CE 6305 Computer Arithmetic
Home Work 6

1. We have a module, M4, that performs the multiply and add function $m = a \times b + d$, for 4 bit quantities a, b, d, producing an 8 bit carry complete result. Show how to connect multiple M4 units to produce a 16 bit by 16 bit multiply and add unit.

2. A $gb \times gb$ bit multiplier can easily be constructed from $b \times b$ bit multiplier modules. In such designs, each $b \times b$ bit module outputs a $2b$ bit carry complete result. These results are called partial products in this setting.

   (a) For this $gb \times gb$ bit multiplier, express the height of the remaining partial product matrix as a function of g.

   (b) Generalize the result of part (a) to a $gb \times hb$ multiplier built from $b \times b$ modules and give the solution for a $6b \times 4b$ multiplier.

3. Give conditions on the relative values of z and d so that overflow is avoided during integer division.

4. Show how the division 0110110100÷10011 is performed (a 10 bit dividend is divided by a 5 bit divisor giving a 5 bit quotient and a 5 bit remainder). Represent the integers as binary fractions: 00.0110110100÷0.10011 and show all the steps.

   (a) when the quotient digit set is $\{-1, 1\}$ and $s^{(j)} \in [-d, d)$ as in Figure 1 in the notes on high radix division.

   (b) when the quotient digit set is $\{-1, 0, 1\}$ and $s^{(j)} \in [-d, d)$ as in Figure 2 in the notes on high radix division.

   (c) when $d \in [1/2, 1)$, the quotient digit set is $\{-1, 0, 1\}$ and $s^{(j)} \in [-1/2, 1/2)$ as in Figure 3 in the notes on high radix division.