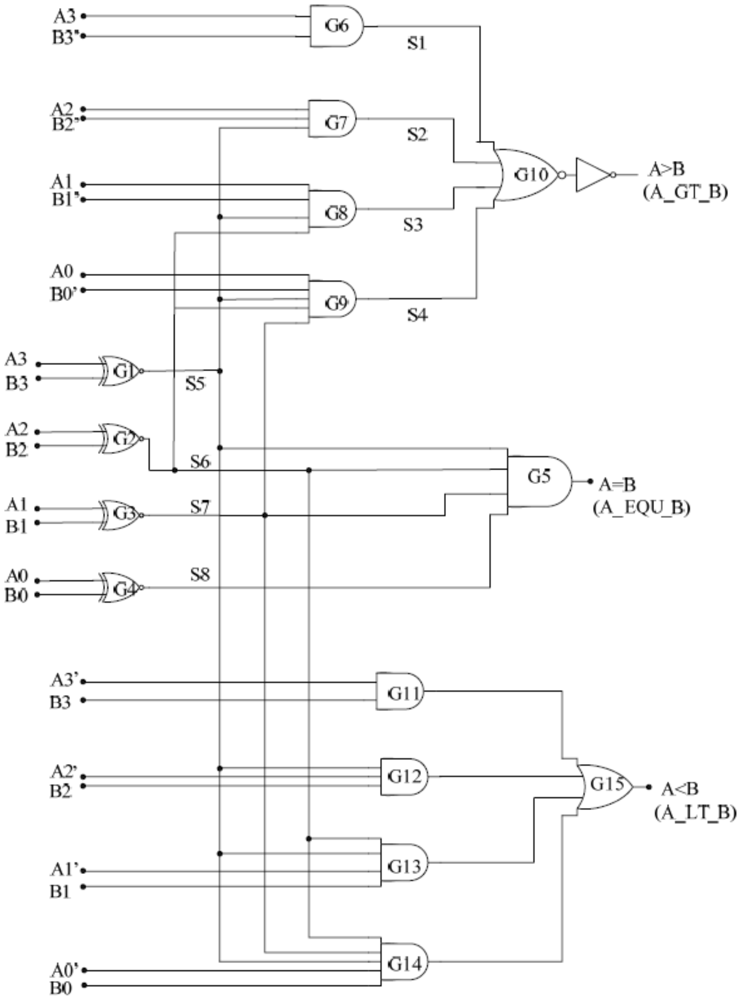
CS 303 Pre-Lab #3 Report

Zeynep Yıldız

00029325

I started off with making Boolean algebraic statements for A>B, A<B and A=B

The logic diagram looked like this:



- Picture is taken from http://users.encs.concordia.ca/~asim/COEN_6511/Projects/final6511report.pdf

I turned every gate into algebraic statements and what turned out is:

```
assign w5 = (~(A30 ^ B30));
assign w6 = (~(A2 ^ B2));
assign w7 = (~(A1 ^ B1));
assign w8 = (~(A0 ^ B0));

assign w1 = (A30 & (~B30));
assign w2 = (A2 & (~B2) & w5);
assign w3 = (A1 & (~B1) & w5 & w6);
assign w4 = (A0 & (~B0) & w5 & w6 & w7);

assign w9  = ((~A30) & B30);
assign w10 = ((~A2) & B2 & w5);
assign w11 = ((~A1) & B1 & w5 & w6);
assign w12 = ((~A0) & B0 & w5 & w6 & w7);
```

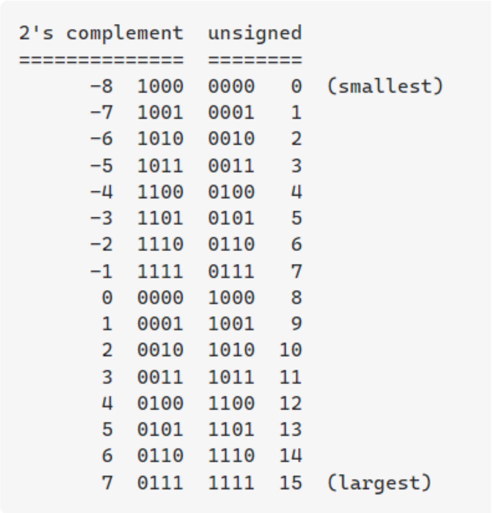
w is for wire and every wire is represented in the picture with s1,s2,…s8. There is not s9…s12 but they are for A<B. They represent those gates.

And I gathered those wires together for final gates that would determine the result.

```
// C0 = "A>B"
// C1 = "A=B"
// C2 = "A<B"

assign C0 = (w1 | w2 | w3 | w4);
assign C1 = (w5 & w6 & w7 & w8);
assign C2 = (w9 | w10 | w11 | w12);
```

But this solution does not work for signed integers. So I negate the first bit (A3 and B3). So I can compare the numbers more accurately.

