 74LS157 (multiplexer)
- 1 x 74LS08 (AND)
- 1 x 74LS83[A] (adder)

## 2 Submitting your work

Once you have a detector working, demonstrate the working circuit by **taking a video** of it multiplying the following pairs of 4-bit numbers (with the **first** value as the multiplicand, and the **second** value as the multiplier):

1. 0000 x 0000

2. 0000 x 0001

3. 0001 x 0000

4. 1111 x 0001

5. 0010 x 0100

6. 1011 x 1101

**Upload** your video to your *college Google Drive account*. Then, **share the video** with me (sfkaplan@amherst.edu) and your lead TA (twstephens26@amherst.edu for Section 01; eleroy27@amherst.edu for Section 02).

**This assignment is due Sunday, Oct-19, at 11:59 pm.**