Lab 3

ECE/CS 472/572
• Lab 1 has been graded. Grades should be up on the website soon.

• Lab 2 is due tonight!
Restarting a simulation

Or type ‘restart’ on the command line in the Transcript window.
Today's Lab

• You will be making a 16-bit Arithmetic Logic Unit (ALU)
ALU Slice

- An ALU Slice unit will be used for each bit.
- Each one will take in 1-bit a and b inputs, a carry-in, a 3-bit select input. They will output the solution and a carry-out.
• Binvert is dependent on the MSB of the 'select' input. The two functions that require you to perform 2's compliment on the b-input are 'subtract' and 'set on less than'.

• Remember that 2's compliment is when you compliment all of the bits and add 1.
Set on Less Than

• This operation does a comparison of A and B. If A<B, then output is 1. Otherwise, the output is 0.

• This can be done by doing A-B, and determining if the result is negative.
ALU Slice MSB

• Overflow detection will be done in the ALU slice for the MSB.

• Remember that the output is signed, so overflow detection is not simply seeing if there is a carryout from the MSB.

• The ‘Set’ output is dependent on the opcode selecting ‘Set on less than’, and A<B.
ALU16

- You will use the ALU Slice and ALU Slice MSB to create a 16-bit ALU.

Figure 3 – ALU Structure
ALU16 (cont.)

• The zero flag will go high if the output of the ALU is zero.
• The 16-bit ALU will initially be in a ripple-carry configuration.
• You will then need to use the carry-lookahead method with the ALU.
  – This will be similar to the last lab, change the ALU_Slice and ALU_SLice MSB modules to output a generate and propagate.
Questions?

Make sure you turn in waveforms showing every ALU operation working correctly