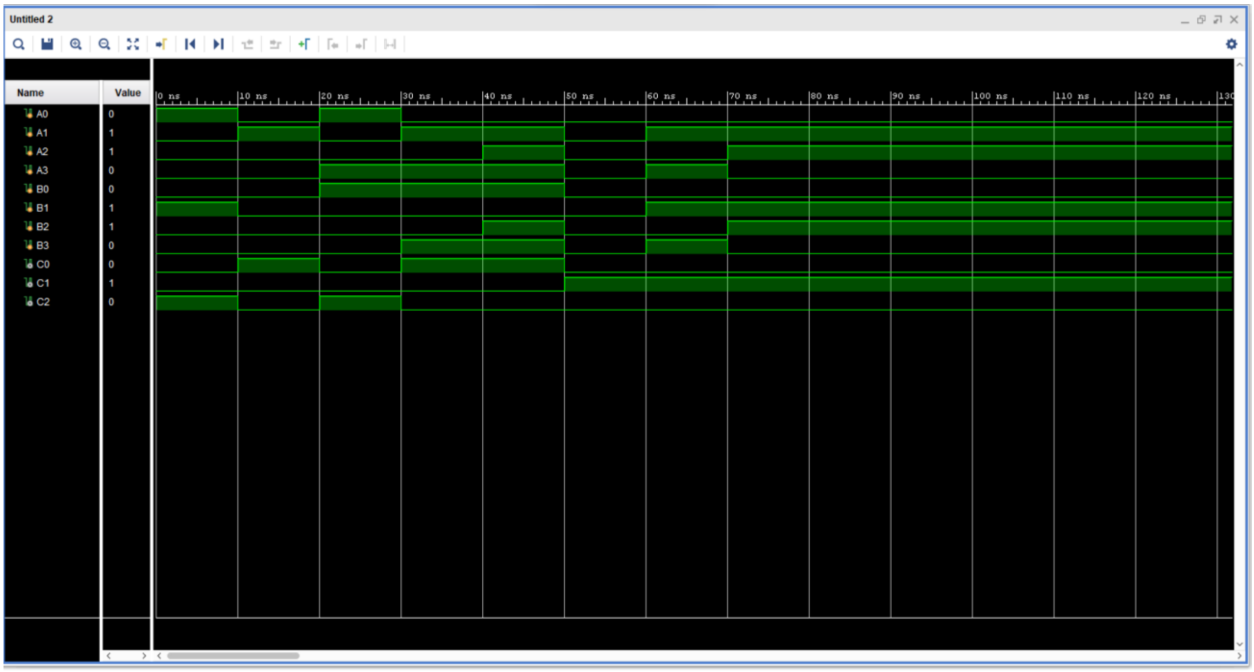


```
2's complement  unsigned
==============  ========
      -8  1000  0000   0  (smallest)
      -7  1001  0001   1
      -6  1010  0010   2
      -5  1011  0011   3
      -4  1100  0100   4
      -3  1101  0101   5
      -2  1110  0110   6
      -1  1111  0111   7
       0  0000  1000   8
       1  0001  1001   9
       2  0010  1010  10
       3  0011  1011  11
       4  0100  1100  12
       5  0101  1101  13
       6  0110  1110  14
       7  0111  1111  15  (largest)
```

The picture and the idea are taken from:

https://electronics.stackexchange.com/questions/519178/boolean-algebra-how-do-i-implenent-a-4-bit-signed-comparator

As wanted, I followed the instructions given for the Xilinx and Vivado. I did simulations which worked perfectly.



// C0 = "A>B"   C1 = "A=B   C2 = "A<B"

simulation code is below:

```
// A = 0001 B = 0010
A0 = 1; A1 = 0; A2 = 0; A3 = 0;
B0 = 0; B1 = 1; B2 = 0; B3 = 0;
#10;

// A = 0010 B = 0000
A0 = 0; A1 = 1; A2 = 0; A3 = 0;
B0 = 0; B1 = 0; B2 = 0; B3 = 0;
#10;

// A = 1001 B = 0001
A0 = 1; A1 = 0; A2 = 0; A3 = 1;
B0 = 1; B1 = 0; B2 = 0; B3 = 0;
#10;

// A = 1010 B = 1001
A0 = 0; A1 = 1; A2 = 0; A3 = 1;
B0 = 1; B1 = 0; B2 = 0; B3 = 1;
#10;

// A = 1110 B = 1101
A0 = 0; A1 = 1; A2 = 1; A3 = 1;
B0 = 1; B1 = 0; B2 = 1; B3 = 1;
#10;

// A = 0000 B = 0000
A0 = 0; A1 = 0; A2 = 0; A3 = 0;
B0 = 0; B1 = 0; B2 = 0; B3 = 0;
#10;

// A = 1010 B = 1010
A0 = 0; A1 = 1; A2 = 0; A3 = 1;
B0 = 0; B1 = 1; B2 = 0; B3 = 1;
#10;

// A = 0110 B = 0110
A0 = 0; A1 = 1; A2 = 1; A3 = 0;
B0 = 0; B1 = 1; B2 = 1; B3 = 0;
#10;
```

I did synthesis and implementation. Those files should be included inside the zip file.