ECE338 Advanced Logic Design

4 March 2013

**Goal: Create a high-speed multiplier in CHDL without using clocked cycles.**

I was tasked with create a high-speed multiplier in VHDL using combinational logic. This was to be done using a 32-bit floating point number in accordance with the IEEE 754 standard. The output of this multiplier is to be standardized as well.

When I first began creating my code for this program, Ii started with a top down model. I knew what my outputs had to look like and so I created a diagram with a visual representation of how I would accomplish this. I would slice up the inputs as vectors and manipulate each part as needed. I could do a simple XOR process on my sign bit, add up the exponents (accounting for the bias), and finally fill an array up with the two multiplied numbers. I could do this latter part by creating an array of vectors which each could hold 48 bits. These arrays would hold copies of input A when input B is one, and filled with zeros when input B is zero. I would then feed these rows into 6 row reduction units. The final output of this would then be fed through a 3-2 row reduction unit. The final outputs could then be added together.

After the adding process was completed I could select which slice of the vector I wanted depending on where the leading one is, this would be my hidden bit. Once I had this result I would add one to my exponent if I needed to shift over my mantissa at all to account for the radix point. At the end all I had to do was to concatenate all my results together in the proper order.

**Results:**

My results were somewhat disappointing. The majority of my values were correct; however some of them were off by only some slight number. This error could be coming from my exponent addition. When I calculated the exact binary representation of my result out by hand, and tried to perform my multiplication out by hand as well, I could see that both my mantissa and my exponent were somehow shifted into the wrong positions. I was unable to figure out why or how this was happening. This is my second time doing this project, as the first time I had done everything inside of a function. Using a function was much easier to obtain my values, however when working this project this was I was able to better understand how the process works and is executed. Though I do not yet understand the reason for my erroneous results, I can see what the answer should be.

**Final Thoughts:**

This was a very hard project (namely having to do it twice). However, I have learned much more with this single project than I did in all of ECE238. It is extremely irritating having answers be so close and only off by a very small factor. Everything was checked and is working properly, I even checked my temp array to make sure all values were being filled and shifted correctly.